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Standard Guide for Selecting Cleaning Agents and Processes[1]

This standard is issued under the fixed designation D6361/D6361M; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

~~ε^1 NOTE—Units information and the designation were revised editorially in July 2010.~~

1. Scope

1.1 This guide is intended to assist design engineers, manufacturing/industrial engineers, and production managers in selecting the best fit cleaning agent and process. This guide takes into account environmental pollution prevention factors in a selection process.

1.2 This guide is not to be considered as a database of acceptable materials. It will guide the engineers and managers through the cleaning material selection process, calling for engineers to customize their selection based on the cleaning requirements for the cleaning tasks at hand. If a part can be cleaned, and kept clean, it can be cycled through several process steps that have cleaning requirements. This eliminates extra cleaning process steps during the total process. A total life cycle cost analysis or performance/cost of ownership study is recommended to compare the methods available.

1.3 This guide is for general industry manufacturing, equipment maintenance and remanufacturing operations, and to some extent precision cleaning of mechanical parts and assemblies. It is not intended to be used for optical, medical, or electronics applications, nor is it intended for dry-cleaning or super-critical fluid cleaning.

1.4 The values stated in either SI units or inch-pound units are to be regarded separately as standard. The values stated in each system may not be exact equivalents; therefore, each system shall be used independently of the other. Combining values from the two systems may result in non-conformance with the standard.

1.5 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards*:[2]

D56 Test Method for Flash Point by Tag Closed Cup Tester
D92 Test Method for Flash and Fire Points by Cleveland Open Cup Tester
D93 Test Methods for Flash Point by Pensky-Martens Closed Cup Tester
D2240 Test Method for Rubber Property—Durometer Hardness
D3167 Test Method for Floating Roller Peel Resistance of Adhesives
D3278 Test Methods for Flash Point of Liquids by Small Scale Closed-Cup Apparatus
D3519 Test Method for Foam in Aqueous Media (Blender Test) (Withdrawn 2013)[3]
D3601 Test Method for Foam In Aqueous Media (Bottle Test) (Withdrawn 2013)[3]
D3707 Test Method for Storage Stability of Water-in-Oil Emulsions by the Oven Test Method
D3709 Test Method for Stability of Water-in-Oil Emulsions Under Low to Ambient Temperature Cycling Conditions
D3762 Test Method for Adhesive-Bonded Surface Durability of Aluminum (Wedge Test)
E70 Test Method for pH of Aqueous Solutions With the Glass Electrode

[1] This guide is under the jurisdiction of ASTM Committee D26 on Halogenated Organic Solvents and Fire Extinguishing Agents and is the direct responsibility of Subcommittee D26.03 on Cold Cleaning.

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[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

[3] The last approved version of this historical standard is referenced on www.astm.org.

E1720 Test Method for Determining Ready, Ultimate, Biodegradability of Organic Chemicals in a Sealed Vessel CO_2 Production Test (Withdrawn 2013)[3]
F483 Practice for Total Immersion Corrosion Test for Aircraft Maintenance Chemicals
F484 Test Method for Stress Crazing of Acrylic Plastics in Contact with Liquid or Semi-Liquid Compounds
F485 Practice for Effects of Cleaners on Unpainted Aircraft Surfaces
F502 Test Method for Effects of Cleaning and Chemical Maintenance Materials on Painted Aircraft Surfaces
F519 Test Method for Mechanical Hydrogen Embrittlement Evaluation of Plating/Coating Processes and Service Environments
F945 Test Method for Stress-Corrosion of Titanium Alloys by Aircraft Engine Cleaning Materials
F1104 Test Method for Preparing Aircraft Cleaning Compounds, Liquid Type, Water Base, for Storage Stability Testing
F1110 Test Method for Sandwich Corrosion Test
F1111 Test Method for Corrosion of Low-Embrittling Cadmium Plate by Aircraft Maintenance Chemicals
G44 Practice for Exposure of Metals and Alloys by Alternate Immersion in Neutral 3.5 % Sodium Chloride Solution
G121 Practice for Preparation of Contaminated Test Coupons for the Evaluation of Cleaning Agents
G122 Test Method for Evaluating the Effectiveness of Cleaning Agents

2.2 *Other Documents:*
Aerospace Material Specification (AMS) 3204/AMS 3209 Test for Rubber Compatibility[4]
ARP 1795 StockLoss Corrosion[4]
FAA Technical Bulletin[5]

2.3 *Military Standards:*[6]
MIL-S-8802
MIL-S-81722
MIL-W-81381/11-20

3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

3.1.1 *cleaning efficiency, n*—the measure of how well a cleaning agent is able to clean a substrate.

3.1.2 *level of cleanliness, n*—the degree to which a part must be cleaned in order to perform successfully in subsequent manufacturing or maintenance procedures, or to perform adequately in its final application.

3.1.3 *pre-cleaning, n*—the initial cleaning step to remove gross contaminants prior to a precision cleaning process.

4. Summary of Guide

4.1 The following is a summary of the five step approach for selecting general cleaning agents and processes for use in manufacturing, overhaul, and maintenance in industrial operation. For each step, the user of the guide will provide specific information on a particular aspect of their process. Then, the user should consult the guide, which will provide appropriate guidance on evaluation criteria that should be followed in order to evaluate the potential cleaning agents. Table 1 provides a summary of the user-defined requirements information and the procedures to be provided by this guide. The order of the steps presented in Table 1 is suggested, but not crucial to the successful use of this guide. Section 6 will provide greater details on both the user input and the guidance provided.

[4] Available from SAE International (SAE), 400 Commonwealth Dr., Warrendale, PA 15096, http://www.sae.org.
[5] Available from Federal Aviation Administration (FAA), 800 Independence Avenue, SW, Washington, DC 20591, http://www.faa.gov.
[6] Available from DLA Document Services, Building 4/D, 700 Robbins Avenue, Philadelphia, PA 19111-5094, http://quicksearch.dla.mil.

TABLE 1 Summary of Guide

Step	Defined User Requirements	Procedure
1	Define the ESH, physical and chemical requirements of the facility	*Physical and Chemical Properties Test*—Verify that the prospective agent is acceptable.
2	Define the material(s) to be cleaned	*Material Compatibility Test(s)*—Verify that the prospective agent will not harm the component(s) being cleaned.
3	Determine shape of part (part geometry)	Applicable processes and equipment
4	Define the reason for cleaning	*Performance Testing*—Verify that the prospective agent and process will perform to the desired level of cleanliness for the particular cleaning application.
5	Select cleaner	Validate environment, cost, and worker health and safety.

5. Significance and Use

5.1 This guide is to be used by anyone developing cleaning requirements for specifications for manufacturing, maintenance, or overhaul. This guide has been designed to be application specific for each cleaning task and to assure the design engineer that the process selected by the industrial or manufacturing engineer will be compatible with both the part material and the subsequent process(es). This guide allows the industrial or manufacturing engineer to customize the selection of the cleaning product based on the materials of the part being cleaned; the cleanliness required for the subsequent process(es); and the environmental, cost, and health and safety concerns.

6. Procedure

6.1 *Step 1—Define the Requirements of the Facility*—The first step taken in selecting a replacement cleaner is to determine which cleaners or classes of cleaners are acceptable to the requirements of the facility. These requirements include environmental, safety, and health requirements and the physical and chemical properties of the cleaner itself.

6.1.1 *Environmental, Safety, and Health Requirements*—Table 2 presents some of the more common concerns regarding cleaning agents and their effects on the environment, and worker safety and health. To use Table 2, the engineer should find their concerns on the left-hand column and ensure that the cleaner meets the requirements listed in the right-hand column.

6.1.2 *Physical and Chemical Properties*—Table 3 presents some of the more common concerns regarding cleaning agents and their physical and chemical properties, and the corresponding tests required to evaluate those properties. To use Table 3, the engineer should find their concern(s) on the left-hand column and require the data from evaluations of the specifications listed in the remainder of the row. Please note that this guide does not provide values for the inspection results. These values are to be determined by the engineer based on the specific requirements of the operation.

6.2 *Step 2—Determine Materials of the Parts Being Cleaned to Ascertain Material Compatibility Test Requirements*—The second step in using this guide is to determine the material, or materials of the parts, being cleaned. The information will provide the engineer with the material compatibility test data required to ensure the cleaner will not damage the parts being cleaned. Table 4 presents a table to be used to determine the required material compatibility tests. To use Table 4, select the material type from the left-hand column. The remaining information in the corresponding row provides the short title and the specification number for each of the tests that must be performed in order to ensure material compatibility with the cleaning agent. It is important to note that alloys behave differently than pure metals and different alloys behave differently than other alloys; therefore, specific alloys must be utilized when conducting these compatibility tests. If data are not available on a specific alloy with a specific cleaner, the data must be developed prior to the use of the cleaner.

TABLE 4 Material Compatibility Requirements

Material Type	Short Title	Standard
Steel	Total Immersion Corrosion or	ASTM F483
	Stock Loss Corrosion	ARP 1795
	Effects on Unpainted Surfaces	ASTM F485
	Hydrogen Embrittlement	ASTM F519
	Sandwich Corrosion	ASTM F1110
	Low-Embrittling Cadmium Plate Corrosion ~~Corrosion~~	ASTM F1111
	Stress Corrosion	ASTM G44 (Modified, see Appendix X2)
Cobalt alloys	Total Immersion Corrosion or	ASTM F483
	Stock Loss Corrosion	ARP 1795
	Effects on Unpainted Surfaces	ASTM F485
	Hydrogen Embrittlement	ASTM F519
	Sandwich Corrosion	ASTM F1110
	Low-Embrittling Cadmium Plate Corrosion ~~Corrosion~~	ASTM F1111
	Stress Corrosion	ASTM G44 (Modified, see Appendix X2)
Nickel alloys	Total Immersion Corrosion or	ASTM F483
	Stock Loss Corrosion	ARP 1795
	Effects on Unpainted Surfaces	ASTM F485

TABLE 2 Environmental, Safety, and Health Requirements

Concern	Requirement
Environment	Compliance with all federal, state, and local laws and regulations concerning the procurement, use, and disposal of the cleaning agent and associated materials.
Worker safety and health	Compliance with OSHA regulations, provide sufficient personal protective equipment to ensure the health and safety risks of using the cleaning agent are minimized.

TABLE 3 Physical and Chemical Properties

Concern	ASTM Standard
Flash point	D56 D92 D93 D3278
pH value	E70
Foaming properties	D3519 D3601
Biodegradability	E1720
Storage stability	D3707 F1104
Temperature stability	D3709

TABLE 4 *Continued*

Material Type	Short Title	Standard
	Hydrogen Embrittlement	ASTM F519
	Sandwich Corrosion	ASTM F1110
	Low-Embrittling Cadmium Plate Corrosion ~~Corrosion~~	ASTM F1111
	Stress Corrosion	ASTM G44 (Modified, see Appendix X2)
Titanium alloys	Total Immersion Corrosion or	ASTM F483
	Stock Loss Corrosion	ARP 1795
	Effects on Unpainted Surfaces	ASTM F485
	Hydrogen Embrittlement	ASTM F519
	Sandwich Corrosion	ASTM F1110
	Stress Corrosion of Titanium[A]	ASTM F945
	Low-Embrittling Cadmium Plate Corrosion ~~Corrosion~~	ASTM F1111
	Stress Corrosion	ASTM G44 (Modified, see Appendix X2)
Iron	Total Immersion Corrosion or	ASTM F483
	Stock Loss Corrosion	ARP 1795
	Effects on Unpainted Surfaces	ASTM F485
	Hydrogen Embrittlement	ASTM F519
	Sandwich Corrosion	ASTM F1110
	Low-Embrittling Cadmium Plate Corrosion ~~Corrosion~~	ASTM F1111
	Stress Corrosion	ASTM G44 (Modified, see Appendix X2)
Aluminum	Total Immersion Corrosion or	ASTM F483
	Stock Loss Corrosion	ARP 1795
	Effects on Unpainted Surfaces	ASTM F485
	Sandwich Corrosion	ASTM F1110
	Stress Corrosion	ASTM G44 (Modified, see Appendix X2)
Magnesium	Total Immersion Corrosion or	ASTM F483
	Stock Loss Corrosion	ARP 1795
	Effects on Unpainted Surfaces	ASTM F485
	Sandwich Corrosion	ASTM F1110
	Stress Corrosion	ASTM G44 (Modified, see Appendix X2)
Brass and bronze	Total Immersion Corrosion or	ASTM F483
	Stock Loss Corrosion	ARP 1795
	Effects on Unpainted Surfaces	ASTM F485
	Sandwich Corrosion	ASTM F1110
	Stress Corrosion	ASTM G44 (Modified, see Appendix X2)
Copper and alloys	Total Immersion Corrosion or	ASTM F483
	Stock Loss Corrosion	ARP 1795
	Effects on Unpainted Surfaces	ASTM F485
	Sandwich Corrosion	ASTM F1110
	Stress Corrosion	ASTM G44 (Modified, see Appendix X2)
Epoxy matrix with metals	Total Immersion Corrosion or	ASTM F483
	Stock Loss Corrosion	ARP 1795
	Effects on Unpainted Surfaces	ASTM F485
	Hydrogen Embrittlement	ASTM F519