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**Space systems — Surface cleanliness of  
fluid systems —**

**Part 4:  
Rough-cleaning processes**

*Systèmes spatiaux — Propreté des surfaces en contact avec des  
fluides —*

*Partie 4: Procédés de nettoyage grossier*



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## Foreword

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The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

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ISO 14952-4 was prepared by Technical Committee ISO/TC 20, *Aircraft and space vehicles*, Subcommittee SC 14, *Space systems and operations*.

ISO 14952 consists of the following parts, under the general title *Space systems — Surface cleanliness of fluid systems*:

- *Part 1: Vocabulary*
- *Part 2: Cleanliness levels*
- *Part 3: Analytical procedures for the determination of nonvolatile residues and particulate contamination*
- *Part 4: Rough-cleaning processes*
- *Part 5: Drying processes*
- *Part 6: Precision-cleaning processes*

## **Introduction**

This part of ISO 14952 defines rough-cleaning processes intended for use prior to precision-cleaning processes for equipment and components used in space fluid systems. The purpose of this part of ISO 14952 is to provide processes that can be used to achieve visibly clean parts and components.

# Space systems — Surface cleanliness of fluid systems —

## Part 4: Rough-cleaning processes

### 1 Scope

This part of ISO 14952 provides requirements related to rough-cleaning processes used to prepare parts and components for precision cleaning. It identifies precleaning processes that can be used for ground support equipment, launch vehicles and spacecraft.

Rough cleaning removes contaminants such as weld scale, heat-treat scale, corrosion, oxide films, oils, grease, shop soil, fuel and carbon deposits. Rough cleaning is considered a normal shop process and usually does not require special environmental controls, packaging, handling or storage beyond accepted good practice.

This part of ISO 14952 is applicable equally to ground support equipment, launch vehicles and spacecraft.

NOTE The cleanliness level achieved by rough cleaning does not normally require verification beyond visual inspection. (Wipe test, waterbreak test, ultraviolet inspection, special lights and mirrors are considered aids to visual inspection.)

### 2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 14951-10:1999, *Space systems — Fluid characteristics — Part 10: Water*

ISO 14952-1:2003, *Space systems — Surface cleanliness of fluid systems — Part 1: Vocabulary*

### 3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 14952-1 apply.

### 4 Rough-cleaning requirements

#### 4.1 General

All parts, components, assemblies, systems or related equipment for use in ground support facilities, launch vehicles and spacecraft shall be cleaned and inspected. Assembled parts that may be damaged during the cleaning process shall be disassembled to a level to permit cleaning. The design for systems and system components should, where practical, include the capability to remove all valves and components from the system.

## 4.2 Rough cleaning

All critical surfaces of system hardware shall be rough cleaned to remove dirt, grit, scale, corrosion, grease, oil and other foreign matter prior to any precision-cleaning process. Metallic items shall be surface treated (cleaned, passivated and/or coated), as applicable, to prevent latent corrosion and contamination. Assembled items that do not lend themselves to this type of treatment shall be treated prior to assembly. Surface areas degraded during subsequent fabrication and assembly shall be reprocessed, as required, to restore the original protective finish.

## 4.3 Material selection

### 4.3.1 General

The selection of the materials used in processing shall be left to the discretion of the customer. However, the fluids shall be compatible with the item being cleaned. The following compatibility issues, as applicable, shall be considered and evaluated in the selection of processing procedures and materials:

- a) corrosion;
- b) stress corrosion cracking;
- c) embrittlement;
- d) leaching;
- e) masking of crack-like indications;
- f) residue;
- g) crazing (nonmetallics);
- h) reversion (nonmetallics);
- i) hydrolysis (nonmetallics).

## 4.4 Types of rough cleaning

### 4.4.1 General

The actual choice of the specific cleaning agents shall be determined by the cleaning contractor and the customer. Descriptions of the cleaning agents, their purpose and application are provided in 4.4.2 to 4.4.8. The use of ultrasonics has been found to enhance the cleaning efficiency of the first five processes described. Care should be taken in the selection of the frequency of the ultrasonic bath. Lower frequencies have been found to be the most efficient in the removal of contamination; however, frequencies below 25 kHz have been found to damage soft metals such as aluminium and silver.

Chemical cleaning agents shall be compatible with material composition to prevent excessive attack or latent degradation.

### 4.4.2 Acid cleaners

Acid cleaners are used to remove the contamination (e.g. weld scale, corrosion and oxide films not removable by other solutions). Acid cleaners include nitric acid, chromic acid inhibited hydrochloric acid, inhibited sulfuric acid, inhibited phosphoric acid, mixed acid deoxidizers and alcoholic phosphoric acid.

#### 4.4.3 Alkaline cleaners

Alkaline cleaners are used for the removal of organic and inorganic contamination (e.g. grease, shop soil, scale and soluble metal oxides). Alkaline cleaners dissolve (etch) certain metals such as aluminium or zinc. Types of alkaline cleaners include alkaline rust strippers, heavy-duty alkaline cleaners, molten alkalines, alkalis and alkalis with nitrates or phosphates.

#### 4.4.4 Degreasers (organic and aqueous-based solvents)

Degreasers are used to remove some forms of organic contamination (e.g. oils, grease and hydrocarbon fuels).

#### 4.4.5 Mild alkaline cleaners and detergents

Mild alkaline cleaners and detergents are used for the removal of organic and inorganic contamination (e.g. oils, fats, shop soil and grease). Mild alkaline cleaners and detergents include inhibited alkaline cleaners (mild alkaline cleaners), soaps and detergents.

#### 4.4.6 Tap water and high-purity water (HP)

Tap water or high-purity water used to remove the residual material left by cleaning solutions and reagent water, in accordance with ISO 14951-10, Type HP, shall be used as a final flushing or rinsing medium.

#### 4.4.7 Neutralizing and passivating solutions

Neutralizing and passivating solutions shall be used as a supplementary treatment to acid, alkaline and mechanical cleaning. The neutralizing and passivating solutions prevent corrosion and acid etching. Nitrates, and alkalis with nitrates or phosphates shall be used for neutralization; nitric acid solutions shall be used for passivation.

#### 4.4.8 Mechanical cleaning

Mechanical cleaning removes contamination by abrasive action. It is used only when physical damage to the item being cleaned will not occur. Mechanical cleaning includes wire brushing, shot blasting (wet and dry), grinding, abrasive blasting (wet or dry), the use of aluminium oxide, abrasive-coated papers and cloths, and related methods.

**NOTE** Mechanical cleaning often leaves foreign deposits that may require additional cleaning removal. Compatibility of dissimilar metals is an important consideration when selecting a mechanical cleaning method.

### 4.5 Rough-cleaning processes

Table 1 shows recommended rough-cleaning processes.

Table 1 — Selection chart for rough-cleaning processes

		Mechanical descale/clean 1	Degrease	Alkaline clean	Tap water rinse	Detergent clean 1	Tap water rinse	Acid pickle	Tap water rinse	Passivate	Tap water rinse 1	High-purity water 1	Drying
Material	Surface condition												
Aluminium	Bare or machined free of heat oxidation		X	X							X	X	X
	Conversion or chemical film coating		X			X	X					X	X
	Weld scale, corrosion, or heat oxidation	X	X	X							X	X	X
Copper, brass, bronze	Bare or machined free of heat oxidation		X	X							X	X	X
	Conversion or chemical film coating		X			X	X			X	X	X	X
	Weld scale, corrosion, or heat oxidation		X	X	X			X			X	X	X
Stainless steel	Free of scale		X	X	X			X	X	X	X	X	X
	Weld scale, corrosion, or heat oxidation	X	X	X	X			X	X	X	X	X	X
Carbon steel	Free of scale		X	X	X						X	X	X
	Weld scale, corrosion, or heat oxidation	X	X	X	X			X	X		X	X	X
Titanium	Bare or machined	X	X <sup>a</sup>	X	X			X	X			X	X
	Conversion or chemical film coating		X	X	X			X	X			X	X
Nonmetallic parts	As received					X					X	X	X
Electroplated parts and dissimilar metals	As received		X	X							X	X	X

NOTE Symbols in the block denote a recommended process for the surface condition indicated, and steps will normally be accomplished in consecutive order from left to right.

<sup>a</sup> Do not use halogenated solvents.



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