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DEPARTMENT OF DEFENSE
MANUFACTURING PROCESS STANDARD

CONTROL OF DETRIMENTAL MATERIALS

AMSC N/A

FSC 20GP

FOREWORD

1. This manufacturing process standard is approved for use by the Naval Sea Systems Command (NAVSEA), Department of the Navy, and is available for use within the distribution limitations noted at the bottom of the cover.

2. Comments, suggestions, or questions on this document should be addressed to: Commander, Naval Sea Systems Command, ATTN: SEA 05S, 1333 Isaac Hull Avenue, SE, Stop 5160, Washington Navy Yard DC 20376-5160 or emailed to commandstandards@navy.mil with the subject line “Document Comment”. Since contact information can change, you may want to verify the currency of this address information using the ASSIST Online database at https://assist.dla.mil.

CONTENTS

1. SCOPE

1.1 Purpose. The purpose of this standard is to establish uniform requirements for control of detrimental materials in products and equipment that come in contact with special purpose hardware during manufacture, shipment, and storage.

1.2 Applicability. This standard applies when invoked by contract technical requirements. Additionally, organizations may invoke this standard in lieu of MIL-STD-767 in contracts for hardware without inaccessible areas. When invoked, this standard applies to internal hardware surfaces, external surfaces of pressure boundary parts, and other surfaces when specified in contract documents.

2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are specified in Sections 3, 4, or 5 of this standard. This section does not include documents cited in other sections of this standard or recommended for additional information or as examples. While every effort has been made to ensure the completeness of this list, document users are cautioned that they must meet all specified requirements of documents cited in Sections 3, 4, or 5 of this standard, whether or not they are listed.

2.2 Government documents.

2.2.1 Government specifications and standards. The following specifications and standards form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those cited in the solicitation or contract.

DEPARTMENT OF DEFENSE SPECIFICATIONS

TT-I-735	-	Isopropyl Alcohol
A-A-59691	-	Silicone Compound, NATO Code Number S-736
MIL-L-24131	-	Lubricant, Colloidal Graphite in Isopropanol
DOD-G-24508	-	Grease, High Performance, Multi-Purpose
MIL-DTL-24671	-	Cloth, Lint-Free, Flushing and Cleaning
MIL-DTL-24777	-	Nonmetallic Materials with Special Requirements

DEPARTMENT OF DEFENSE STANDARDS

MIL-STD-767	-	Control of Hardware Cleanliness
MIL-STD-1684	-	Control of Heat Treatment
MIL-STD-2132	-	Nondestructive Examination Requirements for Special Applications

(Copies of these documents are available online at http://quicksearch.dla.mil.)

2.2.2 Other Government documents and publications. The following other Government documents and publications form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those cited in the solicitation or contract.

DOCUMENTS

CODE OF FEDERAL REGULATIONS (CFR)

27 CFR Part 21 - Formulas for Denatured Alcohol and Rum

(Copies of this other Government document are available online at www.ecfr.gov.)

PUBLICATIONS

NAVAL SEA SYSTEMS COMMAND

NAVSEA 250-1500-1 - Welding Standard

(Copies of other Government publications should be obtained from the contracting activity or as directed by the contracting officer.)

2.3 Non-Government publications. The following document forms a part of this standard to the extent specified herein. Unless otherwise specified, the issue is that cited in the solicitation or contract.

ASTM INTERNATIONAL (ASTM)

ASTM D329 - Standard Specification for Acetone

(Copies of this document are available from www.astm.org.)

3. DEFINITIONS

3.1 Acceptable shop products and acceptable solid nonmetallic materials. Those shop products and solid nonmetallic materials that have been shown to meet the applicable detrimental material chemistry limits of Table A-I within the frequency of analysis requirements of A.2.6.2.

3.2 Approval or approved. Unless specifically stated otherwise, approval or approved means action taken by NAVSEA or its authorized representative.

3.3 Authorized representative.

(a) The Commander of a naval shipyard, for vendors to the shipyard.
(b) NAVSEA, for commercial and naval shipyards.
(c) The shipbuilder, for commercial shipyard subcontracted acquisitions.
(d) That Prime Contractor of NAVSEA, other than a shipbuilder, who has design or procurement responsibility, for vendors to the Prime Contractor.

3.4 Certification. A written statement formally attesting conformance to specified requirements.

3.5 Consolidated Acceptable Products List (CAPL). A listing of shop products and solid nonmetallic materials that have been previously tested for detrimental materials and met the applicable limits of Table A-I. The CAPL is available electronically on the combined

CAPL/Master Qualified Products List (MQPL) website that can be accessed at:

https://logistics.unnpp.gov/ConsolidatedAPLQPLjsprod/default.aspx

3.6 Consolidated Controlled Products List (CCPL). A listing of shop products and solid nonmetallic materials that have been tested for detrimental materials and do not meet the applicable limits of Table A-I.

3.7 Contractor. The seller under the contract or purchase order that incorporates this standard.

3.8 Controlled shop products and controlled solid nonmetallic materials. Those shop products and solid nonmetallic materials that have not been analyzed or that have been shown to not meet the applicable detrimental material chemistry limits of Table A-I.

3.9 Corrosion-resistant material. A metal or alloy that inherently resists oxidation or chemical attack in air and water at ambient temperatures. Examples include chromium-nickel corrosion-resistant steel, nickel-base, cobalt-base and copper-base alloys, and precipitation-hardened corrosion-resistant steel.

3.10 Detrimental material. A material that, when contacting hardware, may have a deleterious effect on the hardware. Detrimental materials are identified in Table A-I and Sections 5.1 and 5.2.

3.11 Final cleaned surface. A final surface of hardware on which all planned cleaning operations have been performed.

3.12 Final surface. A hardware surface that will be subjected to no further material removal operations.

3.13 Foreign material. Any material or object that should not be on or within clean hardware. Examples include grit, chips, particles, oil, machining coolant, liquid penetrant, dried liquid residue/stains, slag, scale, fibers, tape, tools, ink, paint, and loose articles or parts.

3.14. Hardware. Any article, piece of material, individual part, subassembly, assembly, component, or system on which this standard is invoked. Samples of material removed for destructive testing are not considered to be hardware.

3.15 Inaccessible area. A hardware surface that is not readily accessible for cleaning or visual, wipe, or swab inspection. This includes any crevices between mating surfaces in which shop products could be entrapped and not readily observed or removed.

3.16 Internal surface. A surface that contacts system fluid.

3.17 Mercury spill. A release of mercury or a mercury containing substance from its containment in an area or under conditions where mercury contact with hardware could occur.

3.18 Noncorrosion-resistant material. A material that inherently does not resist oxidation or chemical attack in air or water at ambient temperatures. Examples include carbon steels,

low alloy steels, and low chromium non-austenitic steels (generally AISI 400 and 500 series steels and their cast equivalents, except for AISI 403, 410, and CA6NM which are corrosion resistant).

3.19 Organization. Any company or activity performing work within the scope of this standard.

3.20 Shop product. Any substance, other than metals or solid nonmetallic materials, that contacts hardware surfaces. Examples include liquids, pastes (e.g., greases and uncured substances like adhesives, sealants, locking compounds, and epoxies), and powders, not intended to be a permanent part of hardware unless otherwise allowed by exceptions contained herein or in other applicable contract documents.

3.21 Solid nonmetallic material. Materials that contact hardware surfaces not intended to be a permanent part of hardware. Examples include elastomers, plastics, cloths, sheet, tubing, stickers, bags, gloves, consumable ceramics, and tape unless otherwise allowed by exceptions contained herein or in other applicable contract documents. Cured adhesives, sealants, locking compounds, and epoxies that are in a solid form prior to contact with hardware may also be considered solid nonmetallic materials.

3.22 Thermal treatment. Any operation where the temperature of hardware exceeds 350°F (177°C). Examples include heat treating, welding, brazing, preheating for welding or brazing, hot forming, stress relieving, hot tests, and baking for embrittlement relief. Metal removal (other than thermal cutting) is not a thermal treatment.

3.23 Tools and handling equipment. All tools, fixtures, fittings, handling equipment and parts made of solid materials that are not intended to be a permanent part of hardware.

3.24 Transfer. The following conditions constitute transfer to hardware:

(a) Shop products transfer when they contact hardware surfaces.

(b) Solid nonmetallic materials transfer when:

1. the material contacts hardware in a liquid environment, or
2. the material adheres to the hardware surface, or
3. the material contacts hardware surfaces above the manufacturer's recommended temperature rating for product use. If no temperature rating is provided, transfer occurs if the material contacts surfaces above the temperature that softens/decomposes the material or 350°F, whichever is lower.

(c) Metals and alloys transfer when they:

1. mechanically abrade, smear, gall, or forcibly impact the hardware surface, or
2. adhere to the hardware surface, or
3. contact a hardware surface that is above 2/3 of the metal or alloy melting point (MP) on the absolute (°R) temperature scale (2/3 MP of metal/alloy in °F -153°F).

3.25 Visual inspection. An inspection performed by the unaided eye (1X unless otherwise specified) with normal visual acuity (natural or corrected) while using normal reading-level lighting.

4. GENERAL REQUIREMENTS

4.1 Precedence of other contract documents. Other applicable contract documents (such as drawings, standards, instructions, and technical manuals) may provide requirements for use of products and equipment on specific parts. Where a conflict exists between this standard and another NAVSEA approved document, the other NAVSEA approved document shall be followed for use of specific products or equipment (e.g., molybdenum disulfide or brazing materials containing low melting point metals). For use of generic products and equipment, and those procured to specifications without controls on chemical composition, the requirements of this standard shall apply unless specifically waived by other NAVSEA approved documents. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

4.2 Detrimental material control procedures.

4.2.1 Procedure preparation and submittal. Each organization shall develop a detrimental material control procedure that satisfies the requirements of this standard. The detrimental material control procedure shall be made available for review or approval upon request.

4.2.2 Procedure content. The detrimental material control procedure shall include the following information, as applicable.

(a) Procedure identifier, revision, date, and name of the organization.

(b) Procedures for maintenance and use of the Acceptable Products List (see A.2.6.1).

(c) Controls on controlled shop products and solid nonmetallic materials (use, removal, and inspection for removal) (see 5.1.3, 5.3.1, and 5.3.2).

(d) Controls on tools and handling equipment (see 5.1.2).

(e) Additional requirements, if applicable (see 5.2).

(f) Visual inspections to verify cleanliness prior to thermal treatments and after final cleaning (see 5.3.2 and 5.3.3).

(g) Final cleaning methods (see 5.3).

(h) Recovery actions (see Appendix D).

4.3 Subcontractor applicability.

4.3.1 Final surfaces. For all subcontractors who provide hardware with final surfaces, only the following requirements need to be invoked unless already contractually invoked by a Department of Defense specification with alternate detrimental material controls. Base material procured to Department of Defense specifications with alternate detrimental material controls already requires the necessary final surface controls; therefore the controls of this standard need not be passed down.

(a) Transfer of aluminum, copper, silver, and their alloys to final surfaces shall be prohibited (see 5.2.3)

(b) Contact between low melting point metals or alloys and final surfaces shall be prohibited (see 5.2.4)

(c) Contact between hardware surfaces and mercury and mercury compounds shall be prohibited (see 5.2.1(a)).

4.3.2 Thermal treatments of final surfaces and final cleaned surfaces. The organization shall invoke the detrimental material controls of this standard on subcontractors who perform thermal treatments of final surfaces, and subcontractors who provide hardware with final cleaned surfaces.

4.3.2.1 Exceptions. This standard need not be invoked on:

(a) Subcontractors when performing heat treatments of final surfaces in accordance with MIL-STD-1684.

(b) Contractors when providing parts to the identified or later versions of the Controlled Parts Specifications listed in Appendix E.

(c) Electropolishers, platers, and coaters of parts.

4.4 Certification of detrimental material status. Documents accompanying hardware that conforms to the requirements of this standard shall state that the hardware meets the detrimental material control requirements of MIL-STD-2041.

5. CONTROL OF DETRIMENTAL MATERIALS.

5.1 Requirements for control of detrimental material.

5.1.1 Requirements prior to the creation of a final surface. Any product or tool may be used (excluding mercury, see 5.2.1) prior to the creation of a final surface. If the metal surface is removed at a later operation to produce a bright or matte metal surface from the contacted surface, then no controls apply to the product or tool used.

5.1.2 Requirements for control of metal used in tools and handling equipment.

5.1.2.1 Low melting point metals. Surfaces of tools and handling equipment that contact final surfaces of hardware shall not be made of, coated with, or plated with the low melting point metals identified in Table A-I.

5.1.2.2 Controls on cutting tools (drills, bits, taps, etc.). Cutting tools shall be visually clean (except for any appropriate machining coolant) and free of burrs, slivers, chips, shavings, etc., before use.

5.1.2.3 Controls on plugs, seals, surface finishing tools, hand tools, and handling equipment. Plugs, seals, surface finishing tools, hand tools, and handling equipment shall be clean prior to use, and shall not have been previously used on the low melting point metals identified in Table A-I. Carbon, low alloy, or tool steels shall not contact corrosion resistant hardware unless hardened and free of rust prior to use. Wire brushes made from carbon, low alloy, or tool steels shall not be used on corrosion resistant hardware.

5.1.2.3.1 Abrasives. Grinding, polishing, grit blasting, water jet cutting, and other hardware final surface finishing operations shall not be performed with silicon dioxide containing abrasives (e.g., silica sand) when the hardware is made of austenitic stainless steel or nickel-base alloy unless otherwise approved.

5.1.3 Requirements for control of all shop products and all solid nonmetallic materials.

(a) A shop product or solid nonmetallic material shall not be left on any internal or applicable external hardware final cleaned surface except as specified in NAVSEA approved documents or as otherwise approved (e.g. 5.2.10).

(b) When surfaces are assembled to form inaccessible areas, shop products and solid nonmetallic materials shall be removed and the surface shall be visually inspected to confirm complete removal prior to forming inaccessible areas. Shop products and solid nonmetallic materials shall not be used in a manner whereby they can enter an inaccessible area, except in approved procedures where a product or material is specified and its use is followed by an associated approved cleaning procedure.

(c) Shop products and solid nonmetallic materials used prior to the creation of the final surface that will be removed in accordance with the requirements of 5.1.1 need not be tested. Shop products and solid nonmetallic materials shall not contact any hardware final surface during thermal treatments except as allowed in 5.1.3.1 or 5.1.3.2.1. Shop products and solid nonmetallic materials that are used in accordance with the requirements of this standard may remain on hardware provided they have a functional purpose and are planned for use but should be removed once the products are no longer needed.

5.1.3.1 Requirements applicable to acceptable shop products and acceptable solid nonmetallic materials. Acceptable shop products and acceptable solid nonmetallic materials may remain on hardware during thermal treatment provided they have a functional purpose and are planned for use (e.g., temperature indicator crayons, weld anti-spatter compound, etc.).

5.1.3.2 Requirements applicable to controlled shop products and controlled solid nonmetallic materials. Controlled shop products or controlled solid nonmetallic materials shall not contact or be left on a hardware final surface during thermal treatments.

5.1.3.2.1 Halides on steel hardware during thermal treatment. For steel hardware made of material other than austenitic or precipitation-hardening stainless steel, or AISI 400 or 500 series steel, shop products or solid nonmetallic materials containing halides in excess of the Table A-I limits may be used during thermal treatment of final surfaces, provided the other chemistry limits of Table A-I are met.

5.1.4 Thermal treatment of final surfaces. Visual inspections shall be performed prior to thermal treatments of final surfaces and on final cleaned surfaces to confirm removal of shop products or solid nonmetallic materials from hardware, except as allowed by 5.1.3.1, and for evidence of transfer of prohibited metals or alloys (see 5.1.2.3, 5.2.3, and 5.2.4).

5.1.5 Welding and brazing. For welding and brazing operations, the cleanliness requirements of the applicable fabrication document are acceptable for the purpose of complying with the detrimental material control requirements of this standard. Cleaning of additional areas shall be required if deemed warranted to meet the intent of this specification. For example, areas where preheat is being applied should be clean.

5.2 Additional requirements. The additional requirements of this section are summarized in Table I.

TABLE I. Summary of additional requirements.

Requirement	Paragraph
Mercury	5.2.1
Lubricant for fit-up	5.2.2
Aluminum, copper, silver, and their alloys	5.2.3
Low melting point metals	5.2.4
Ammonia	5.2.5
Acids	5.2.6
Polyvinylchloride sheet and film	5.2.7
Corrosion inhibitors	5.2.8
Thiosulfate	5.2.9
Grease	5.2.10
Plugs and seals used to protect final cleaned hardware	5.2.11

5.2.1 Mercury.

(a) Mercury controls. Contractors shall certify that hardware supplied to this standard has not come in direct contact with mercury, mercury-containing compounds, or mercury-containing devices employing a single boundary of containment. The presence of mercury in a product or contacting material may be determined by reviewing product labeling, material safety data sheets, or safety data sheets for declarations that mercury is a constituent of the product. The absence of a declaration of mercury on product labeling, material safety data sheets, or safety data sheets is considered as evidence of no mercury or mercury-containing compounds in the product or contacting material. Chemical analysis is not required. If a product is reported to contain mercury, up to 10 parts per million (ppm) mercury is acceptable. Possible sources of mercury include (but are not limited to):

1. Instrumentation such as thermometers and manometers.
2. Mercury vapor and fluorescent light fixtures
3. No-bounce hammers.
4. Electronic levels.
5. Electrical switches and relays.
6. Metal halide lamps.
7. Backlight assemblies in electronic devices that use liquid crystal displays.
8. Mercury-containing batteries.

(b) Light sources. Each light source (where hardware may be present) that contains mercury and that is located less than twenty feet above the shop floor or less than two feet above the top surface of hardware, shall employ a secondary boundary of protection and containment. Each portable or handheld light source that contains mercury shall be shock resistant and employ a secondary boundary of containment regardless of location. Commonly installed glass or plastic shields are considered to be acceptable protection and containment for permanent light fixtures.

(c) Mercury spill. Each mercury spill that may have resulted in mercury contract with hardware shall be reported in writing to NAVSEA or its authorized representative within ten working days after the spill occurs. The spill report shall contain the information identified in Appendix C.

5.2.2 Lubricant for fit-up. Unless otherwise specified in contract technical requirements, only water conforming to Table A-II requirements or graphite in isopropanol conforming to MIL-L-24131 shall be used as a lubricant for hardware fit-up, including threaded connections.

5.2.3 Aluminum, copper, silver, and their alloys. Transfer of aluminum, copper, silver, or their alloys to hardware final surfaces shall be prohibited.

5.2.3.1 Exception(s). The prohibitions on aluminum, copper, silver, and their alloys do not apply to aluminum/ aluminum alloys in contact with hardware made of aluminum or aluminum alloys or to copper/ copper alloys in contact with hardware made of copper or copper alloys or to silver/ silver alloys in contact with hardware made of silver or silver alloys.

5.2.4 Low melting point metals. Contact of any low melting point metal (antimony, bismuth, cadmium, lead, tin, or zinc) or an alloy of these metals with final surfaces of hardware shall be prohibited.

5.2.5 Ammonia. Ammonia shall not contact final surfaces of hardware made of copper base alloys.

5.2.6 Acids. The use of acid with less than pH 5 on final surfaces of hardware is prohibited.

5.2.6.1 Acid etch test exception. The requirement of 5.2.6 does not apply to detailed acid etch test procedures (e.g., alloy identity tests, low melting point metal tests, etc.) specified in NAVSEA approved technical documents, or other detailed procedures for specific hardware surfaces with approval.

5.2.6.2 Acid cleaning exception. The requirement of 5.2.6 does not apply to acid cleaning when approved and performed in accordance with MIL-STD-767.

5.2.7 Polyvinylchloride sheet and film. Polyvinylchloride (PVC) sheet and film may be used to maintain cleanliness of hardware final surfaces provided all of the following requirements are met:

(a) The PVC shall not contact hardware final surfaces at temperatures above 175°F. If contact occurs above 175°F and the surface cannot subsequently be removed, recovery shall be in accordance with Appendix D.

(b) Heated metal surfaces without temperature controls to prevent PVC decomposition shall not be used to heat seal PVC film, and all heat sealing shall be done in accordance with local procedures. This restriction does not apply to hot devices used for cutting or temperature controlled sealing irons designed for bonding PVC.

5.2.8 Corrosion inhibitors. Except as specified or as approved, corrosion inhibitors shall not be employed on hardware final surfaces.

5.2.9 Thiosulfate. The use of thiosulfate in contact with hardware final surfaces is prohibited.

5.2.10 Grease. When specified in NAVSEA approved equipment manuals, greases that are acceptable products (see A.2.5.1) may remain on external non-wetted hardware surfaces provided they are used in accordance with specified grease specifications and are not present on hardware during any operation that exceeds their temperature limits as specified in the applicable contract equipment manuals.

5.2.11 Plugs and seals used to protect final cleaned hardware. Flexible seals and plugs used to maintain cleanliness of final cleaned surfaces, crevices, and inaccessible areas shall meet the following requirements:

(a) Nonmetallic materials shall be acceptable solid nonmetallics or be listed on the MIL-DTL-24777 Qualified Nonmetallics List (QNL).

(b) Cadmium plated parts are prohibited in plugs and seals.

(c) Plugs and seals shall exhibit no oily exudate when compressed at 500 ± 50 psi for at least four hours. This test does not apply to O-rings, silicone rubber, or rubber parts less than 1/4 inch thick.

(d) Carbon steel parts of plugs and seals shall not contact corrosion resistant hardware surfaces.

5.3 Final cleaning. All hardware surfaces (both internal and external) shall be cleaned using the methods and requirements of MIL-STD-767 or the following requirements:

5.3.1 Cleaning hardware. All final surfaces shall be final cleaned with a Table II solvent or water conforming to Table A-II requirements.

5.3.2 Visual inspection for shop products, solid nonmetallic materials, and prohibited metals or alloys. Visual inspections shall be performed on final cleaned surfaces.

5.3.3 Acceptance criteria. The final cleaned surface shall be visually inspected to be free of foreign material, for evidence of incomplete removal of shop products or solid nonmetallic materials from hardware, for evidence of harmful effects (such as, but not limited to, discoloration, rusting or other abnormal oxidation, hazing, etching, surface roughening, pitting or cracking), and for evidence of transfer of prohibited metals or alloys (see 5.1.2.3, 5.2.3, and 5.2.4). A few discrete lint fibers per square foot of hardware surface area, each less than 1/4 inch in length, left after cleaning are acceptable.

TABLE II. Final cleaning solvents.

Solvent	Specification 1/	Additional requirements
Acetone	ASTM D 329	Unused or redistilled
Denatured alcohol	27-CFR-21	Denatured ethanol according to formula 3-A, 3-C, 23-A or 30
Isopropyl alcohol	TT-I-735	Grade A or B

1/ American Chemical Society reagent grade solvents meeting the purity requirements of the above specifications may also be used.

5.4 Loss of detrimental material control. If a material or product contacts or transfers to a hardware surface when prohibited by this standard, the organization shall follow the procedure of Appendix D for recovery from loss of detrimental material control.

5.5 Shipping and storage. Final cleaned hardware shall be protected from environmental precipitates and foreign material during shipment and storage. Outside storage of unprotected final cleaned hardware is prohibited.

6. NOTES

6.1 Changes from previous issue. Marginal notations are not used in this revision to identify changes with respect to the previous issue due to the extent of the changes.

ANALYSIS AND CLASSIFICATION OF PRODUCTS

A.1 SCOPE

A.1.1 Scope. This appendix specifies the requirements associated with the analysis and classification of products. This Appendix is a mandatory part of the standard. The information contained herein is intended for compliance.

A.2 REQUIREMENTS

A.2.1 Analysis requirements for metal and ceramic tools and handling equipment. Metals and non-consumable ceramics used in tools and handling equipment do not require chemical analysis, except non-consumable ceramic tools used in a liquid environment shall be analyzed as solid nonmetallic materials when required for use.

A.2.2 Analysis requirements for solid nonmetallic materials. In order to be listed as acceptable, solid nonmetallic materials shall be quantitatively analyzed only for water leachable halogens and water leachable sulfur as identified in Table A-I and, with the exception of polytetrafluoroethylene (Teflon), polyvinylchloride film (PVC film), and polyvinylchloride nylon laminated cloth (Herculite), shall not contain halogens in its chemical structure. PVC film and Herculite contain high levels of chloride and should only be used where their added durability and tear resistance is needed (see 5.2.7). Tests covered by Appendix B shall be conducted in accordance with Appendix B. Analysis of a specific (manufacturer and compound/ formulation) solid nonmetallic compound is representative of all parts and/or pieces of material made of that compound regardless of geometry or dimensions.

A.2.2.1 Exceptions.

(a) Rubber gloves may be leach tested at 150°F minimum in place of 200°F minimum. Rubber gloves which will be rinsed with water per Table A-II prior to use may be rinsed prior to leach testing. If tested following rinsing, this must be noted on the Acceptable Products List.

(b) Solid nonmetallic materials may be analyzed for the total levels of halogens or sulfur instead of water leachable levels. The acceptance criteria for total halogens and sulfur are the Table A-I limits for shop products.

(c) Solid nonmetallic materials used over 350°F shall be analyzed for total halogens and sulfur instead of water leachable halides and sulfur unless they are used below the manufacturer's temperature rating. The acceptance criteria for total halogens and sulfur are the Table A-I limits for shop products.

A.2.3 Analysis requirements for shop products. In order to be listed as acceptable, shop products shall be quantitatively analyzed for low melting point metals, total halogens, total sulfur, and phosphorus as identified in Table A-I.

A.2.3.1 Sample preparation. Shop product samples shall be prepared in accordance with Appendix B.

A.2.3.2 Analysis of valve action markers. Valve action markers shall be tested as shop products. The markers shall be tested by analyzing the marking ink contained in the markers after the ink has contacted the marker tip. However, for metal ball-tip markers, the ink may be tested directly without contacting the marker tip.

A.2.4 Shop products and solid nonmetallic materials exempt from analysis. The following shop products and solid nonmetallic materials may be used in accordance with the requirements for acceptable shop products or acceptable solid nonmetallic materials without analysis:

(a) Shop products and solid nonmetallic materials used in a manner such that they will be removed or cleaned in accordance with 5.1.1 or 5.1.3, as appropriate.

(b) Those that were procured to a specification or to contract technical requirements that contains detrimental material requirements at least as restrictive as those of this standard.

(c) Those that are specified for use in this standard or in MIL-STD-767.

(d) Those that are explicitly (e.g. specific manufacturer and product number) specified for use in NAVSEA approved contract technical requirements.

(e) Those that are listed in the MIL-DTL-24777 Qualified Nonmetallics List.

(f) Air, nitrogen, carbon dioxide, inert gases, and flammable gases used for welding, cutting, or brazing.

(g) Cloths that conform to MIL-DTL-24671 or filter cloths used for outflushes.

(h) Items listed on the Consolidated Acceptable Products List that were analyzed within the past four years.

(i) Wool felt pellets conforming to SAE J314 type F-1 or F-10 used in accordance with MIL-STD-767.

A.2.5 Classification of shop products and solid nonmetallic materials. Shop products and solid nonmetallic materials are classified as either acceptable, controlled, or exempt. Shop products and solid nonmetallic materials determined to meet the applicable detrimental material limits of Table A-I shall be classified as acceptable. Shop products and solid nonmetallic materials not analyzed or containing any detrimental material in excess of the chemistry limits specified in Table A-I shall be classified as controlled. Items exempt from analysis (see A.2.4) need not be classified as acceptable or controlled.

A.2.5.1 Exceptions to the chemistry limits.

(a) Low melting point metal exception. A shop product may contain low melting point metals in the form of stable chemical compounds that do not melt or decompose below 2200°F (e.g. zinc oxide). Chemicals in such a form need not be counted toward the low melting point metal limits specified in Table A-I.

(b) Water exception. The limits of Table A-I do not apply to water in accordance with Table A-II.

(c) Rubber gloves. Water-leachable chloride limits of 500 ppm apply for rubber gloves, in lieu of 250 ppm.

(d) Tape. Water-leachable chloride and sulfur limits of 500 ppm each apply for tape, in lieu of 250 ppm each.

(e) Liquid penetrant materials. The detrimental material content of liquid penetrant materials shall be in accordance with MIL-STD-2132 or NAVSEA 250-1500-1.

(f) Grease. A chloride limit of 500 ppm applies for grease in accordance with DOD-G-24508. Phosphorus limits of 750 ppm and 500 ppm apply for Mobilgrease 28™ and Aeroshell Grease 22™ respectively. A fluoride limit of 4,000 ppm applies for Aeroshell Grease 22™.

TABLE A-I. Detrimental material limits.

Detrimental Material	Maximum Limits for Shop Products 1/	Maximum Limits for Solid Nonmetallic Materials 1/
Low melting point metals: Antimony Bismuth Cadmium Lead Tin Zinc	 250 ppm 250 ppm 250 ppm 250 ppm 250 ppm 250 ppm	 Not Applicable
Halides: Bromides Chlorides Fluorides	 250 ppm (total) 250 ppm (total) 250 ppm (total)	 250 ppm (leachable) 250 ppm (leachable) 250 ppm (leachable)
Sulfur	250 ppm (total)	250 ppm (leachable)
Phosphorus	250 ppm	Not Applicable

1/ See A.2.5.1 for exceptions

TABLE A-II. Water purity requirements.

Attribute	Limit 2/
Chloride ion 1/	1.0 ppm, maximum
Conductivity 3/ 4/	20 microsiemens/cm, maximum
Resistivity 3/	50K ohms-cm, minimum
Visual clarity	No turbidity, oil, or sediment

1/ Chloride ion measurement is not required if the conductivity is less than 2.5 microsiemens/cm, or if the resistivity is 400,000 ohms-cm or greater.
2/ Demineralized water meeting the requirements of ASTM D1193, Type II, satisfies Table A-II requirements.
3/ Measure either conductivity or resistivity, resistivity is the inverse of conductivity.
4/ Microsiemens/cm and micromhos/cm are equivalent units.

A.2.6 Requirements for listing acceptable shop products and acceptable solid nonmetallic materials.

A.2.6.1 Acceptable Products List. The organization shall maintain an Acceptable Products List which consists of shop products and solid nonmetallic materials that have been shown to meet the detrimental material limits of Table A-I, except those exempt from analysis by paragraph A.2.4. At the organization's option, an Acceptable Products List may be generated by accessing the CAPL electronically per the combined CAPL/ MQPL website (see 3.5).

A.2.6.1.1 Content of Acceptable Products List. The Acceptable Products List shall include the following information for each shop product or solid nonmetallic material listed:

(a) Manufacturer's name.

(b) Name of the product or nonmetallic material.

(c) Generic product or nonmetallic material description, including information that is necessary to describe the actual condition tested (e.g., gloves, rubber, model number, rinsed with distilled water).

(d) Reference to the certification or quantitative chemical analysis report for detrimental materials, including the date.

A.2.6.2 Frequency of analysis or certification. For acceptable shop products and acceptable solid nonmetallic materials, an analysis or certification shall be obtained on each procurement (or be from the same batch/lot initially tested), or once every four years, whichever is less frequent.

A.2.6.2.1 Subsequent test failures. If an acceptable shop product or solid nonmetallic material does not meet Table A-I limits when next tested, the nonconforming test result shall be reported for information within 5 business days to NAVSEA or its authorized representative and the product shall be removed from the organization's Acceptable Products List (APL) and/ or the CAPL (by NAVSEA's authorized representative) as applicable. From then on, each batch or lot shall be tested, and only specific batches or lots that meet Table A-I limits may be used as

acceptable shop products or acceptable solid nonmetallic materials. The shop product or solid nonmetallic material may be reclassified as an acceptable shop product or solid nonmetallic material, subject to normal testing frequency requirements, only after three production lots that have been produced subsequent to the test failure are tested and shown to meet Table A-I requirements.

A.2.6.3 Acceptable shop product and acceptable solid nonmetallic material analysis records. The latest analysis record for each acceptable shop product and acceptable solid nonmetallic material shall be maintained as long as the product or nonmetallic material is used. Records shall be made available for review at the organization's facility upon request of NAVSEA or its authorized representative, or the Government inspector. Records need not be retained for items listed on the Consolidated Acceptable Products List (CAPL) for which an electronic copy of the record is available through the combined CAPL/ MQPL website.

Unless otherwise approved, all test results (including failures) shall be entered into the CAPL/MQPL website by the testing organization. Results should normally be entered within 5 business days of receipt of product test results. If the CAPL/MQPL website is unavailable, the testing organization shall submit test results to BPMI Fleet Support and Logistics (fax number 412-829-8338) within 5 business days of the testing organization’s receipt of product test results. The fax should be marked “CAPL/MQPL Test Results.” BPMI will incorporate these results into the CAPL/MQPL when the website becomes available.

A.2.7 Analysis of controlled shop products and controlled solid nonmetallic materials. If analysis of controlled shop products or controlled solid nonmetallic materials is performed, organizations should retain the results for compilation into the Consolidated Controlled Products List (CCPL). Records need not be retained for items listed on the CCPL for which an electronic copy of the record is available through the combined CAPL/MQPL website (see 3.5).

A.2.8 Sources of analysis data. Testing may be performed by the Contractor, the user organization, or by another user organization and the test results shall be made available through the CAPL/MQPL website.

DETRIMENTAL MATERIAL TEST METHODS

B.1 SCOPE

B.1.1 Scope. This appendix specifies test methods to detect mercury, lead, halides (i.e., chlorides, fluorides, and bromides), and sulfur. This Appendix is a mandatory part of the standard. The information contained herein is intended for compliance.

B.2 APPLICABLE DOCUMENTS

B.2.1 Non-Government publications. The following documents form a part of this standard to the extent specified herein. Unless otherwise specified, the issues of the documents are those cited in the solicitation or contract.

ASTM INTERNATIONAL (ASTM)

ASTM D512	-	Standard Test Methods for Chloride Ion in Water
ASTM D516	-	Standard Test Method for Sulfate Ion in Water
ASTM D1179	-	Standard Test Methods for Fluoride Ion in Water
ASTM D1246	-	Standard Test Method for Bromide Ion in Water
ASTM D4327	-	Standard Test Method for Anions in Water by Suppressed Ion Chromatography

(Copies of these documents are available from www.astm.org.)

B.3 MERCURY TEST

B.3.1 Introduction. This section specifies two test methods to be used to measure the surface concentration of mercury and mercury compounds for recovery from a mercury spill.

B.3.2 Heated method. The heated method for mercury measurement shall be performed as follows:

(a) Clean the hardware with an acceptable solvent.

(b) Seal the hardware in a clean container that is impermeable to mercury vapor (such as a polyethylene bag). The container's volume shall be approximately twice that of the contained hardware.

(c) Purge the container with gas that contains no mercury vapor or substance known to interfere with mercury vapor detection, in an amount that would give inaccurate results.

(d) Heat the contained hardware to 125°F ± 5°F (52°C ± 3°C) and maintain this temperature range for at least one hour.

(e) In accordance with the manufacturer’s instructions, zero the mercury vapor detector in the atmosphere used to inflate the hardware container. The mercury vapor detector shall be capable of detecting 0.005 milligram of mercury per cubic meter.

(f) Measure and record the mercury content of the atmosphere in the container.

B.3.3 Unheated method. The unheated method for mercury measurement shall be performed as follows:

(a) Clean beyond the area(s) of the hardware where the mercury spill is known or suspected to have occurred.

(b) Enclose the cleaned area(s) in one or more polyethylene bags or sheets and seal this enclosure to the hardware with tape. If the cleaned area exceeds 10 percent of the area of the hardware then the total area to be enclosed shall be at least 10 percent of the area of the hardware or two square feet, within the cleaned area, whichever is greater.

(c) Maintain the sealed enclosure at or above 70°F (21°C) for at least eight hours.

(d) Zero the mercury vapor detector in an atmosphere free of mercury contamination. The mercury vapor detector shall be capable of detecting 0.005 milligram of mercury per cubic meter.

(e) Measure and record the mercury content of the atmosphere in each sealed enclosure.

B.3.4 Acceptance criteria. The acceptance criteria for mercury as determined by a method in this section or an approved alternate method shall be as follows. If the atmosphere in any sealed enclosure contains 0.01 milligram or more mercury per cubic meter, the entire spill area shall be cleaned and retested. The solvents used to clean the hardware must be completely removed from the surface and exhausted from the area prior to retesting.

B.4 LEAD TEST

B.4.1 Introduction. This section specifies the test method to detect lead on a metal surface.

B.4.2 Restriction. This test shall not be performed if the presence of barium or strontium is known or suspected. Instead, inform NAVSEA or its authorized representative.

B.4.3 Test supplies.

(a) Plumbtesmo® lead detection paper (Macherey-Nagel #90602 or equivalent).

(b) Potassium cyanide reagent: 20 milligrams of reagent grade potassium cyanide dissolved in 100 milliliters of distilled water.

(c) Dithizone-trichloroethane reagent: 1.5 milligrams of reagent grade dithizone dissolved in 100 milliliters of reagent grade 1,1,1 trichloroethane.

NOTE: Reagents (b) and (c) above shall be used only if tellurium, silver, or cadmium are known or suspected of being present in the area to be tested.

B.4.4 Test procedure. The test for lead shall be performed as follows:

(a) Using a solvent from Table I, degrease the area to be tested.

(b) Moisten a sheet of lead detection paper with distilled water.

(c) Press the lead detection paper firmly against the surface and maintain it there for at least two minutes.

(d) Remove the lead detection paper.

(e) If the presence of tellurium, silver, or cadmium is known or suspected, then proceed as follows:

1. Apply a few drops of potassium cyanide reagent to the lead detection paper.
2. Apply the same number of drops of dithizone-trichloroethane reagent to the lead detection paper.

(f) Visually examine the side of the lead detection paper that contacted the hardware surface.

(g) Rinse the test surface with distilled water.

B.4.5 Acceptance criteria.

B.4.5.1 Normal test. In the absence of any reacting element, the test paper should remain light yellow. If the lead detection paper exhibits a red-pink color, the tested area shall be re-cleaned and retested in accordance with this appendix.

B.4.5.2 Tellurium, silver, or cadmium present. If the lead detection paper exhibits a brownish-red color, the tested area shall be recleaned and retested in accordance with this appendix using reagents b and c above.

B.5 CHLORIDE ION SWIPE TEST

B.5.1 Introduction. This section specifies a test method for measuring chloride ion concentration on a metal surface.

B.5.2 Swipe preparation. Prepare clean, new, approximately one inch (25 millimeters) diameter cotton balls for use as chloride ion test swipes (NOTE: During preparation and during all subsequent handling, handle the swipes only with clean rubber gloves or clean corrosion resistant implements):

(a) Place the cotton balls in distilled water at 180°F - 200°F (82°C - 93°C).
(b) Maintain temperature in the above range and after 1 to 2 hours remove the swipes.
(c) Squeeze each swipe to remove excess water.
(d) Test two unused swipes in accordance with B.5.3.c through B.5.3.g and use the average chloride ion content to correct the results of subsequent chloride ion tests.

B.5.3 Chloride ion surface concentration. Measure the surface concentration of chloride ions as specified below:

(a) Swab one 4 square inch (25 square centimeter) area of the surface for each 400 square inches (2500 square centimeters) of surface to be chloride ion tested. For a surface with an area of less than 400 square inches, swab 4 square inches or the entire surface, whichever is less.

(b) Maintain a record of the location of the area swabbed with each swipe.

(c) Place each swipe in an individual clean beaker containing approximately 100 ± 5 milliliters of distilled water.

(d) Maintain the water and swipe at 180°F - 200°F (82°C - 93°C) for one hour (minimum).

(e) Remove the swipe from each beaker.

(f) Allow the water and beaker to cool to ambient temperature.

(g) Using Method A (mercurimetric titration) of ASTM D512, individually analyze the water in each beaker for chloride ion content.

(h) Subtract the average chloride ion content of the swipes analyzed in accordance with B.5.2(d) to correct for the residual chlorides. Chloride ion correction is not required but should be noted if not performed.

(i) Calculate the chloride ion content in units of micrograms per square centimeter of surface swabbed.

B.5.4 Acceptance criteria. If the surface contains 0.8 micrograms or more of chloride ions per square centimeter (0.02 milligrams/25 square centimeters), it shall be cleaned and retested in accordance with this appendix.

B.5.5 Acceptable alternate test methods. Suppressed ion chromatography analysis in accordance with ASTM D4327 is an acceptable alternate for the mercurimetric titration specified herein. In addition, other alternate analysis methods may be used when approved.

B.6 WATER LEACHING TESTS

B.6.1 Introduction. This section specifies test methods for measuring water leachable halides (i.e., chloride, fluoride, and bromide) and water leachable sulfur from solid nonmetallic materials.

B.6.2 Test Procedure. The water leaching test shall be performed as follows:

(a) Cut one specimen from the selected sample, weighing approximately 15 grams, and record its weight to 0.1 gram. When there is insufficient sample material available, the sample weight may be adjusted provided the ratio of sample weight to final volume of solution is maintained (i.e. 15 g/500 ml). When there is insufficient sample material to maintain the designated weight/volume ratio and perform the required analysis, a smaller ratio may be used provided the sensitivity of the analysis is sufficient to show that halide and sulfur levels are below required levels. Any adjustment of the weight/volume ratio shall be indicated in the analysis report along with the supplied material weight and volume.

(b) Cut the specimen into small pieces not greater than 1/4 inch in any dimension.

(c) Place the specimen in an appropriately sized beaker.

(d) Add approximately 400 ml of distilled water per 15 grams of sample weight to the beaker or approximately 80% of the final predetermined volume of leachate.

(e) Cover the beaker with a watch glass and heat for one hour minimum at 200°F - 212°F (93°C - 100°C).

(f) Allow the beaker to cool to room temperature.

(g) Vacuum filter the leachate from the beaker separately through a prewashed filter (No. 41 Whatman or equivalent coarse porosity filter) and a Buchner funnel. Wash the beaker thoroughly with distilled water using ten or more washes and vacuum filter the wash solutions. Dilute the filtrate to 500 ml, or the appropriate volume to maintain a 15 g/500 ml ratio or other predetermined volume. Any other equivalent filtration technique or decantation technique may be used as determined by the analyst.

(h) If necessary, store the filtrate in a cleaned polyethylene or glass container covered to prevent evaporation.

(i) Prepare a control filtrate with no specimen following the instructions in d through h.

B.6.3 Determination of leachable halide ion concentration. Using aliquots from the control filtrate and the sample filtrate, the concentration of bromide, chloride, and fluoride ions in each filtrate shall be determined by an appropriate method of ASTM D1246, ASTM D512, and ASTM D1179, respectively. The concentration of water-leachable halide in the material shall be determined as follows:

$$\text{Bromide, Chloride, or Fluoride, } \mu g/g \text{ (ppm)} = C \times V_S/M$$

Where:

C = concentration of bromide, chloride, or fluoride in filtrate, in milligrams per liter (micrograms per milliliter)

V_S = final volume of solution in milliliters per B.6.2.g

M = grams of the test specimen, prepared per B.6.2.a

B.6.3.1 Acceptance criteria. If the concentration of leached halide ions in the specimen exceeds the limits specified in Appendix A, the nonmetallic material shall be considered a controlled nonmetallic material in accordance with this standard.

B.6.4 Determination of leachable sulfur concentration. When using an analytical test method that only detects sulfur in sulfate (SO_4^{-2}) form, the leachable sulfur concentration shall be determined in accordance with the following. Using aliquots from the control filtrate and the sample filtrate in B.6.2.g, determine the concentration of sulfur as follows:

(a) Place 25 ml of the filtrate in a 50 ml or larger clean beaker properly identified.

(b) Add distilled water saturated with bromine drop by drop while stirring until a red-brown color persists. Then cover the beaker with a watch glass.

(c) Heat the solution in the covered beaker on a hot plate until the bromine color disappears.

(d) Allow the solution to cool to room temperature.

(e) Transfer the solution to a volumetric flask and add distilled water rinses from the beaker to make up a final volume that is consistent with the sulfate test method. Determine the sulfate ion concentration of this final diluted volume using an appropriate method of ASTM D516 or ion chromatography in accordance with ASTM D4327.

(f) Use the following formula to obtain the water-leachable sulfur concentration of the filtrate:

$$\text{Sulfur, } \mu g/g \text{ (ppm)} = C \times V_S \times V \times 0.334/ (25.0 \times M)$$

Where:

C = concentration of sulfate ion (SO_4^{-2}) in filtrate, in milligrams per liter (micrograms per milliliter), determined in step e.

V_S = final volume of solution in milliliters per B.6.2.g

V = milliliters of final diluted volume

M = grams of the test specimen, prepared per B.6.2.a

B.6.4.1 Acceptance criteria. If the concentration of leached sulfur and sulfur compounds in the specimen exceeds the limit specified in Appendix A, the nonmetallic material shall be considered a controlled nonmetallic material in accordance with this standard.

B.6.5 Acceptable alternate test methods. Suppressed ion chromatography analysis in accordance with ASTM D4327 and inductively coupled plasma (ICP) analysis are acceptable alternates for the ASTM leachate analyses specified herein. In addition, other alternate analyses may be used when approved.

B.7 SAMPLE PREPARATION

B.7.1 Greases. For sample preparation of greases for quantitative analysis for low melting point metals and phosphorus, acid digestion or microwave acid digestion shall be the method of sample preparation.

B.7.2 Shop products. For sample preparation of shop products other than greases for quantitative analysis for low melting point metals and phosphorus, acid digestion or microwave acid digestion shall be used for sample preparation if other sample preparation techniques (such as Parr bomb) are not effective.

MERCURY SPILL REPORT

C.1 SCOPE

C.1.1 Scope. This appendix identifies the contents of mercury spill reports. This Appendix is a mandatory part of the standard. The information contained herein is intended for compliance.

C.2 CONTENTS

C.2.1 Required content for mercury spill report. All mercury spill reports shall include the following information:

(a) Organization identity.
(b) Date, time, and location of the spill, if known.
(c) Date and time that the spill was discovered.
(d) Reason that the spill was discovered later than its occurrence, if applicable.
(e) Source of the mercury.
(f) Reason for the spill.
(g) All hardware that the mercury contacted or may have contacted.
(h) Corrective or remedial steps that were taken immediately upon discovering the spill.
(i) The mercury test method used or the alternate method used.
(j) Results of the Appendix B, Section B.3 surface mercury test and any other tests performed.
(k) Current status of the hardware involved.
(l) The organization's evaluation of the situation.
(m) Steps to be taken to restore the cleanliness of hardware involved.
(n) Permanent corrective actions that are necessary to prevent future mercury spills and dates by which each action will be accomplished.

C.3 EXCEPTION

C.3.1 Broken light bulb exception. For a mercury spill due to a single broken fluorescent light bulb, no mercury test is required provided the following conditions are met:

(a) Only external hardware surfaces are affected.
(b) All identified bulb debris is removed.
(c) The affected areas are thoroughly inspected and cleaned to the maximum extent practical, including the vacuuming of all accessible crevices and other areas that are likely to gather bulb debris and it is reasonable to assume that all bulb glass, phosphor, and tube electrode fragments have been removed.

PROCEDURE FOR RECOVERY FROM LOSS OF DETRIMENTAL MATERIAL CONTROL

D.1 SCOPE

D.1.1 Scope. This appendix defines procedures for recovery from loss of detrimental material control. This Appendix is a mandatory part of the standard. The information contained herein is intended for compliance. Other procedures may be used with approval.

D.2 PROCEDURES

D.2.1 General requirements.

D.2.1.1 Removal of detrimental material. If a detrimental material contacts hardware when contact is prohibited, but does not transfer (see Section 3 Definitions) to the hardware, the detrimental material shall be removed and the hardware shall be visually inspected for evidence of harmful effects such as, but not limited to, discoloration, rusting or other abnormal oxidation, hazing, etching, surface roughening, pitting or cracking. If harmful effects are observed, approval of hardware acceptance is required.

D.2.1.2 Recovery. If a detrimental material transfers to the hardware when prohibited then the procedures identified below shall be used for recovery from loss of detrimental material control. If the metal removal exception requirements of 5.1.1 can be satisfied, no further reporting or approval in accordance with this appendix are necessary.

D.2.2 Recovery procedure for transfer of mercury or other low melting point metal, silver, copper, aluminum, or their alloys. If mercury or other low melting point metal, silver, copper, aluminum, or any alloy of these metals transfers to a hardware surface when prohibited, the organization shall recover from the loss of detrimental material control as follows:

1. Determine the extent of transfer of the metal/alloy by visual inspection and other appropriate testing of the hardware listed in this specification (e.g., see Appendix B).

2. Remove the transferred metal/alloy by mechanical cleaning (e.g., machining, grinding, use of a hand abrasive) followed by solvent cleaning, water rinsing, or vacuuming.

3. Verify complete removal of the metal/alloy by visual inspection and other appropriate testing of the hardware listed in this specification.

4. Visually inspect the hardware beneath the metal/alloy for evidence of harmful effects such as, but not limited to, discoloration, rusting or other abnormal oxidation, hazing, etching, surface roughening, pitting, or cracking. Magnification up to 10X may be used, if appropriate.

5. Report and obtain hardware approval of acceptance per D.2.4 except that reporting and hardware approval per D.2.4 is not required for transfer of these metals/alloys (except mercury) if the transferred material can be completely removed by mechanical cleaning and no harmful effects are observed by visual inspection.

D.2.3 Recovery procedure for transfer of a shop product or solid nonmetallic material. If a shop product or solid nonmetallic material transfers to the hardware surface at a stage in processing when prohibited, the organization shall recover from the loss of detrimental material control as follows:

1. Determine the extent of transfer of the product/material by visual inspection.

2. If the product/material entered crevices or inaccessible areas or the hardware was above 350°F, if the detrimental material is not already known and if sufficient quantity exists, perform a quantitative chemical analysis for detrimental materials.

3. Remove the transferred product/material by a method determined to be effective.

4. Verify complete removal of the product/material by visual inspection.

5. Visually inspect the hardware beneath the detrimental material for evidence of harmful effects such as, but not limited to, discoloration, rusting or other abnormal oxidation, hazing, etching, surface roughening, pitting, or cracking. Magnification up to 10X may be used if appropriate.

6. Report and obtain hardware approval of acceptance per D.2.4 except that reporting and hardware acceptance per D.2.4 is not required for transfer of products/materials that can be completely removed by mechanical cleaning and no harmful effects are observed or that meet Table A-I limits and no harmful effects are observed. If any of the above steps cannot be completed, report and obtain hardware approval per D.2.4.

D.2.4 Reporting and approvals. The organization shall document the loss of detrimental material control and obtain hardware approval under any of the following conditions:

(a) If all of the material cannot be removed from the hardware, or if visual inspection cannot be performed to verify complete removal of the material from all exposed surfaces.

(b) If a harmful effect on the hardware is observed.

(c) If mercury or a low melting point metal (identified in Table A-I) or alloy of these metals transfers to hardware and cannot be completely removed.

(d) If silver, copper, aluminum, or an alloy of these metals transfers to hardware and cannot be completely removed.

(e) If a shop product or solid nonmetallic material transfers to a hardware internal surface or external surface of a pressure boundary part, at a temperature above 350°F, and the contacted hardware surface cannot subsequently be removed.

(f) If it is impossible or impractical to follow the applicable recovery procedure specified in this appendix.

(g) If the material transferred to a surface of hardware that is a seal membrane.

(h) If material enters an inaccessible area and cannot be completely removed.

For all other transfer of a detrimental material to hardware at a stage in processing when prohibited, the organization shall locally document the incident unless complete removal can be assured by prompt retrieval of all the detrimental material at the time of transfer and the metal surface was below 350°F.

CONTROLLED PARTS SPECIFICATIONS

MIL-S-23192	Springs, Helical, Age-Hardenable Nickel-Chromium-Iron Alloy Revision D (11 March 1986)
MIL-F-23467	Fittings and Flanges, Wrought Seamless, Butt and Socket Welding, Austenitic Corrosion-Resistant Steel Revision F (11 March 1985)
MIL-F-23508	Fittings and Flanges, Wrought Seamless, Butt and Socket Welding, Nickel-Chromium-Iron Alloy Revision E (28 July 1986)
MIL-F-23509	Fittings and Flanges, Wrought Seamless, Butt and Socket Welding, Nickel-Copper Alloy Revision F (4 January 1985)
MIL-F-24339	Fittings and Flanges, Wrought Seamless, Butt and Socket Welding, Carbon Steel Revision C (22 October 1985)
MIL-F-24342	Fittings and Flanges, Wrought Seamless, Butt and Socket Welding, 70-30 Copper-Nickel Alloy Revision C (27 March 1985)
MIL-M-24130	Metallic Seal Rings, Non-Integral, General Specification For Revision B (29 April 1980)
MIL-M-24130/1	Metallic Seal Rings, Non-Integral, Nickel-Chromium-Iron Alloy Revision D (12 February 1988)
MIL-M-24130/2	Metallic Seal Rings, Non-Integral, Steel, Corrosion-Resistant Revision C (8 April 1985)
MIL-M-24130/3	Metallic Seal Rings, Non-Integral, Nickel-Copper Alloy Revision B (9 January 1986)
MIL-DTL-24130/4	Metallic Seal Rings, Non-Integral, Nickel-Chromium-Iron Alloy Revision Original (11 March 2014)
MIL-S-24287	Studs; Bolt-Studs; Bolts; Nuts, Alloy Steel (for Service to 700°F) Revision C (11 April 1985) with Amendment 2 (21 March 1991) and Interim Change 1 (27 August 1993)
MIL-S-24354	Studs; Bolt-Studs; Bolts; Nuts; Capscrews, Corrosion-Resistant and Non Ferrous Material Revision E (3 April 1985)
MIL-DTL-24789	Externally Threaded Fasteners, Rolled Thread Revision Original (28 February 1997)
MIL-W-24493	Wire, Cold Drawn, Age-Hardenable, Nickel-Chromium-Iron Alloy Revision B (11 March 1986)
MIL-P-24503	Packing Material, Graphitic, Corrugated Ribbon or Textured Tape and Preformed Ring Revision B (22 August 1991)

MIL-P-24583	Packing Material, Graphitic or Carbon Braided Yarn Revision B (22 August 1991)
MIL-G-24716	Gaskets, Metallic - Flexible Graphite, Spiral Wound Revision Original (10 May 1989)
MIL-DTL-24777	Non-Metallic Materials with Special Requirements Revision A (29 January 1998) with Interim Change 1 (24 May 2001)
MIL-DTL-32631	Hot Isostatic Pressure Diffusion Bonded Parts for Special Applications Revision Original (1 October 2019)
MIL-DTL-32668	Fittings and Flanges, Wrought, Seamless, Butt and Socket Welding, Nickel-Chromium-Iron Alloy Revision Original (12 August 2022)
MIL-DTL-32672	Fittings and flanges, Wrought, Seamless, Butt and Socket Welding, Nickel-Chromium-Molybdenum-Niobium Alloy Revision Original (12 August 2022)
MIL-DTL-32683	Nickel Alloy Powder Metallurgy Parts, Hot Isostatic Pressed Revision Original (31 August 2021)

CONCLUDING MATERIAL

Preparing activity:
Navy – SH
(Project 20GP-2022-001)

NOTE: The activities listed above were interested in this document as of the date of this document. Since organizations and responsibilities can change, you should verify the currency of the information above using the ASSIST Online database at http://assist.daps.dla.mil.