

NAVAL SEA SYSTEMS COMMAND

Issues of Interest to NSRP, Surface Preparations & Coatings Panel



NSRP Meeting

February, 2025

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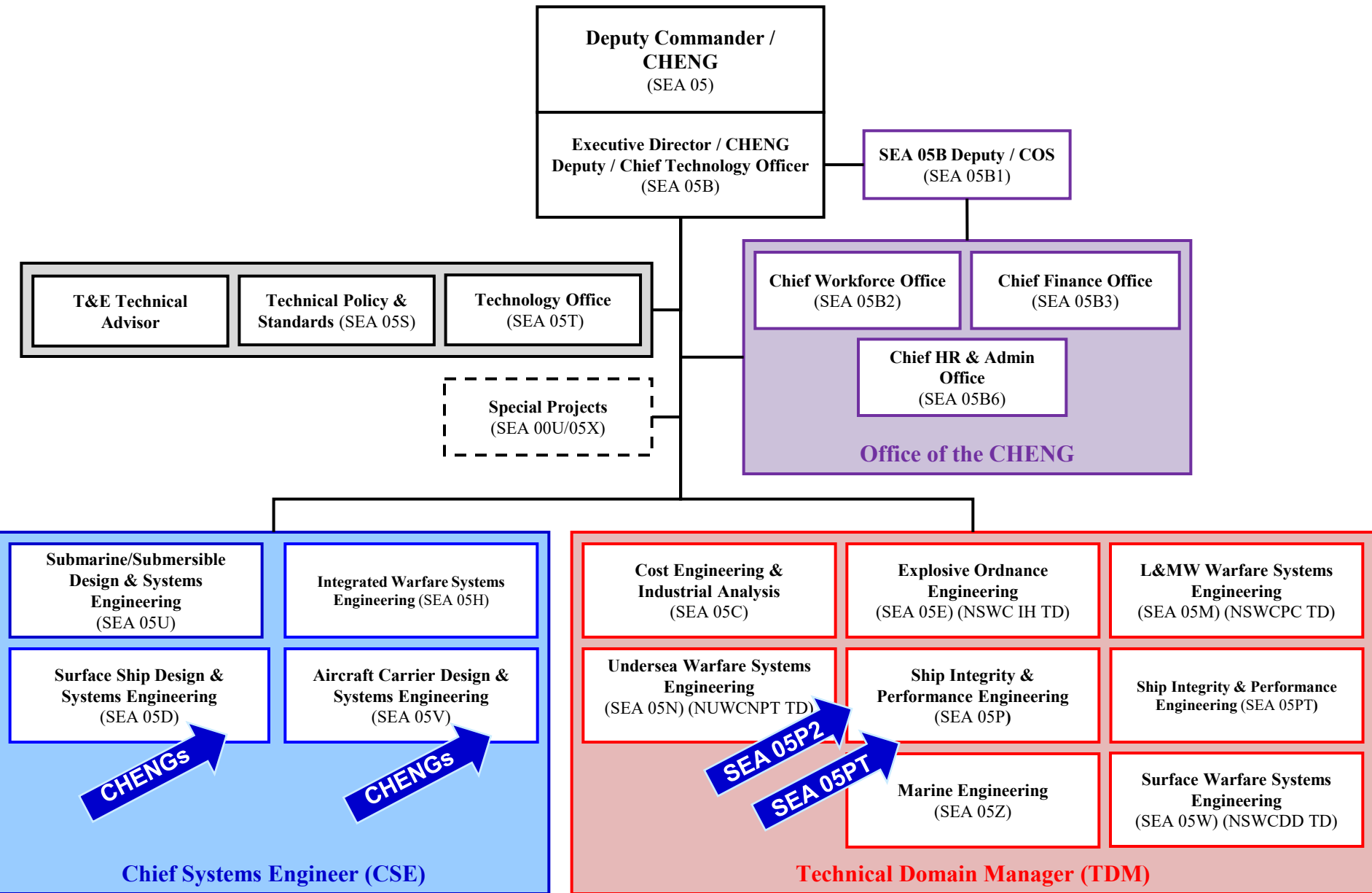
OBJECTIVES

- Summarize evolving Naval Sea Systems Command (NAVSEA) organization, material, and coating requirements:
 - Headquarters NAVSEA organization & objectives.
- Summarize **key issues for NSRP team and determine how NSRP can assist NAVSEA** in addressing evolving coatings and materials requirements:
 - Issues with copper-free antifouling coatings.
 - Issues with copper-bearing antifouling coatings.
 - NAVSEA published MIL-PRF-24647E, Amendment 1 to antifouling coating specification.
 - NAVSEA publishing MIL-PRF-22262C, Amendment 1 that addresses beryllium issue.
 - NAVSEA publishing MIL-PRF-16173F that includes a Class 9, persistent, corrosion-preventative compound.
- Summarize opportunities for **NSRP team to assist NAVSEA**.



Naval Systems Engineering Directorate (SEA 05)

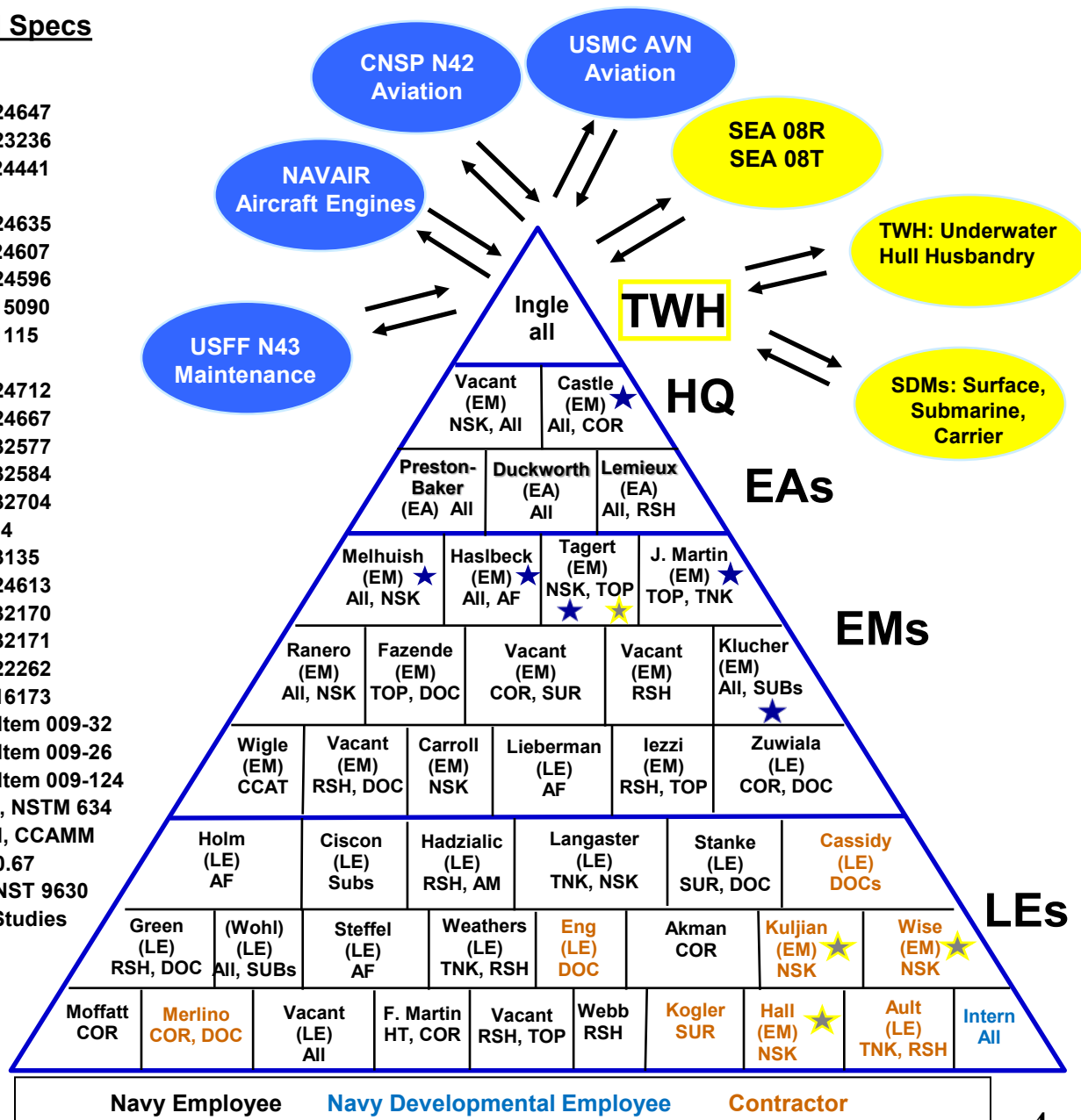
Draft: Oct 2024



Technical Authority Pyramid - Coatings & Corrosion Control

Draft: Feb. 2025

Code	Product	Related Specs
All	All Technical Products, Managerial	All
AM	Additive Manufacturing	Multiple
AF	Antifouling Coating Systems	MIL-PRF-24647
TNK	Tank Coatings, Epoxy Primers	MIL-PRF-23236 MIL-DTL-24441
PRM	Primers, Single Component	TT-P-645
TOP	Topside, Alkyds & Polysiloxanes	MIL-PRF-24635
INT	Interior Coatings (SEA 08)	MIL-DTL-24607 MIL-PRF-24596 MIL-DTL-15090 MIL-DTL-1115
HT	High Temp Coatings, Metallic	TT-P-28
PWD	Powder, Interior, Cosmetic	MIL-PRF-24712
NSK	Nonskid	MIL-PRF-24667 MIL-PRF-32577
DCK	Deck Coverings	MIL-PRF-32584 MIL-PRF-32704 MIL-D-3134 MIL-PRF-3135 MIL-PRF-24613 MIL-PRF-32170 MIL-PRF-32171
SUR	Abrasive blasting, surface prep	MIL-PRF-22262
SEL	Sealants & Preservatives	MIL-PRF-16173
DOC	Policy Documents	Standard Item 009-32 Standard Item 009-26 Standard Item 009-124 NSTM 631, NSTM 634
COR	Corrosion, PCOE	S636-MAN, CCAMM DODI 5000.67 NAVSEAINST 9630
RSH	Research & Development	Reports, Studies
UNDS	Regulations, Underwater hull	TBD



- ★ Delegated signature authority
- ★ NAVSEA-approved Technical Representative

Navy Employee Navy Developmental Employee Contractor



Issue Summary

Key Raw Material Used in Copper-Free Antifoulings No Longer Available

ISSUE: September 2024, Janssen Pharmaceuticals stated that they will cease domestic sales of their ECONEA biocide (i.e., CAS #122454-29-9, 2-(p-chlorophenyl)-3-cyano-4-bromo-5-trifluoromethyl pyrrole) used in ALL NAVSEA QUALIFIED MIL-PRF-24647E, Type I, copper-free, ablativ

BACKGROUND: Early 2000s, Navy had OPNAV funded project to identify more environmentally acceptable, short half-life in the environment, non-metallic biocides to replace copper in ablativ

- Successful program demonstrated that ablativ antifouling with ECONEA and a zinc pyrithione algaecide performed as well as cuprous-oxide-based ablativ antifouling.
- 2005, published MIL-PRF-24647D antifouling specification that included new requirements for Type I products that, “. . . contain biocide(s) other than copper which ablate or self polish.”
- 2007, ECONEA registered with U.S. EPA.
- 2008 NAVSEA qualified first MIL-PRF-24647D, Type I, copper-free ablativ antifouling.
- 2009, NAVSEA published FY-11 Standard Item 009-32 that included requirements for MIL-PRF-24647D, Type I coatings to be applied to aluminum hulls. Additional MIL-PRF-24647D, Type I, copper-free antifouling coatings qualified.

RESULT: Manufacturers of MIL-PRF-24647E, Type I qualified coatings working to address supply issues.

- No alternative biocide system yet identified.
- No developmental, copper-free biocides for ablativ antifoulings in qualification testing.
- 11 Dec 2024, NAVSEA published Amendment 1 to MIL-PRF-24647E to update requirements for Type IV coatings that contain biocides but do not ablate or polish.

[Janssen commercial decision to cease production of ECONEA will adversely affect U.S. Navy supply of MIL-PRF-24647E qualified, Type I coatings by late 2025 or early 2026.](#)





Issue Summary

National Defense Authorization Act (NDAA) Copper-Based Antifouling

ISSUE: 23 Dec 2025, NDAA signed into law and Joint Explanatory Statement cites Section 5 that includes provisions of H.R. 8070, and the provisions of S. 4638. The house bill contained a provision in Section 1084) that "would require the Department of Defense to assess the feasibility of alternatives to copper-based antifouling. The Senate committee-reported bill contained no similar provision. The agreement does not include the House provision. We direct the Secretary of Defense to provide a briefing, not later than March 1, 2025, to the Committees on Armed Services of the Senate and the House of Representatives on the feasibility and advisability of moving away from copper-based antifouling coatings.

KEY ASSESSMENT ISSUES: NAVSEA tasker to develop brief for the Secretary of Defense that includes three key assessment provisions:

First paragraph requires DoD to: "assess feasibility of alternatives to copper-based antifouling coatings" and requests that the briefing include:

1. Notional timeline to remove copper-based antifouling paint by 1 Jan 2028.
2. Criteria for antifouling effectiveness, measured by duration of time such coating prevents biological adhesion, corrosion and degradation of vessel surfaces,"

Assessment regarding antifouling coatings

The House bill contained a provision (sec. 1084) that would require the Department of Defense to assess the feasibility of alternatives to copper-based antifouling coatings.

The Senate committee-reported bill contained no similar provision.

The agreement does not include the House provision. We direct the Secretary of Defense to provide a briefing, not later than March 1, 2025, to the Committees on Armed Services of the Senate and the House of Representatives on the feasibility and advisability of moving away from copper-based antifouling coatings.

The briefing should include:

- (1) A notional timeline to remove existing copper-based antifouling coatings from naval vessels by January 1, 2028;
- (2) Criteria for antifouling effectiveness, measured by the duration of time such coating prevents biological adhesion, corrosion and degradation of vessel surfaces, environmental damage caused by shedding and leaching of the coating, and the effect of the coating on fuel efficiency and vessel speed; and
- (3) An evaluation of whether a new antifouling coating standard could reduce time and costs associated with maintenance, while also being environmentally sound.

Prior to the briefing, the Secretary should evaluate commercially available products, technologies, applications, and services that could be used to improve combat readiness by decreasing the need for re-application of antifouling coatings.

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[SEA 05P2 part of NAVSEA team working to develop response to NDAA.](#)



Issue Summary

National Defense Authorization Act (NDAA) Copper-Based Antifouling

KEY ASSESSMENT ISSUE: NAVSEA developing brief for the Secretary of Defense that addresses:

2. (Continued) “. . . environmental damage caused by shedding and leaching of the coating, and

“. . .the effect of the coating on fuel efficiency and vessel speed; . . .”
3. An evaluation of whether a new antifouling coating standard could reduce time and costs associated with maintenance, while also being environmentally sound.

Prior to the briefing, the Secretary should evaluate commercially available products, technologies, applications, and services that could be used to improve combat readiness by decreasing the need for re-application of antifouling coatings.”

WAY AHEAD: Brief provides specific summary to address each issue raised in the NDAA.

[Response to NDAA shown addressing each issue cited in the NDAA.](#)



Issue Summary

National Defense Authorization Act (NDAA) Copper-Based Antifouling

KEY ASSESSMENT ISSUES: NAVSEA tasked to develop brief for the Secretary of Defense that includes three key assessment provisions:

1. Notional timeline to remove copper-based antifouling paint by 1 Jan 2028. To be provided by SEA 04P and CNRMC.
2. Criteria for antifouling effectiveness, measured by duration of time such coating prevents biological adhesion, corrosion and degradation of vessel surfaces,"

NAVSEA RESPONSE: Since 1985, NAVSEA has had a performance specification that defines requirements for antifouling effectiveness, prevention of organism adhesion, and corrosion of the substrate.

Most recent, MIL-PRF-24647E, with Amendment 1, "PERFORMANCE SPECIFICATION PAINT SYSTEM, ANTICORROSIVE AND ANTIFOULING, SHIP HULL," published on 11 Dec 2024 defines requirements for antifouling effectiveness for:

- Type I coatings that ablate or self polish and contain biocides, other than copper.
- Type II coatings that ablate or self polish and contain copper.
- Type III coatings that do not contain biocides and do not ablate or self polish.
- Type IV coatings that contain biocides and do not ablate or self polish.

[Four Types of coatings cited in MIL-PRF-24647E, with Amendment 1 support qualification of commercial antifouling coating systems that are used on ". . . virtually all ocean-going vessels" \(Ocean Engineering Volume 173, 1 February 2019\).](#)

Antifouling Performance Criteria Defined by Formula Specifications and Performance Requirements

ISSUE: Criteria for antifouling effectiveness, measured by duration of time such coating prevents biological adhesion, corrosion and degradation of vessel surfaces currently defined by:

MIL-PRF-24647E, "Paint System, Anticorrosive and Antifouling, Ship Hull"

- Performance specification defines requirements for commercial antifouling coatings and does not define the formula or composition of antifouling.

BACKGROUND: Controlling fouling on U.S Navy ships started with first commissioned warships that used copper sheathing to protect wooden hull.

USS CONSTITUTION in 1797 was to be "copper bottomed." (Desy)



1908 - Norfolk Navy Yard manufactured the first antifouling paints that contained red mercuric oxide, zinc oxide, zinc dust (Adamson)



1926 - Mare Island Navy Yard developed hot plastic ship-bottom paint that contained cuprous oxide and mercuric oxide (Wehmhoff).

1952 – Bureau of Ships published, MIL-P-15931A, "PAINT, ANTIPOULING, VINYL (FORMULAS NO. 121A, AND 129A)," that included formula for cuprous oxide, vinyl chloride antifouling. Document was cancelled in 2005.



1985 – NAVSEA published DOD-P-24647, "PAINT, ANTIPOULING, SHIP HULL" that defined performance requirements for antifouling paints that contain copper and/or tin biocides. Performance requirements included:

- Cathodic disbondment.
- Surface roughness.
- Evaluate ship-installed panels tested for 3 years.
- Panel performance in seawater.
- Erosion rate.



[U.S. Navy antifouling formulations have used copper in paints for over 100 years.](#)

Issue Summary

National Defense Authorization Act (NDAA) Criteria for Antifouling Effectiveness

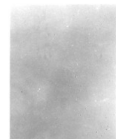
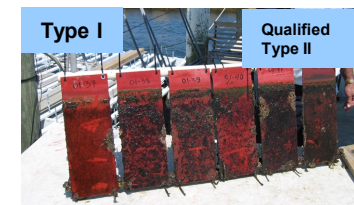
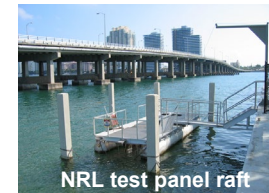
NAVSEA RESPONSE: Most recent, MIL-PRF-24647E, with Amendment 1, “PERFORMANCE SPECIFICATION PAINT SYSTEM, ANTICORROSIVE AND ANTIFOULING, SHIP HULL,” published on 11 Dec 2024 defines requirements for:

- “Criteria for antifouling effectiveness, measured by duration of time such coating prevents biological adhesion, corrosion and degradation of vessel surfaces”
- Type I coatings that ablate or self polish and contain biocides, other than copper.
 - Type II coatings that ablate or self polish and contain copper.

PERFORMANCE

REQUIREMENTS: Criteria for validating antifouling and corrosion control performance for ablative and self polishing coatings based on panel, patch and ship tests:

1. Panel testing in the natural marine environment in Biscayne Bay, Florida; Daytona Beach, Florida; or Pearl Harbor, Hawaii.
2. Compares fouling control performance to MIL-PRF-24647E qualified coating.
3. Testing for 12- to 24-months to allow marine growth and visual assessment.
Must exhibit comparable or less marine fouling.
4. Corrosion resistance validated by testing in accordance with ASTM G8 “Standard Test Methods for Cathodic Disbonding of Coated Steel.”
Must disbond less than 0.5 inches after three months.
5. Visual corrosion and blistering assessment in accordance with ASTM D714 “Standard Test Method for Evaluating Degree of Blistering of Paints.”
Blistering must be less than 8 and “few” blisters.



[Panel testing at Navy or commercial \(i.e., Daytona Beach\) test site allows coating manufacturers a cost-effective means of validating that coatings will satisfy NAVSEA fouling-control and corrosion-control performance criteria.](#)

Issue Summary

National Defense Authorization Act (NDAA) Criteria for Antifouling Effectiveness

NAVSEA RESPONSE: Most recent, MIL-PRF-24647E, with Amendment 1, “PERFORMANCE SPECIFICATION PAINT SYSTEM, ANTICORROSIVE AND ANTIFOULING, SHIP HULL,” published on 11 Dec 2024 defines requirements for antifouling effectiveness for:

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PERFORMANCE

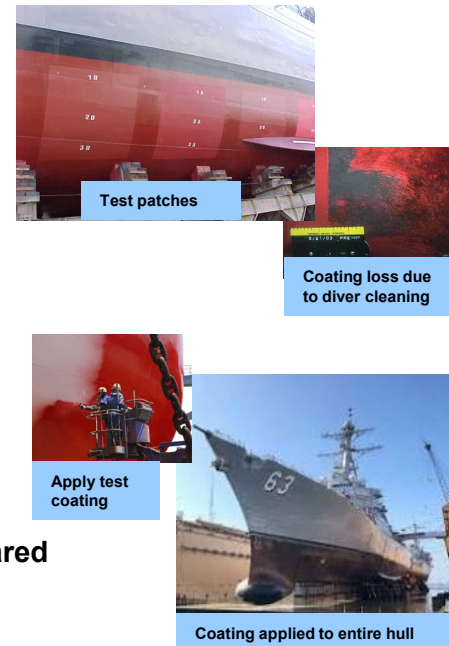
REQUIREMENTS: Criteria for validating antifouling and corrosion control performance for ablative and self polishing coatings based on panel, patch and ship tests:

1. Patch testing on Navy or commercial ship validates that coating satisfies antifouling and corrosion-control performance criteria for 12 months on a Navy ship or 24 months on a commercial ship.

Must exhibit comparable or less marine fouling, comparable polishing rate, resistance to established diver cleaning, and overall performance as compared with MIL-PRF-24647E qualified coating.

2. Ship testing on U.S. Navy ship validates that coating satisfies antifouling and corrosion-control performance criteria for 2, 5, 7, or 12 years, as appropriate.

Must exhibit comparable or less marine fouling, comparable polishing rate, resistance established diver cleaning processes, and overall performance as compared with MIL-PRF-24647E qualified coatings.



[Patch and ship testing on Navy ship validates that antifouling coatings satisfy NAVSEA fouling-control and corrosion-control performance criteria under “real world” conditions.](#)

Issue Summary

National Defense Authorization Act (NDAA) Criteria for Antifouling Effectiveness

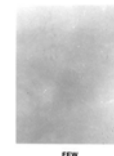
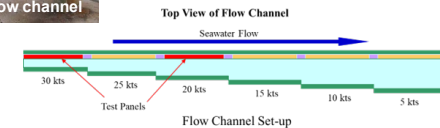
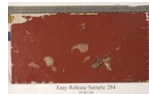
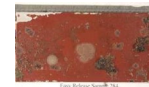
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- Type III coatings that do not contain biocides and do not ablate or self polish.
- Type IV coatings that contain biocides and do not ablate or self polish.

PERFORMANCE

REQUIREMENTS: Criteria for validating antifouling and corrosion-control performance for silicone-based, foul-release coatings that may, or may not, contain biocide based on panel, patch and ship tests:

1. Panel testing in the natural marine environment in Biscayne Bay, Florida; Daytona Beach, Florida; or Pearl Harbor, Hawaii.
2. Compares fouling control performance to MIL-PRF-24647E qualified, foul-release coating.
3. Testing quarterly for 12- to 24-months to allow marine growth and visual assessment.
Must exhibit comparable or less marine fouling.
4. Corrosion resistance validated by testing in accordance with ASTM G8 “Standard Test Methods for Cathodic Disbonding of Coated Steel.”
Must disbond less than 0.5 inches after three months.
5. Visual corrosion and blistering assessment in accordance with ASTM D714 “Standard Test Method for Evaluating Degree of Blistering of Paints.”
Blistering must be less than 8 and “few” blisters.



Panel testing at Navy or commercial (i.e., Daytona Beach) test site allows coating manufacturers a cost-effective means of validating that coatings will satisfy NAVSEA fouling-control and corrosion-control performance criteria.

Issue Summary

National Defense Authorization Act (NDAA) Criteria for Antifouling Effectiveness

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PERFORMANCE

REQUIREMENTS: Criteria for validating antifouling and corrosion control performance for silicone-based, foul-release coatings based on panel, patch and ship tests:

1. Patch testing on Navy or commercial ship validates that coating satisfies antifouling and corrosion-control performance criteria for 12 months on a Navy ship or 24 months on a commercial ship.

Must exhibit comparable or less marine fouling, comparable polishing rate, resistance to established diver cleaning, and overall performance as compared with MIL-PRF-24647E qualified coating of similar Type.



2. Ship testing on Navy ship validates that coating satisfies antifouling and corrosion-control performance criteria for 2, 5, 7, or 12 years, appropriate.

Must exhibit comparable or less marine fouling, comparable polishing rate, resistance established diver cleaning processes, and overall performance as compared with MIL-PRF-24647E qualified coating of similar Type.



Patch and ship testing on Navy ship validates that antifouling coatings satisfy NAVSEA fouling-control and corrosion-control performance criteria under “real world” conditions.

Public Interest in Need for Update to MIL-A-22262B for Abrasive Blasting Media

BACKGROUND: NAVSEA has extensive history with public and government comments, about the OSHA [beryllium Permissible Exposure Limit \(PEL\) for workplace air](#).

INPUT AND COMMENTS: Comments included the following:

Feb 2012 - Baltimore Sun article on hazards posed by beryllium during abrasive blasting.

Jun 2013 – Public Citizen press release on how shipyards are not testing workers to address beryllium hazard.

Sep 2013 – Daily Press in Mobile, AL cites shipyard worker exposure to “hidden toxin.”

Jan 2017 - OSHA reduces the beryllium Permissible Exposure Limit (PEL) by a factor of ten.

Mar 2017 – Supplier of crushed glass abrasive requests that NAVSEA prohibit beryllium in abrasive blast media due to published OSHA beryllium PEL.

Jun 2017 - Mega Rust keynote by Huntington Ingalls, Newport News, Production Vice President commented on need to mitigate beryllium risk.

Feb 2019 - Norfolk Naval Shipyard abrasive media contract solicitation notes, “Coal slag abrasive material is prohibited due to beryllium exposure concerns.”

Jul 2020 - New OSHA, 29 C.F.R. § 1910.1024 rules for beryllium come into effect at shipyards.

Oct 2022 - Public comment provided data on MIL-PRF-22262C, Grade A to support establishing maximum beryllium content of 0.00001 weight percent.

Feb 2024 – NAVSEA concluded that establishing a negligible, or de-minimis, or as low as reasonably measurable requirement for beryllium provides options for waterfront industrial hygiene team.

Apr 2024 - Propose Amendment 1 to MIL-PRF-22262C to explain Grade A beryllium level validation.



[NAVSEA had multiple comments on need to update MIL-A-22262B to address reduction in OSHA beryllium PEL.](#)

Published Update to MIL-PRF-22262C for Abrasive Blasting Media

ISSUE: 24 Aug 2023, NAVSEA published MIL-PRF-22262C that addressed public and government comments about beryllium by creating new Grades of abrasive based on beryllium content:

New Types of abrasive media including natural materials and by-product (slags), engineered materials, and manufactured materials.

New Grades of abrasive media with current limits on maximum allowable beryllium content and new lower limit on beryllium.

New Classes of abrasive media to include the Class 3 aluminum oxide media required by Standard Item 009-124 thermal spray nonskid process.

New Classes of abrasive media to include the Class 4 "Other Metal Oxide" media of interest to shipyards.

INCH-POUND
MIL-PRF-22262C(SH)
24 August 2023
SUPERSEDING
MIL-A-22262B(SH)
5 April 1993

PERFORMANCE SPECIFICATION
ABRASIVE BLASTING MEDIA, SHIP BLAST CLEANING

This specification is approved for use by the Naval Sea Systems Command and is available for use by all Departments and Agencies of the Department of Defense.

1. SCOPE

1.1 Scope. This specification covers inorganic abrasive media used in the blast cleaning of metal surfaces, such as ship hulls and tanks, to remove corrosion, scale, old paint, and other foreign matter resulting in surfaces that are clean and suitable for painting. Examples of inorganic abrasive materials are minerals, recycled materials like crushed glass, by-products of metal or energy production such as slags, and engineered materials that are manufactured to serve as industrial abrasives.

1.2 Classification. Inorganic abrasive materials covered in this specification are of the following types, classes, and grades as specified (see 6.2).

1.2.1 Types.

- a. Type I - Naturally occurring minerals.
- b. Type II - By-product, engineered, and manufactured materials.

1.2.2 Classes.

- a. Class 1 - Glass abrasive material.
- b. Class 2 - Garnet abrasive material.
- c. Class 3 - Aluminum oxide abrasive material.
- d. Class 4 - Other metal oxide abrasive material.
- e. Class 5 - Metal silicate abrasive material.
- f. Class 6 - Silicon carbide abrasive material.
- g. Class 7 - Coal slag abrasive material.
- h. Class 8 - Other slag abrasive material.
- i. Class 9 - Blend of the above.

1.2.3 Grades.

- a. Grade A - Total beryllium content shall be not greater than 0.00001 percent by weight.
- b. Grade B - Total beryllium content shall be not greater than 0.0075 percent by weight.

Comments, suggestions, or questions on this document should be addressed to Commander, Naval Sea Systems Command, ATTN: SEA 055, 1333 Isaac Hall 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>

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Proposed Amendment 1

MIL-PRF-22262C for Abrasive Blasting Media Beryllium Limit

ISSUE: MIL-PRF-22262C, Amendment 1 addresses abrasive blast media beryllium content to provide waterfront industrial hygiene community with options to address beryllium content in blast media.

- Grade B beryllium limit **unchanged** from MIL-A-22262B with maximum total allowable beryllium content of 0.0075% by weight.
- Requirement has been in MIL-A-22262 since 1993 and is based on California Title 22, § 66261.24, “Characteristic of Toxicity.” **All currently qualified blast media remain qualified as Grade B materials.**
- Grade A beryllium limit intended to address *de minimis* beryllium limit based on 2023 industry comment and NSWCD analysis. Requires maximum total beryllium limit of 0.1 mg/kg (i.e., 0.00001% by weight), using already required analytical methods, **defines numerical value and addresses analytical “non-detect.”**

RESULT: 20 Jan 2025, completed NAVSEA Specification Review Board assessment of MIL-PRF-22262C, Amendment 1 that also included final industry comments.

- **Adopted industry comment to reduce the minimum specific gravity of abrasive media from 2.5 to 2.3.**

Reduction in specific gravity requirement avoids qualification issue with some recycled media.



WAY AHEAD: 11 Feb 2025, MIL-PRF-22262C, Amendment 1 submitted for final NAVSEA review and will include requirements that Grade A media will have either:

- Beryllium content less than 0.00001% by weight.
- or -
- A non-detect or below detection level result for beryllium with a Lower Limit of Quantitation (LLOQ) less than 0.00001% by weight.

[Pending MIL-PRF-22262C “Amendment 1” to define analytical methods for validating that Grade A media exhibit negligible amounts of beryllium.](#)

Proposed Amendment 1 to MIL-PRF-22262C

Clarifies That Non-detect Below LLOQ Supports Grade A Qualification

WAY AHEAD: Amendment 1 to MIL-PRF-22262C to clarify that Grade A abrasive media will have either:

- A measured beryllium level less than 0.00001% by weight.
- or -
- A non-detect or below detection level of beryllium with a LLOQ, limit of quantitation, reported limit, or minimum reported limit value of 0.00001% by weight.

3.2.2.1 Soluble and total metal content. When tested in accordance with 4.5.2.1, the soluble metal content and total metal content of the abrasive shall not exceed the values listed in [table I](#) or in California Code of Regulations, Title 22, Division 4.5, Chapter 11, Article 3, Section 66261.24, (a),(2),(A).

Current analytical requirements

TABLE I Metals content of abrasive material

Metal and its compounds	Soluble maximum (mg/L)	Total maximum (%WT)
Antimony	5	0.05
Arsenic	5	0.05
Barium (excluding barite)	100	1.00
Beryllium (grade A)	0.001	0.00001
Beryllium (grade B)	0.75	0.0075
Cadmium	1	0.01
Chromium (VI)	5	0.05
Chromium and chromium (III)	5	0.25
Cobalt	80	0.09

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Current beryllium Grade requirements

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Current analytical requirements

TABLE I Metals content of abrasive material

Metal and its compounds	Soluble maximum (mg/L)	Total maximum (%WT)
Antimony	5	0.05
Arsenic	5	0.05
Barium (excluding barite)	100	1.00
Beryllium (grade A)	0.001	0.00001
Beryllium (grade B)	0.75	0.0075
Cadmium	1	0.01
Chromium (VI)	5	0.05
Chromium and chromium (III)	5	0.25
Cobalt	80	0.09

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Current beryllium Grade requirements

TABLE I Metals content of abrasive material - Continued

Metal and its compounds	Soluble maximum (mg/L)	Total maximum (%WT)
Copper	25	0.25
Fluoride salts	180	1.80
Lead	1.0	0.01
Mercury	0.2	0.002
Molybdenum	35	0.35
Nickel	10	0.09
Selenium	1	0.01
Silver	5	0.05
Thallium	7	0.07
Vanadium	24	0.24
Zinc	50	0.50

NOTES:

- Some of the metal limits specified in this specification are lower than required by the State of California Department of Health Services. Users may require lower metal limits as deemed necessary to comply with local environmental and occupational safety and health regulatory requirements.
- The metal limits listed are maximum values and are not time-weighted averages. The airborne ceiling values in 29 CFR 1915 are different from the metal limits in the table.

3.2.2.7 Maximum concentration of contaminants. When evaluated in accordance with 4.5.2.2, the maximum content of the abrasive material shall not exceed the values listed in [table II](#) or in California Code of Regulations, Title 22, Division 4.5, Chapter 11, Article 3, Section 66261.24, (a),(1),(B) (see 4.5.2.2).

Current Table 2 notes that values are different from 29 CFR 1915 requirements

TABLE I Metals content of abrasive material - Continued

Metal and its compounds	Soluble maximum (mg/L)	Total maximum (%WT)
Copper	25	0.25
Fluoride salts	180	1.80
Lead	1.0	0.01
Mercury	0.2	0.002
Molybdenum	35	0.35
Nickel	10	0.09
Selenium	1	0.01
Silver	5	0.05
Thallium	7	0.07
Vanadium	24	0.24
Zinc	50	0.50

NOTES:

- Some of the metal limits specified in this specification are lower than required by the State of California Department of Health Services. Users may require lower metal limits as deemed necessary to comply with local environmental and occupational safety and health regulatory requirements.
- The metal limits listed are maximum values and are not time-weighted averages. The airborne ceiling values in 29 CFR 1915 are different from the metal limits in the table.

3.2.2.7 Maximum concentration of contaminants. When evaluated in accordance with 4.5.2.2, the maximum content of the abrasive material shall not exceed the values listed in [table II](#) or in California Code of Regulations, Title 22, Division 4.5, Chapter 11, Article 3, Section 66261.24, (a),(1),(B) (see 4.5.2.2).

Adding new Note 3 that clarifies that metals data must be below the Table I limit or must be below the lower limit of quantitation.

Current MIL-PRF-22262C Pages 3 & 4

Proposed MIL-PRF-22262C, Amendment 1, Page 4

- Paragraph 3.4.6 requirement for the minimum abrasive specific gravity was 2.5, but reduced by 10% to a specific gravity of 2.3 to streamline product qualification.

MIL-PRF-22262C Amendment 1 undergoing final NAVSEA review before publication.

Updating MIL-PRF-16173 Specification Include New Types and Classes of Preservatives

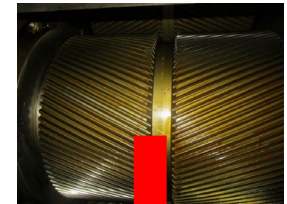
ISSUE: MIL-PRF-16173E(2), “Corrosion Preventive Compound, Solvent Cutback, Cold-Application” with interim amendments published on 19 Oct 2017, included:

- Updated Volatile Organic Compounds (VOC) requirements in paragraph 3.4.2 to state:
VOC for Class I compounds shall exceed 2.8 lbs/gal (340 grams/liter).
VOC for Class II compounds shall not exceed 2.8 lbs/gal (340 grams/liter).

Interim amendments require full specification update within two years.

WAY AHEAD: NAVSEA significantly updating MIL-PRF-16173 as part of a Paint Center of Excellence (PCOE) project to address the following issues:

- Instances where Navy has ordered material (i.e., MIL-PRF-16173E, Class I, Grade I) and received a product from one manufacturer that met operational requirements while at other times received the same Class/Grade product from a different manufacturer that **did not meet** their operational requirements.
- Update MIL-PRF-16173 to an “Application” based classification based system instead of current film removal characteristic based system.
- Replace obsolete tests like “shed” storage and eliminate archaic/redundant test methods (i.e., MIL-C-16173A published in 1953) by citing current ASTM test methods. Update the requirements for conformance testing.
- Add new technology products for long-term corrosion control performance without surface preparation (e.g., spray waxy material).



[Update to MIL-PRF-16173F will include new Types, Classes, and Grades to better satisfy all Fleet customer needs.](#)

Updating MIL-PRF-16173F Specification Including New Preservative Types, Modified Classes, and Revised Grades

Created new Types of products to include lower VOC levels (e.g., <100 g/l)

Modified Class 5 to include specific applications (e.g., gear boxes) where miscibility in lubricants is required.

Revised Grades to define the application methods (e.g., self-pressurized container)

MIL-PRF-16173F(SH)
DRAFT DATED 18 OCTOBER 2024

INCH-POUND
MIL-PRF-16173F(SH)
DRAFT
SUPERSEDING
MIL-PRF-16173E(SH)
w/INT. AMENDMENT 2
19 October 2017

PERFORMANCE SPECIFICATION

CORROSION PREVENTIVE COMPOUND, SOLVENT CUTBACK, COLD APPLICATION

This specification is approved for use by all Departments and Agencies of the Department of Defense.

1. SCOPE

1.1 Scope. This specification covers corrosion preventive compounds that are deposited as thin films. These products are formulated to be removed by solvent, oil, or steam; or to provide persistent, long-term, corrosion-control performance on metallic substrates.

1.2 Classification. Corrosion preventive compounds covered by this specification are furnished in the following types, classes, and grades, as specified (see 6.1).

1.2.1 Types. The types of corrosion preventive compounds are as follows:

Type I A corrosion preventive compound having a Volatile Organic Compound (VOC) content greater than 2.8 pounds/gallon (340 grams/liter) and less than or equal to 4.6 pounds per gallon (550 grams/liter).

Type II A corrosion preventive compound having a VOC content greater than 0.8 pounds/gallon (100 grams/liter) and less than or equal to 2.8 pounds/gallon (340 grams/liter).

Type III A corrosion preventive compound having a VOC content less than or equal to 0.8 pounds/gallon (100 grams/liter).

1.2.2 Classes. The classes of corrosion preventive compounds are the following (see 6.1):

Class 1 Temporary, hard film, solvent removable compound for corrosion protection during outdoor storage and overseas shipping. NATO Code Number C-652 cites this specification to define performance requirements for this class of corrosion preventative compounds.

Class 2 Temporary, solvent removable compound for corrosion protection during indoor storage of machinery, instruments, or parts.

Class 3 Temporary, hard asphaltic film, mechanically removable (e.g., peel, scrape, etc.) compound for corrosion protection during outdoor or indoor storage.

Class 4 Temporary, soft film, solvent removable compound for corrosion protection on equipment where miscibility with lubricants is required. NATO Code Number C-620 cites this specification to define performance requirements for this class of corrosion preventative compounds.

Class 5 Temporary, solvent removable compound for corrosion protection during storage of equipment (e.g., gear boxes) where miscibility with lubricants and nominal heat resistance is required.

Class 6 Temporary, penetrating, solvent removable compound for corrosion protection of fasteners and crevices formed between faying surfaces.

Class 7 Temporary, water displacing, soft film, solvent removable compound for corrosion protection during outdoor or indoor storage.

Class 8 Temporary, low-pressure steam or hot water removable compound for corrosion protection during outdoor or indoor storage.

Class 9 Persistent, preservative compound for corrosion protection of metals in outdoor or indoor environments.

1.2.3 Grades. The corrosion preventive compound grades are as follows:

Grade A For brush application.

Grade B For dip application.

Grade C For fill and drain application.

Grade D For spray application using spray equipment.

Grade E For spray application using a self-pressurized container.

Modified Class 1 & 4 to relate to NATO requirements

Modified Classes to include new, Class 9 "Persistent" preservatives

MIL-PRF-16173E cited 14 archaic Federal specifications, current MIL-PRF-16173F cites only one, current Federal specification.

Updating MIL-PRF-16173F Specification To Show How Current Requirements Relate to New Preservative Types, Modified Classes, and Revised Grades

TABLE V. Supersession data.



MIL-PRF-16173E classification designations	MIL-PRF-16173F classification designations ¹
Class I, Grade 1 - High VOC, Hard film	Type I ² ; Class 1, 3
Class II, Grade 1 - Low VOC, Hard film	Type II; Class 1, 3
Class I, Grade 2 - High VOC, Soft film	Type I; Class 4, 5
Class II, Grade 2 - Low VOC, Soft film	Type II, III; Class 4, 5, 7
Class I, Grade 3 - High VOC, Water displacing, soft film	Type I; Class 7
Class II, Grade 3 - Low VOC, Water displacing, soft film	Type II, III; Class 4, 5, 7
Class I, Grade 4 - High VOC, Transparent, non-tacky film	Type I; Class 1, 2, 3
Class II, Grade 4 - Low VOC, Transparent, non-tacky film	Type II; Class 1, 2, 3
Class I, Grade 5 - High VOC, Low pressure steam removable film	Type I; Class 8
Class II, Grade 5 - Low VOC, Low pressure steam removable film	Type II; Class 8
<p>NOTE:</p> <p>1 Supersession classifications are based on known product performance. The direction provided in this table is the expected classification but does not override qualification data. Products may qualify for multiple Classes but may not qualify for all corresponding Classes listed in the supersession table. Products may qualify for Classes other than the suggested classes listed in this table.</p> <p>2 It may be possible that certain qualified products can meet the Type II requirement based on product VOC content.</p>	

Note that Class 9 does not appear because it is a new, "Persistent" preservative requirement with no supersession



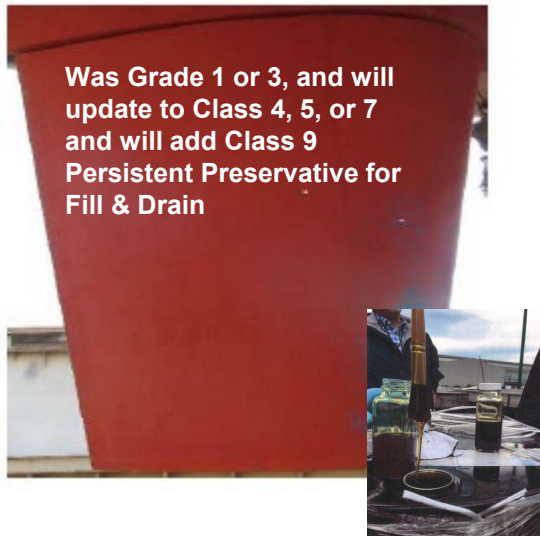
MIL-PRF-16173E qualified preservatives map to MIL-PRF-16173F requirements and recommend industry validation.

Updated MIL-PRF-16173 Specification Include Multiple New Requirements for Preservatives

STATUS: NAVSEA has created a draft MIL-PRF-16173F that includes new Type, Class, and Grade requirements.

NAVSEA will maintain [Qualified Product Database](#) listing for preservative products.

- Feb 2025, NAVSEA completes technical development and final editorial review.
- Mar 2025, MIL-PRF-16173F to be released to the industry and public for informal for comment.
- Jun 2025, NAVSEA adjudicates comments and releases to Specification Review Board
- Aug 2025, NAVSEA adjudicates SRB comments
- Sep 2025, MIL-PRF-16173 to be published.



[NAVSEA will be soliciting comments on draft MIL-PRF-16173F from Navy technical community, but will provide to NSRP and industry for comment.](#)

Updated MIL-PRF-16173 Specification

Opportunity for Application of future, Class 10 “Persistent” Preservatives

STATUS: NAVSEA has created a draft MIL-PRF-16173F that includes new Type, Class, and Grade requirement that includes “Class 10, Persistent” preservatives intended as supplement for coatings in spaces where **coating installation and maintenance are impractical** and corrosion is an issue.

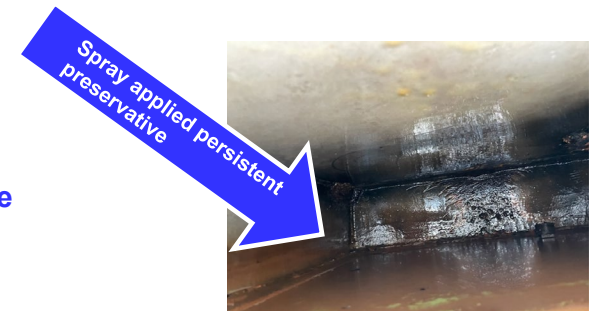
Key technical considerations for use of “persistent” preservatives:

- Space or void where coatings are impractical to install that are analogous to interior of rudder or bilge keel, but more accessible to the environment or weather.
- Cosmetic appearance of waxy, oily coating will not be an issue. Translucent, amber preservative attracts dirt or dust.
- Thick, waxy material will not interfere with mechanical equipment operation.
- Runoff or release of preservative to the environment will not be significant.



TECHNICAL COMMUNITY INPUT NEEDED ON KEY ISSUES:

1. Define OQE for acceptable, and unacceptable, preservative application process.
2. Preservative runoff and cleaning requirements for ship's force.
3. Need to define applicable spaces and areas for preservatives, possible new SURFMEPP [Design Memorandum](#).



[NAVSEA will provide NSRP and industry with final draft of MIL-PRF-16173F for comments.](#)

Conclusions

- NAVSEA goal is to support Fleet customer by updating coating specifications and enhancing coating application processes.
- NAVSEA addressing multiple issues with antifouling coatings and will work cooperatively with industry to identify new technologies and qualified products - **NSRP input potentially useful.**
- NAVSEA publishing MIL-PRF-22262C, Amendment 1 to update requirements to address the beryllium issue.
- NAVSEA publishing MIL-PRF-16173F to better align preservative performance with Fleet requirements.
- NAVSEA goal to work with NSRP and waterfront community to address evolving regulatory issues.



QUESTIONS?

Antifouling Performance Criteria Currently Defined by MIL-PRF-24647 Performance Requirements

ISSUE: Criteria for antifouling effectiveness, measured by duration of time such coating prevents biological adhesion, corrosion and degradation of vessel surfaces currently defined by:

MIL-PRF-24647E, "Paint System, Anticorrosive and Antifouling, Ship Hull"

BACKGROUND: Current MIL-PRF-24647E evolved since 1985 to define performance requirements for antifouling coatings developed by commercial industry and to ensure products comply with environmental requirements:

1991 – MIL-PRF-24647B, "PAINT SYSTEM, ANTICORROSIVE AND ANTIFOULING, SHIP HULL" defines performance requirements for antifouling paints and new technology:

- Eliminated citations to tin biocides.
- Included new Class 1C for "toxic free" coatings.
- Included Grades that address Volatile Organic Compound (VOC) content.
- Includes Applications that define service life up to 7 years.
- Cited *29 CFR Parts 1910, 1915, 1917, 1918, 1926, and 1928 - Hazard Communication Act, Final Rule.*
- Evaluated coating installed on ship for 5 or 7 years.



2001 – MIL-PRF-24647C, "PAINT SYSTEM, ANTICORROSIVE AND ANTIFOULING, SHIP HULL" defines performance requirements for antifouling paints and new technology:

- Clarified Grades that address VOC content and cited *40 CFR 63.780 U.S. EPA National Emissions Standards for Hazardous Air Pollutants, Shipbuilding and Ship Repair Coatings.*
- Cited *40 CFR Part 251, Appendix II – Toxic Characteristics Leaching Procedure.*
- Evaluated coating installed on ship for 5 or 7 years.



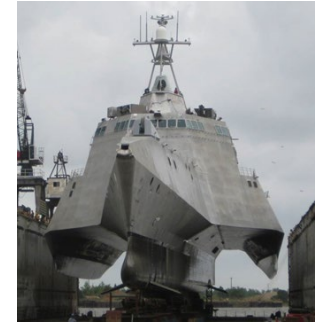
[U.S. Navy antifouling coating specification defines performance criteria, environmental, and worker health & safety issues.](#)

Antifouling Performance Criteria Currently Defined by MIL-PRF-24647 Performance Requirements

BACKGROUND: Current MIL-PRF-24647E evolved since 1985 to define performance requirements for antifouling coatings developed by commercial industry and to ensure products comply with environmental

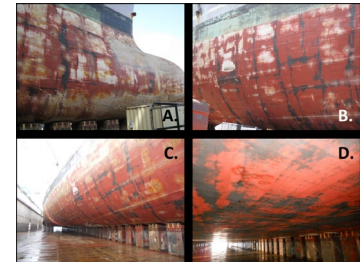
2005 – MIL-PRF-24647D, "PAINT SYSTEM, ANTICORROSIVE AND ANTIFOULING, SHIP HULL" defines performance requirements for antifouling paints and new technology:

- Clarified Types of antifoulings to include foul release coatings that do not contain biocides and biocidal coatings that do not ablate or polish.
- Includes Applications that define service life up to 12 years.
- Includes Application for service at 50 knots.
- Evaluate test panels and patches and ship for 2, 5, or 12 years.



2013 – MIL-PRF-24647E, "PAINT SYSTEM, ANTICORROSIVE AND ANTIFOULING, SHIP HULL" defines performance requirements for antifouling paints and new technology:

- Clarified Types of antifoulings to include Type IIIa foul release coatings that release fouling at 10 knots.
- Clarified Application for service at 40 knots.
- Evaluate coating installed on panels and patches and a ship for 2, 5, or 12 years.



2025 – MIL-PRF-24647E, with Amendment 1, "PAINT SYSTEM, ANTICORROSIVE ANTIFOULING, SHIP HULL" re-defines Type IV performance requirements to address new technology, biocide booster foul-release coatings:

- Clarifies that Type IV coatings are tested in flow channel at 10, 20, and 30 knots.
- Allows Type IV coatings to be qualified for Applications 2 (i.e., 7-year service life) and Application 3, (i.e., 12-year service life).

[U.S. Navy antifouling specification performance requirements regularly updated to reflect most recent, world-wide, commercial developments in marine fouling control technology.](#)