Designation: F 1130 – 99 (Reapproved 2005)

An American National Standard

Standard Practice for Inspecting the Coating System of a Ship[1]

This standard is issued under the fixed designation F 1130; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This practice covers a standard procedure for inspecting the coating system of a ship's topside and superstructure, tanks and voids, decks and deck machinery, and underwater hull and boottop during drydocking. Included are a standard inspection form to be used for reporting the inspection data, a diagram that divides topside and superstructure individual inspection areas, and a series of diagrams that are used to report the extent of damage to the coating system.

1.2 This practice is intended for use only by an experienced marine coating inspector.

1.3 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

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

2. Referenced Documents

2.1 *ASTM Standards:* [2]

D 660 Test Method for Evaluating Degree of Checking of Exterior Paints

D 714 Test Method for Evaluating Degree of Blistering of Paints

D 772 Test Method for Evaluating Degree of Flaking (Scaling) of Exterior Paints

2.2 *Steel Structures Painting Council:*

SSPC-PA-2 Measurement of Dry Paint Thickness With Magnetic Gages[3]

3. Significance and Use

3.1 This practice establishes the procedure for the inspection of coating systems on board ships. It contains a series of diagrams to be used to report the extent of damage to coatings.

4. Reference Standards

4.1 *Extent of Failure*—The overall extent of failure diagrams (see Fig. 1) and the extent within affected area diagrams (see Fig. 2 and Fig. 3) are used to report the area covered by various fouling organisms, different types of corrosion, and paint failures. The overall extent of failure diagrams are used first to group all areas where a particular type of damage has occurred into one contiguous block. The extent within affected area diagrams are then used to identify the pattern of damage within that contiguous block. (For example, inspection for Section I.A.—General Corrosion (see Figs. 4-7)) and general corrosion appears distributed over the entire inspection area as shown by the black areas in Fig. 8.)

4.1.1 The first step is to draw an imaginary line that would enclose all of the general corrosion. This enclosure should be as small as possible. Select the diagram from the overall extent of failure diagrams that most closely approximates the enclosed area with respect to the entire inspection area. Using the general corrosion example, the enclosed area (shaded area) would closely match Fig. 9.

4.1.2 Enter a "6" (for Diagram 6 in Fig. 1) in the box next to I.A.1. overall extent of failures in Fig. 4.

4.1.3 The second step is to look at only the enclosed area and select the diagram from the extent within affected-area diagrams that most closely identifies the pattern of general corrosion in the enclosed area. In this example, Fig. 10 (Diagram N) would be a good choice.

4.1.4 Enter an "N" (for Diagram N in Fig. 3) in the box next to I.A.1.A. extent within the affected area.

NOTE 1—Selection of diagrams is based on visual comparisons, and therefore, different inspectors may select different diagrams. The diagrams are designed to minimize these differences and enhance reproducibility.

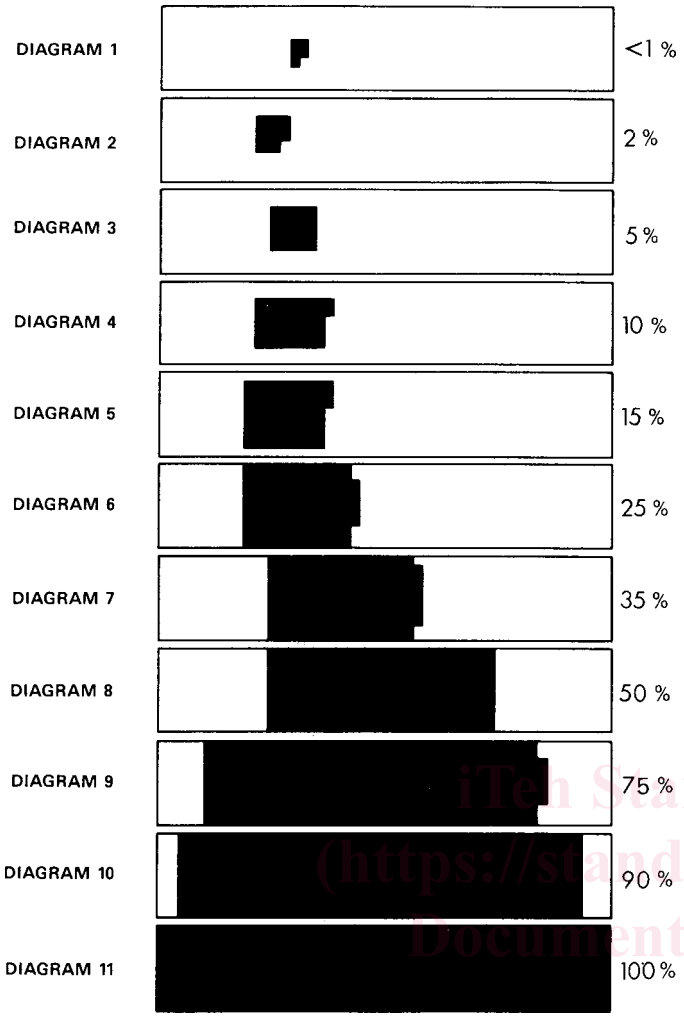
4.2 *Forms of Mechanical Damage*—This reference standard (Fig. 11) is a series of photographs used to identify the various forms of mechanical damage to a coating that can lead to corrosion.

[1] This practice is under the jurisdiction of ASTM Committee F25 on Ships and Marine Technology and is the direct responsibility of Subcommittee F25.01 on Structures.

Current edition approved May 1, 2005. Published May 2005. Originally approved in 1988. Last previous edition approved in 1999 as F 1130 – 99.

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

[3] Available from Steel Structures Painting Council, 40 24th St., Pittsburgh, PA 15222-4656.



NOTE 1—The specific type of failure is to be defined. The failure may be fouling, corrosion, and so forth. Do not combine all failures into one overall extent diagram.

FIG. 1 Overall Extent of Failure Diagrams

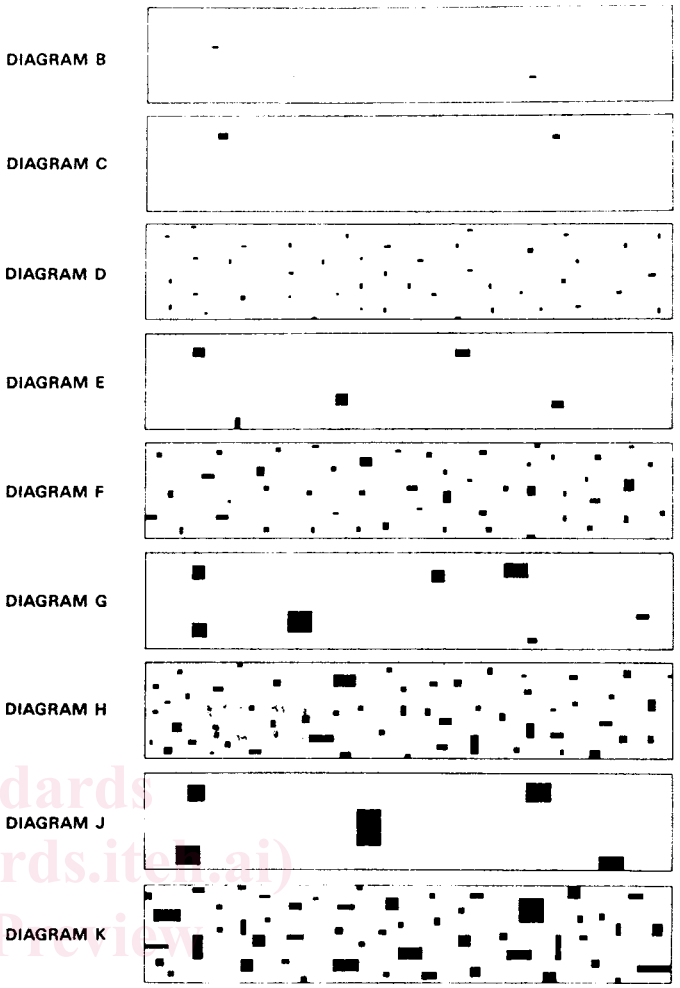


FIG. 2 Extent Within Affected Area Diagrams (B Through K)

4.3 *Types of Corrosion*—This reference standard (Fig. 12) is a series of photographs used to show examples of general coating damage. Included could be general corrosion, pitting corrosion, pin-point corrosion, galvanic corrosion/coating undercutting, cavitation corrosion, corrosion along welds, and rust staining.

4.4 *Levels of Delamination*—This reference standard (Fig. 13) is a series of diagrams that identifies the levels in a coating system where delamination can occur.

5. Requirements for Inspectors

5.1 The inspector must be able to perform the following tasks:

5.1.1 Calibrate and use a magnetic gage to measure dry film thickness (DFT).

5.1.2 Use pH paper or pH meter properly.

5.1.3 Use a camera properly.

5.1.4 Recognize the various types of corrosion and forms of paint failures (blistering, delamination, and so forth).

5.1.5 Recognize the various ship areas as described in Figs. 14-16.

6. Procedure

6.1 The inspection form consists of two pages to be completed by the inspector and four pages of reference standards. Complete the first of the two pages as shown in Fig. 17. This form, which is self-explanatory, requests general information about the ship.

6.2 The second page of the applicable inspection form to be completed by the inspector is shown in Figs. 4-7. Complete a separate inspection form for each of the inspection areas delineated in Figs. 14-16. Instructions for completing the form (shown in Figs. 4-7) are given in Section 7.

6.2.1 For the ship's topside and superstructure, divide the inspection area into six sections. These six inspection areas are defined by the diagram in Fig. 14. For each complete inspection, complete one form, shown in Fig. 4, for each section.

6.2.2 For the ship's tanks and voids, divide the inspection area into seven sections. These seven inspection areas are defined by the diagram in Fig. 15. For each complete tank inspection, complete one form, shown in Fig. 5, for each section.

6.2.3 For the ship's underwater hull and boottop, divide the inspection area into twelve inspection areas. These twelve

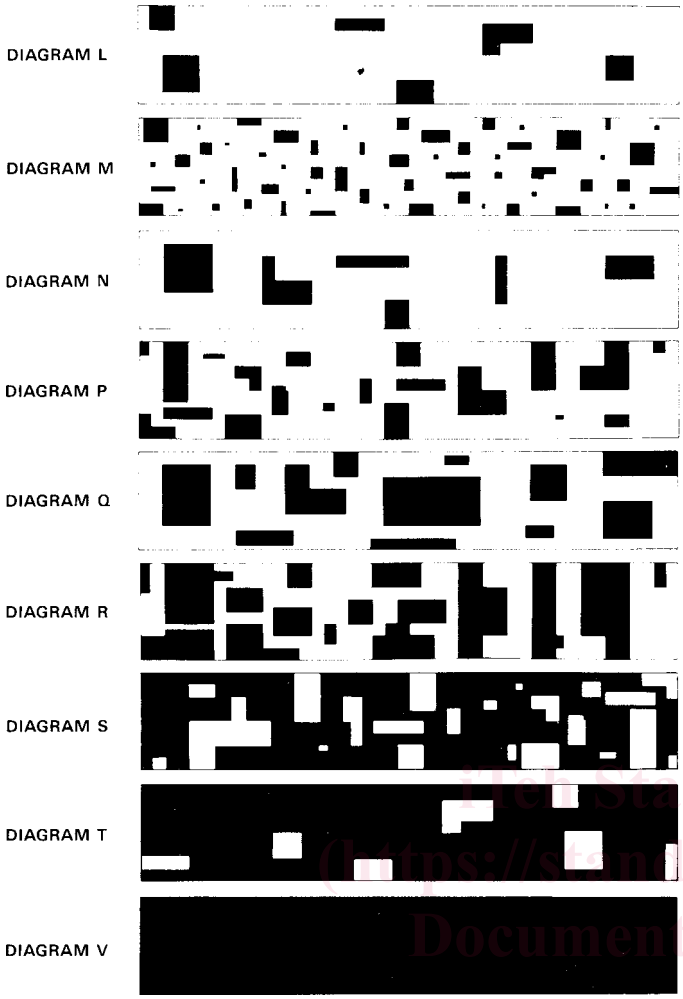


FIG. 3 Extent Within Affected Area Diagrams (L Through V)

inspection areas are defined by the diagram in Fig. 16. For each complete underwater hull inspection, complete one form, shown in Fig. 6, for each section.

6.2.4 For the ship's deck and machinery, the inspection area is a code which is used to designate an area of the ship's deck or a piece of deck machinery. The purpose of the code is to identify positively the area being inspected so that a history of inspection data can be gathered. For sections of the ship other than decks and deck machinery (that is, underwater hull, boottop, topside, superstructure, tanks, and voids), it is possible to develop a general diagram of the ship section. Divide the ship section into logical inspection areas, and provide inspection area codes for these inspection areas. Decks and deck machinery vary so greatly between ship types that the development of a general diagram with logical inspection areas and inspection area codes is not feasible. It should be the responsibility of the organization that authorizes the inspections to develop the ship diagram, logical inspection areas, and inspection area codes and to make certain that this same coding system is used during all subsequent inspections.

7. Form Instructions

7.1 *Inspection Area*—The topside/superstructure is divided into six inspection areas (see Fig. 14). Enter the code for the area being inspected. (For example, enter "SA" for the superstructure aft; "SM" for the superstructure midships;" SF" for the superstructure forward; "SO" for othersuperstructure, that is, bulwarks, vents, sideport openings, and so forth; "HS" for hull starboard; and "HP" for hull port.)

7.1.1 A tank is segmented into seven inspection areas (see Fig. 15. Enter the code for the area being inspected. (For example, enter "B" for the bottom of tank inspection, "A" for the aft bulkhead, and so forth.) A complete list of tank segments and their codes is shown in Fig. 15.

7.1.2 The underwater hull and boottop are segmented into twelve distinct inspection areas. Enter the code for the area being inspected. (For example, enter "P1" for the port bow inspection, "S1" for the starboard bow inspection, and so forth.) A complete list of hull segments and their codes is shown in Fig. 16.

7.1.3 Decks and deck machinery vary so greatly between ship types that the development of a general diagram with logical inspection areas and inspection area codes is not feasible. It should be the responsibility of the organization that authorizes the inspections to develop the ship diagram, logical inspection areas, and inspection area codes and to make certain that this same coding system is used during all subsequent inspections.

7.2 *Date*—Enter the date of the inspection. If the inspection requires more than one day, enter the date the inspection is completed.

7.3 *Ship Name*—Enter the ship's name (for example, LPH-14, USS Trenton).

7.4 *Hull Number*—Enter the builder's hull number of the ship (for example, Nassco No. 1182).

7.5 *Inspector's Name*—The inspector should print his name.

7.6 *Tank Number*—Enter tank designation.

7.7 *Tank Type*—Enter type (for example, fuel oil, ballast, and so forth).

7.8 *Required Photographs*—For each inspection area, a photograph of the entire area is required. If the area is too large to capture in one photograph, the area should be divided into equal-sized segments and each segment should be photographed. An individual close-up photograph of each damaged section in the inspection area is required. Each photograph should be marked with the area number, ship name, and date. Also a size scale should be captured in each photograph. This size scale is a reference standard that would be used to determine the approximate size of the photographed ship area. (For example, a 12-in. (304.8-mm) rule might be an appropriate size scale for a relatively small ship area.)

7.9 *Inspection Area Obscured*—If the inspection area is completely obscured and cannot be inspected, circle the" Y." This condition of being completely obscured will probably occur most frequently in the bottom inspection area ("B")

Inspection Area ____________ Date ____________

Ship Name ____________

Hull Number ____________

Inspector's Name ____________

Required Photographs
1. Entire Area
2. Close-Up of All Damage

I. Corrosion
- A. General
  - 1. Overall Extent of Failure .... ☐
    - A. Extent Within Affected Area .... ☐
- B. Mechanical Damage
  - 1. Overall Extent of Failure .... ☐
    - A. Extent Within Affected Area .... ☐
  - 2. Type of Damage
    - A. Scraping/Impact .... ☐
    - B. Anchor Chains/Ropes .... ☐
    - C. Internal Welds/Burning .... ☐
- C. Pitting Corrosion
  - 1. Overall Extent of Failure .... ☐
    - A. Extent Within Affected Area .... ☐
- D. Pin-Point Corrosion
  - 1. Overall Extent of Failure .... ☐
    - A. Extent Within Affected Area .... ☐
- E. Galvanic Corrosion/Coating Undercutting? .... Y N
- F. Rust Staining? .... Y N

II. Paint Condition
- A. Delamination
  - 1. Overall Extent of Failure .... ☐
    - A. Extent Within Affected Area .... ☐
  - 2. Topcoat .... ☐
  - 3. Within Repair System .... ☐
  - 4. Between Original/Repair .... ☐
  - 5. Within Original System .... ☐
  - 6. To Primer Coat .... ☐
  - 7. To Steel Substrate .... ☐
  - 8. Organic Odor From Delam. Area? .... Y N
  - 9. Sample Taken? .... Y N
- B. Blistering (Test Method D 714)
  - 1. Overall Extent of Failure .... ☐
    - A. Extent Within Affected Area .... ☐
  - 2. Size (Test Method D 714) .... ☐
  - 3. Density (Test Method D 714) .... ☐
  - 4. % Broken Blisters .... ☐
  - 5. Organic Odor in Blisters? .... Y N
  - 6. Blisters Contain Water? .... Y N
    - A. pH .... ☐
  - 7. Corrosion Under Blisters? .... Y N
- C. Cracking
  - 1. Overall Extent of Failure .... ☐
    - A. Extent Within Affected Area .... ☐
- D. Checking (Test Method D 660)
  - 1. Overall Extent of Failure .... ☐
    - A. Extent Within Affected Area .... ☐
- E. Flaking (Test Method D 772)
  - 1. Overall Extent of Failure .... ☐
    - A. Extent Within Affected Area .... ☐
  - 2. Severity .... ☐
- F. Sags or Curtains? .... Y N
- G. Chalking? .... Y N
- H. Presence of Oil/Grease/Smoke? .... Y N
- I. Bleeding? .... Y N
- J. Fading? .... Y N
- K. Knife Test
  - 1. Acceptable? .... Y N
    - If "N," Mark Level(s) Below
    - A. Topcoat .... ☐
    - B. Within Repair System .... ☐
    - C. Between Original/Repair .... ☐
    - D. Within Original System .... ☐
    - E. To Primer Coat .... ☐
    - F. To Steel Substrate .... ☐

III. Measured Properties
- A. Dry Film Thickness (SSPC-PA-2)

Spot 1	Spot 2	Spot 3	Spot 4	Spot 5
_:_:_	_:_:_	_:_:_	_:_:_	_:_:_
_:_:_	_:_:_	_:_:_	_:_:_	_:_:_
_:_:_	_:_:_	_:_:_	_:_:_	_:_:_
_:_:_	_:_:_	_:_:_	_:_:_	_:_:_
_:_:_	_:_:_	_:_:_	_:_:_	_:_:_
_:_:_	_:_:_	_:_:_	_:_:_	_:_:_
_:_:_	_:_:_	_:_:_	_:_:_	_:_:_
_:_:_	_:_:_	_:_:_	_:_:_	_:_:_
_:_:_	_:_:_	_:_:_	_:_:_	_:_:_
_:_:_	_:_:_	_:_:_	_:_:_	_:_:_
_:_:_	_:_:_	_:_:_	_:_:_	_:_:_
_:_:_	_:_:_	_:_:_	_:_:_	_:_:_
_:_:_	_:_:_	_:_:_	_:_:_	_:_:_

1. More DFT Readings? .... Y N

IV. Recommendations ____________

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Copy to Ship's Officer .... Y N

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FIG. 4 Topside and Superstructure

where dirt and other contaminants have settled. If the inspection area is not completely obscured, circle the "N."

CORROSION

8. Classification of Corrosion

8.1 The inspector should distinguish between six types of corrosion and report each type separately. The six types of corrosion are as follows:

8.1.1 *General Corrosion*—General corrosion, for the purposes of this inspection form, is all corrosion that is not covered in the mechanical damage, pitting corrosion, pinpoint corrosion, galvanic corrosion/coating undercutting, or rust staining in 8.1.2, 8.1.3, 8.1.4, 8.1.5, and 8.1.6. Patches of common, ordinary rusting are classified as general corrosion.

Inspection Area ____________ Date ____________

Ship Name ____________

Hull Number ____________

Inspector's Name ____________

Tank Number____________ Type____________

Required Photographs
1. Entire Area
2. Close-Up of All Damage

Inspection Area Obscured? .... Y N

I. Corrosion
- A. General
  - 1. Overall Extent of Failure .... ☐
    - A. Extent Within Affected Area .... ☐
- B. Mechanical Damage
  - 1. Overall Extent of Failure .... ☐
    - A. Extent Within Affected Area .... ☐
  - 2. Type of Damage
    - A. Scraping/Impact .... ☐
    - B. Internal Welds/Burn Marks .... ☐
- C. Pitting Corrosion
  - 1. Overall Extent of Failure .... ☐
    - A. Extent Within Affected Area .... ☐
- D. Pin-Point Corrosion
  - 1. Overall Extent of Failure .... ☐
    - A. Extent Within Affected Area .... ☐
- E. Corrosion Along Welds? .... Y N
- F. Rust Staining? .... Y N
- G. Galvanic Corrosion/Coating Undercutting? .... Y N

II. Paint Condition
- A. Delamination
  - 1. Overall Extent of Failure .... ☐
    - A. Extent Within Affected Area .... ☐
  - 2. Topcoat .... ☐
  - 3. Within Repair System .... ☐
  - 4. Between Original/Repair .... ☐
  - 5. Within Original System .... ☐
  - 6. To Primer Coat .... ☐
  - 7. To Steel Substrate .... ☐
  - 8. Organic Odor From Delam. Area? .... Y N
  - 9. Sample Taken? .... Y N
- B. Blistering (Test Method D 714)
  - 1. Overall Extent of Failure .... ☐
    - A. Extent Within Affected Area .... ☐
  - 2. Size (Test Method D 714) .... ☐
  - 3. Density (Test Method D 714) .... ☐
  - 4. % Broken Blisters .... ☐
  - 5. Organic Odor in Blisters? .... Y N
  - 6. Blisters Contain Water? .... Y N
    - A. pH .... ☐
  - 7. Corrosion Under Blisters? .... Y N
- C. Cracking
  - 1. Overall Extent of Failure .... ☐
    - A. Extent Within Affected Area .... ☐
- D. Checking (Test Method D 660)
  - 1. Overall Extent of Failure .... ☐
    - A. Extent Within Affected Area .... ☐
- E. Flaking (Test Method D 772)
  - 1. Overall Extent of Failure .... ☐
    - A. Extent Within Affected Area .... ☐
  - 2. Severity .... ☐
- F. Sags or Curtains? .... Y N
- G. Chalking? .... Y N
- H. Discoloration? .... Y N
- I. Softening? .... Y N
- J. Valves, Piping, Heating Coils Present? .... Y N
  - 1. Coating Damage in Adjacent Areas? .... Y N
- K. Stiffeners Present? Y N
  - 1. Coating Damage Behind Stiffeners? .... Y N
- L. Anodes Present? .... Y N
  - 1. Coating Damage in Adjacent Areas? .... Y N
  - 2. Anodes Functioning? .... Y N
- M. Knife Test
  - 1. Acceptable? .... Y N
    - If "N," Mark Level(s) Below
    - A. Topcoat .... ☐
    - B. Within Repair System .... ☐
    - C. Between Original/Repair .... ☐
    - D. Within Original System .... ☐
    - E. To Primer Coat .... ☐
    - F. To Steel Substrate .... ☐

III. Measured Properties
- A. Dry Film Thickness (SSPC-PA-2)

Spot 1	Spot 2	Spot 3	Spot 4	Spot 5
__:__:__	__:__:__	__:__:__	__:__:__	__:__:__
__:__:__	__:__:__	__:__:__	__:__:__	__:__:__
__:__:__	__:__:__	__:__:__	__:__:__	__:__:__
__:__:__	__:__:__	__:__:__	__:__:__	__:__:__
__:__:__	__:__:__	__:__:__	__:__:__	__:__:__
__:__:__	__:__:__	__:__:__	__:__:__	__:__:__
__:__:__	__:__:__	__:__:__	__:__:__	__:__:__
__:__:__	__:__:__	__:__:__	__:__:__	__:__:__
__:__:__	__:__:__	__:__:__	__:__:__	__:__:__
__:__:__	__:__:__	__:__:__	__:__:__	__:__:__
__:__:__	__:__:__	__:__:__	__:__:__	__:__:__
__:__:__	__:__:__	__:__:__	__:__:__	__:__:__
__:__:__	__:__:__	__:__:__	__:__:__	__:__:__

1. More DFT Readings? .... Y N

IV. Recommendations____________

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FIG. 5 Tanks and Voids

Inspection Area ____________ Date ____________

Ship Name ________________________

Hull Number ________________________

Inspector's Name ________________________

Required Photographs
1. Entire Area
2. Close-Up of All Damage

I. Fouling
- A. Slime
  - 1. Overall Extent of Failure ☐
    - A. Extent Within Affected Area ☐
- B. Grass
  - 1. Overall Extent of Failure ☐
    - A. Extent Within Affected Area ☐
- C. Barnacles
  - 1. Overall Extent of Failure ☐
    - A. Extent Within Affected Area ☐
- D. Tubeworms
  - 1. Overall Extent of Failure ☐
    - A. Extent Within Affected Area ☐
- E. Other
  - 1. Overall Extent of Failure ☐
    - A. Extent Within Affected Area ☐
- F. Corrosion/Paint Failures Obscured by Fouling? Y N
- G. Pitting Under Fouling? Y N

II. Corrosion
- A. General
  - 1. Overall Extent of Failure ☐
    - A. Extent Within Affected Area ☐
- B. Mechanical Damage
  - 1. Overall Extent of Failure ☐
    - A. Extent Within Affected Area ☐
  - 2. Type of Damage
    - A. Grounding ☐
    - B. Scraping/Impact ☐
    - C. Anchor Chains/Ropes ☐
    - D. Internal Welds/Burning ☐
    - E. Damage From Scrubbing ☐
- C. Pitting Corrosion
  - 1. Overall Extent of Failure ☐
    - A. Extent Within Affected Area ☐
- D. Pin-Point Corrosion
  - 1. Overall Extent of Failure ☐
    - A. Extent Within Affected Area ☐
- E. Cavitation (P5, S5, A Only)? Y N
- F. Galvanic Corrosion/Coating Undercutting? Y N

III. Paint Condition
- A. Delamination
  - 1. Overall Extent of Failure ☐
    - A. Extent Within Affected Area ☐
  - 2. Topcoat ☐
  - 3. Within Repair System ☐
  - 4. Between Original/Repair ☐
  - 5. Within Original System ☐
  - 6. To Primer Coat ☐
  - 7. To Steel Substrate ☐
- B. Blistering (Test Method D 714)
  - 1. Overall Extent of Failure ☐
    - A. Extent Within Affected Area ☐
  - 2. Size (Test Method D 714) ☐
  - 3. Density (Test Method D 714) ☐
  - 4. % Broken Blisters ☐
  - 5. Organic Odor in Blisters? Y N
  - 6. Blisters Contain Water? Y N
    - A. pH ☐
  - 7. Corrosion Under Blisters? Y N
- C. Cracking
  - 1. Overall Extent of Failure ☐
    - A. Extent Within Affected Area ☐
- D. Checking (Test Method D 660)
  - 1. Overall Extent of Failure ☐
    - A. Extent Within Affected Area ☐
- E. Flaking (Test Method D 772)
  - 1. Overall Extent of Failure ☐
    - A. Extent Within Affected Area ☐
  - 2. Severity ☐
- F. Sags or Curtains? Y N
- G. Erosion? Y N
- H. Knife Test
  - 1. Acceptable? Y N
    - If "N," Mark Level(s) Below
    - A. Topcoat ☐
    - B. Within Repair System ☐
    - C. Between Original/Repair ☐
    - D. Within Original System ☐
    - E. To Primer Coat ☐
    - F. To Steel Substrate ☐

IV. Measured Properties
- A. Dry Film Thickness (mils) (SSPC-PA-2)

Spot 1	Spot 2	Spot 3	Spot 4	Spot 5
_:_:_	_:_:_	_:_:_	_:_:_	_:_:_
_:_:_	_:_:_	_:_:_	_:_:_	_:_:_
_:_:_	_:_:_	_:_:_	_:_:_	_:_:_
_:_:_	_:_:_	_:_:_	_:_:_	_:_:_
_:_:_	_:_:_	_:_:_	_:_:_	_:_:_
_:_:_	_:_:_	_:_:_	_:_:_	_:_:_
_:_:_	_:_:_	_:_:_	_:_:_	_:_:_
_:_:_	_:_:_	_:_:_	_:_:_	_:_:_
_:_:_	_:_:_	_:_:_	_:_:_	_:_:_
_:_:_	_:_:_	_:_:_	_:_:_	_:_:_
_:_:_	_:_:_	_:_:_	_:_:_	_:_:_
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_:_:_	_:_:_	_:_:_	_:_:_	_:_:_

  - 1. More DFT Readings? Y N

V. Dielectric Shields

	Prim.	Sec.
A. Blistering?	Y N	Y N
B. Delamination?	Y N	Y N
C. Fouling?	Y N	Y N
D. Corrosion		
1. General?	Y N	Y N
2. Pitting?	Y N	Y N
E. Film Thickness (mils)	☐	☐
F. Calcareous Deposit?	Y N	Y N
G. Erosion?	Y N	Y N

VI. Recommendations ________________________

Copy to Ship's Officer Y N

Acknowledged Receipt ________________________

FIG. 6 Underwater Hull and Boottop

8.1.2 *Mechanical Damage*—Mechanical damage corrosion is corrosion that occurred because the paint was removed from the hull by some type of scraping or impact against the hull. With the paint removed and the steel hull exposed to sea water, corrosion occurred. Photographic examples of corrosion caused by various forms of mechanical damage (that is, scraping/impact, anchor chains/ropes, and internal welds/burning) are shown in Fig. 8.