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(Edition 1)

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PERFORMANCE REQUIREMENTS FOR NON-SKID COATING SYSTEMS

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NORTH ATLANTIC TREATY ORGANISATION

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1. AEP-63(Edition 1) – PERFORMANCE REQUIREMENTS FOR NON-SKID COATINGS SYSTEMS is a non-classified publication.

2. AEP-63(Edition 1) is effective upon receipt.

Juan A. MORENO
Vice Admiral, ESP(N)
Director, NATO Standardization Agency

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TABLE of CONTENTS

CHAPTER 1 INTRODUCTION

The aim of this Allied Engineering Publication (AEP) is to establish the minimum requirements for non-skid deck covering performance. This is a specification for the approval of non-skid coating systems and non-skid coatings which have the following minimum expected service life :

- landing area : 15,000 landings, or 24 months;
- nonlanding area exterior : 4 years;
- interior : 4 years.

This document does not establish requirements for emissivity (IR) of the top coat.

CHAPTER 2 SCOPE

This AEP deals with the performance requirements for non-skid performance and corrosion resistance by non-skid coating systems of ships exterior and interior decks exposed to the marine atmosphere.
This AEP deals with high durability protective non-skid coating systems for ships exterior and interior decks. Those structures are exposed to the corrosivity category C5-M with special stresses as given in § 4.3 and annex B of ISO 12944-2.
This AEP addresses:

- Laboratory performance test methods for assessment of the durability of the non-skid coating system(s);
- Evaluation criteria for performance testing ;
- Test methods for the identification of the individual components of the non-skid coating system;
- Acceptance criteria.

CHAPTER 3 NORMATIVE REFERENCES

BS 381C Colours for Identification, Coding and Special Purposes

ISO 1247 Aluminium Pigments for Paints

ISO 1248 Iron oxide pigments – Specifications and methods of test

ISO 1514 Paints and varnishes - Standard panels for testing

ISO 2808 Paints and varnishes - Determination of film thickness.

ISO 2810 Paints and varnishes - Natural weathering of coatings – exposure and assessment

ISO 2811 Paints and varnishes - Determination of density.

ISO 3001 Plastics – Epoxy compounds – Determination of epoxy equivalent

ISO 3233 Paints and varnishes - Determination of volume of dry coating (non-volatile matter) obtained from a given volume of liquid coating

ISO 3251 Paints and varnishes - Determination of non-volatile matter of paints, varnishes and binders for paints and varnishes.

ISO 3270 Paints and varnishes - Temperatures and humidities for conditioning and testing

ISO 3549 Zinc Dust Pigments for Paints – Specifications and Test Methods

ISO 3678 Paints and Varnishes - Print-Free Test

ISO 3679 Paints, varnishes, petroleum and related products - Determination of flash point. - Rapid equilibrium method.

ISO 3682 Determination of acid value – Titrometric method

ISO 4618 Paints and varnishes - Terms and definitions

ISO 4624 Paints and varnishes - Pull off test for adhesion

ISO 4628 Paints and varnishes - Evaluation of degradation of paint coatings - Designation of intensity, quantity and size of common types of defect.

Part 1: General introduction and designation system

Part 2: Assessment of degree of blistering

Part 3: Assessment of degree of rusting

Part 4: Assessment of degree of cracking

Part 5: Assessment of degree of flaking

Part 6: Rating of degree of chalking by tape method

ISO 4629 Paints and varnishes - Determination of hydroxyl value

ISO 6270 Paints and varnishes - Determination of resistance to humidity (continuous condensation)

ISO 6745 Zinc Phosphate Pigments for Paints – Specifications and Methods of Test

ISO 7724 Paints and varnishes – Colorimetry

Part 1 : Principles

Part 2 : Colour measurement

Part 3 : calculation of colour differences

ISO 8044 Corrosion of metals and alloys – Basic terms and definitions

ISO 8501 Preparation of steel substrates before application of paint and related products – Visual assessment of surface cleanliness

Part 1: Rust grades and preparation grades of uncoated steel substrates and of steel substrates after overall removal of previous coatings

Part 3: Preparation grades of welds, edges and other areas with surface imperfections

ISO 8502 Preparation of steel substrates before application of paint and related products – Tests for the assessment of cleanliness

Part 3: Assessment of dust on steel surfaces prepared for painting (pressure-sensitive tape method)

Part 4: Guidance on the estimation of the probability of condensation prior to paint application

Part 6: Extraction of soluble contaminants for analysis - The Bresle method

Part 9: Field method for the conductometric determination of water-soluble salts

ISO 8503 Preparation of steel substrates before application of paint and related products – Surface roughness characteristics of blast cleaned substrates

Part 1: Specifications and definitions for ISO surface profile comparators for the assessment of abrasive blast-cleaned surfaces

Part 2: Method for the grading of surface profile of abrasive blast-cleaned steel – Comparator procedure

ISO 8504 Preparation of steel substrates before application of paints and related products - Surface preparation methods

Part 3: Hand- and power-tool cleaning

ISO 9117 Paints and Varnishes – Determination of Through-Dry State and Through-Dry Time – Method of Test

ISO 9227 Corrosion Tests in Artificial Atmospheres - Salt Spray Tests

ISO 9514 Paints and varnishes - Determination of the pot-life of liquid systems

ISO 10601 Micaceous iron oxide pigments for paints — Specifications and test methods

ISO 11507: Paints and varnishes – Exposure of coatings to artificial weathering – Exposure to fluorescent UV and water

ISO 11890 Paints and varnishes - Determination of volatile organic compounds

Part 1: Difference method

Part 2: Gas-chromatographic method

ISO 11908 Binders for Paints and Varnishes - Amino Resins - General Methods of Test

ISO 11909 Binders for paints and varnishes — Polyisocyanate resins — General methods of test

ISO 12944 Paint and varnishes - Corrosion protection of steel structures by protective paint systems

Part 1: General introduction

Part 2: Classification of environments

Part 5: Protective paint systems

Part 6: Laboratory performance test methods

ISO 14680 Paints and varnishes - Determination of pigment content

Part 1: Centrifuge method

Part 2: Ashing method

ISO 20340 Paints and varnishes – Performance requirements for protective paint systems for offshore and related structures

ASTM A 229 Specification for Steel Wire, Oil-Tempered for Mechanical Springs.

ASTM D 1141 Standard Practice for the Preparation of Substitute Ocean Water

ASTM D 2372 Standard practice for separation vehicles from solvent-reducible paints

ASTM D 2621 Infrared identification of vehicle solids from solvent-reducible paints

ASTM G 14 Standard Test Method for Impact Resistance of Pipeline Coatings (Falling Weight Test)

SSPC-SP 1 Surface Preparation No. 1, Solvent Cleaning

STANAG 1135 Interchangeability of Fuels, Lubricants and Associated Products Used by the Armed Forces of the North Atlantic Treaty Nations

STANAG 1162 Vertical Replenishment (Vertrep) Operating Area Marking, Clearances, and Lighting

STANAG 1278 Standard for the required level and measurement of coefficient of friction on flight decks

STANAG 4602 Fire Assessment of Materials

MIL-F-24385 Fire Extinguishing Agent, Aqueous Film Forming Foam (AFFF) Liquid Concentrate, for Fresh and Seawater

MIL-STD-1623 Fire Performance Requirements and Approved Specifications for Interior Finish Materials and Furnishings (Naval Shipboard Use)

FED-STD-595 Colors Used in Government Procurement

CHAPTER 4 DEFINITIONS

For the purposes of this agreement, the following terms and definitions apply.

NOTE : Some of the definitions have been taken from ISO 8504-3, ISO 8044:1999, ISO 12944/-1-5 or ISO 4618, as indicated.

4.1. CLEANED SURFACE (CLEANLINESS)

Surface from which the contaminants have been removed to a specified level [ISO 8504-3]

4.2. COAT

A continuous layer of a coating material resulting from a single application [ISO 4618].

4.3. CORROSION

Electrochemical interaction between a metal and its environment that results in changes in the properties of the metal and that may often lead to impairment of the function of the metal, the environment or the technical System of which these form a part [ISO 8044].

4.4. C5-M

This is the very high marine corrosivity category, defined by standard ISO 12944-2, in terms of the mass or thickness loss of standard specimens made of low-carbon steel and/or zinc, after the first year of exposure. It corresponds to coastal and offshore areas with high salinity.

4.5. DURABILITY

The expected life of a protective non-skid coating system to the first major replacement. Durability concerns the anticorrosive performances of the non-skid coating system and its ability to maintain slip resistance, but not the cosmetic behaviour of the topcoat.

4.6. NON-SKID COATING

A pigmented coating material containing slip-resistant aggregate(s) in liquid, paste or powder form that, when applied to a substrate, forms an opaque film having slip-resistant properties.

4.7. NON-SKID COATING SYSTEM

The sum total of the coats including primer, stripe coat and non-skid coating or related products that are to be applied or have been applied to a substrate to provide corrosion protection and non-skid performance.

4.8. SUBSTRATE

The surface to which the coating material is applied or is to be applied [ISO 4618].

4.9. NOMINAL DRY FILM THICKNESS (NDFT

The dry film thickness specified for each coat of anticorrosive to achieve the required durability [ISO 12944-5].

4.10. NOMINAL WET FILM THICKNESS (NWFT)

The wet film thickness for each coat of anticorrosive that corresponds to the specified NDFT.

4.11. DRY FILM THICKNESS (DFT

The thickness of a coating remaining on the surface when the coating has hardened.

4.12. WET FILM THICKNESS (WFT

The thickness of a coating remaining on the substrate immediately after application and prior to volatile evaporation.

4.13. PRODUCT DATA SHEET (PDS

A document designed to provide information on a specific non-skid coating product
NOTE 1 : The type of information includes product uses, features, service properties, application properties, application instructions, packaging information, and information on storage and handling.
NOTE 2 : See A1-2 for specific required minimum information.

4.14. MATERIAL SAFETY DATA SHEET (MSDS)

A document designed to provide information regarding the health and safety aspects of a non-skid coating product.
NOTE : The MSDS typically includes information concerning generic material identification, hazardous ingredients, physical data, fire and explosion data, health hazards, reactivity data, spill or leak procedures, special protection requirements and other special precautions.

4.15. QUALIFICATION

A process for the evaluation of protective non-skid coating systems using test criteria which allow the selection of suitable non-skid coating systems for distinct environmental exposure conditions.

4.16. SHELF LIFE

The period from the date of manufacture during which the non-skid coating can be transported and / or stored in undamaged and unopened packaging without any influence on its application or performance providing the ambient conditions are within the limits recommended by the non-skid coating manufacturer, or otherwise agreed.
NOTE : After exceeding this period, the non-skid coating is subject to re-inspection.

4.17. VOC (VOLATILE ORGANIC COMPOUND)

Fundamentally, any organic liquid and/or solid that evaporates spontaneously at the prevailing temperature and pressure of atmosphere with which it is in contact.
The mass of the volatile organic compounds present in coating material, as determined under specified conditions. Note: the exact interpretation of the word “volatile” will depend on the sphere of application of the coating material and the conditions at the place of application. For each sphere of application, the limiting value of VOC content and the methods of determination or calculation are stipulated by regulations or by agreements. (ISO 12944-5).

4.18. SPREAD RATE

A measure of the area of coverage per volume provided by the non-skid coating (i.e., m2/l).

CHAPTER 5 FIELD OF APPLICATION

The field of application for which this AEP is developed is characterised by:

- the type of structure
- the type of environment
- the service life and durability
- the applications
- the type of substrate and surface preparation
- the type of non-skid coating product.

5.1. TYPE OF STRUCTURES

This AEP concerns structures - exterior and interior decks of ships - made of C-Mn steels, other metallic materials or Glass Reinforced Plastic (resin fibreglass).
Not covered by this agreement are:

- wood
- rubber.

5.2. TYPE OF ENVIRONMENT

This AEP deals with the atmospheric corrosivity category C5-M in accordance with ISO 12944-2.

5.3. SERVICE LIFE AND DURABILITY

The corrosion protection of the non-skid coating system shall be of high durability, with a service life of no less than the minimum specified for the intended application area (i.e., landing area, nonlanding area exterior, or interior), in accordance with ISO 12944-1. During this period, localized repair applications may be carried out. These works are considered as minor maintenance.
The minimum service life of the non-skid coating system shall be specified to last for 15,000 landings or 24 months for landing area application, 4 years for nonlanding area exterior application, and 4 years for interior application.

5.4. APPLICATIONS

The applications covered by this AEP are new building application or equivalent (total removal of pre-existing coatings).
The new building non-skid coating system must be adapted to maintenance procedures such as localized repairs of areas that may become damaged (e.g., due to mechanical damages, burnt areas, etc.).
No mechanical surface preparation of the anticorrosive shall be required for the general non-skid topcoat application.
The maintenance shall be carried out using a standard non-skid coating maintenance system.

5.5. TYPE OF SUBSTRATE AND SURFACE PREPARATION

The major substrate of exterior and interior decks is steel, which may or may not have been coated by shop primer (e.g., zinc rich primer, zinc ethyl silicate) at construction.
If used, shop primers are not considered as the first coat of non-skid coating system and must be removed prior to application of the non-skid system.
The description of surface preparation covers cleanliness, levels of contamination and roughness.

5.5.1. Cleanliness

The surface preparations generally used for the different types of substrates are identified in table 5-1.

Nature of substrate	Surface preparation	Standardization
Steel	Sa 2½	ISO 8501-1
Resin fibreglass	Sweep blast to remove gloss	
Other metallic materials (copper alloys, aluminium alloys, stainless steel,…)	Sweep blast and optional solvent wipe	

Table 5 - 1 : Substrate Cleanliness

5.5.2. Contamination

For all types of substrate, the minimum level of cleanliness (contamination) before non-skid coatings application is identified in Table 5-2.

Criteria	Minimum level	Standardization
Dust	Intensity : < 2 Size : ≤ 2	ISO 8502-3 (*) (Fig 1, Board 1)
Probability of condensation	Relative humidity : ≤ 85 % Substrate temperature ≥ dew point + 3°C, and ≤ 40 °C, Application temperature between + 5°C and +35 °C	ISO 8502-4 (*)
Oils and greases	None visible	SSPC-SP 1
Soluble salts	≤ 5 µg/cm² (Chloride equivalent)	ISO 8502-6/9 (*)

(*) – These specifications are standardized only for steel surfaces but may be used on other types of substrates commonly encountered in building naval vessels (Steel, GRP, aluminium alloys, etc…).

Table 5 - 2 : Substrate Contamination

5.5.3. Roughness

The grade used is MG (Medium Grit) of the comparator procedure defined by ISO 8503-2.

5.6. TYPE OF NON-SKID COATING PRODUCT

The types of non-skid covered by this document are non-abrasive non-skid used in landing areas of aircraft carriers, and general purpose, abrasive or non-abrasive, non-skid used for general applications.
The generic types of non-skid coating widely used in non-skid coating systems for providing adequate slip-resistance are described but not limited to aircraft carrier landing areas, other aviation decks, exterior working and walking areas, and interior working areas near machinery where slip resistance is desired.
Non-skid coatings may be applied by roller, trowel, spray, or as specified, and dry at ambient temperatures in accordance with Table 6-1 for each non-skid coating.

CHAPTER 6 REQUIREMENTS FOR QUALIFICATION

Requirements for non-skid coating systems submitted for the qualification approval are described in the following items:

- Document requirements
- Basic requirements
- Qualification tests
- Non-skid coating identification.

For the proposed non-skid coating system, the manufacturer shall prepare and submit documents in accordance with 6.1.
Basic requirements for the non-skid coating system submitted for the qualification are listed in paragraph 6.2 ; characteristics of non-skid coating system shall be in accordance with them.
The protective non-skid coating systems shall be performance tested in accordance with Chapter 7 and the individual coatings comprising the system shall be identified in accordance with Chapter 8.
The chemical composition of the non-skid coatings in the non-skid system shall be controlled during and after the qualification process. Any change shall be noted and justified by the manufacturer proving that such changes do not negatively affect the long-term properties of the material (see Annex A.4). A new data sheet shall be submitted for each modified non-skid coating.

6.1. DOCUMENT REQUIREMENTS

At the time of qualification submission the non-skid coating system shall be identified by unique nomenclature (system name, alpha/numeric identification) and also each individual product constituting the system shall be identified by unique nomenclature (product name, alpha/numeric identification, index of product formulation, chemical nature, colour, nominal dry film thickness for each coat in µm).
The Manufacturer shall submit a technical file containing all of the following information and documents:

- Technical data sheet of non-skid coating system including (see Annex A.1):
- Product information of the non-skid coating system (see Annex A.2)
- Material safety data sheet and labelling requirements for each coating. MSDS format to be in accordance with the regulation of the nation.
- Use references (see Annex A.3).

6.2. BASIC REQUIREMENTS

6.2.1. General objectives

Non-skid coating systems submitted for qualification shall:

- maintain adequate slip resistance.
- have good anticorrosive performances in service life in very high marine corrosivity category (C5-M), without total replacement (see 5.3).
- have a primer compatible with the anticorrosive paint system of the adjacent ship structure
- be compatible with standard non-skid coating system of maintenance
- have reflectance < 0.12 for landing area (STANAG 1162)
- be colour stable.

6.2.2. Requirements

Non-skid coating systems submitted for qualification shall have:

6.2.2.1. Non-skid coating system architecture

The non-skid system shall consist of a minimum of a single coat of primer, a single stripe coat of primer of alternate colour (applied by brush, roller, or spray to all deck edges, edges of deck protrusions, and weld beads), and a minimum of a single coat of non-skid coating, as identified in Table 6-1.

Coat	Application requirements
1 coat primer	≥125µm NDFT
1 coat stripe (applied to welds, deck edges, etc.)	≥125µm NDFT
1 coat non-skid coating (Rolled)	spread rate : ≥ 0.50 m2/l; ≤ 0.75 m2/l
2 coats non-skid coating (Sprayed)	spread rate for each coat : ≤ 1.8 m2/l

Table 6 - 1 Thickness Requirements

6.2.2.2. Application conditions

Coatings constituting non-skid coating systems shall be applicable and shall dry in normal atmospheric conditions which are defined as:
Relative Humidity : ≤ 85 %,
Substrate temperature : ≥ T dew point + 3°C, and ≤ 40 °C,
Environmental temperature for application: + 5°C → +35 °C.
No mechanical surface preparation between coats.

6.2.2.3. Dry time

Time to dry hard is maximum 16 hours (ISO 3678).

6.2.2.4. Pot life

Pot life : > 2 hours at 20°C (ISO 9514).

6.2.2.5. Safety, occupational health, and environmental impact

All components comprising the non-skid coating system submitted shall be in accordance with the national regulations, target requirements for VOC as given in Table 6-2.

Criteria	Primer and intermediate coat (1)	Topcoat (1)
VOC (max.)	250 g/L	340 g/L

(1) for two component products, values are for the mixed and ready to use product

Table 6 - 2 Target VOC Requirements

6.2.2.6. Adhesion

Adhesion of non-skid coating system is a minimum of 4 MPa (Pull off test ISO 4624) (Wc : values from ISO 20340)

6.2.2.7. Shelf life

Shelf life of each non-skid coating is at least 18 months (on delivery)

6.2.2.8. Condition in container

Non-skid coatings shall not exhibit on delivery or during shelf life: hard settling, skinning, phase separation, corrosion of container, persistent foam after mix or other properties indicating unfitness for use.

6.2.2.9. Colour

Colour of different topcoats are given in Annex A.5.

CHAPTER 7 QUALIFICATION TESTS

7.1. PREPARATION AND CONDITIONING OF TEST PANELS

7.1.1. Test panels

Type, size, number, preparation and conditioning of test panels are in accordance with the ISO 12994-6 and the instructions of the manufacturer of the coating material. If not otherwise agreed, the thickness of panels is 5 mm. These panels shall be in steel complying with ISO 1514.

7.1.2. Surface preparation

The test panels shall be grit blasted to Sa 2½ (ISO 8501-1) and using a non metallic abrasive (inert slag). The surface profile of test side of each panel shall correspond to MG class (Medium grit) as define in ISO 8503-1 and checked with comparator as ISO 8503-2. Surface contaminant levels are in accordance with § 5.5.
Other surface preparation may be used to represent actual field conditions, in accordance with manufacturer instructions and agreed by parties.

7.1.3. Application and curing

The panels shall be coated by spraying and strictly in accordance with the latest manufacturer's written instruction.
The backside and edges of test panels shall be protected with an appropriate protection agreed by parties.

7.1.4. Dry film thickness (DFT)

For primer, prior to overcoating, the DFT on test face panels shall be measured in accordance with ISO 2808 at a minimum of 5 positions (centre and corners, 15 to 20 mm from edges). The average value shall be within ±10% of the NDFT.
For non-skid, the spread rate as determined by weight shall be ±10% of the nominal spread rate.

7.1.5. Overcoating time

Overcoating time for each layer shall be conducted in accordance with non-skid coating manufacturer instruction. Deviated overcoating time shall be agreed between parties involved and recorded in the test report.

7.1.6. Conditioning

The panels shall be conditioned under controlled temperature and humidity as ISO 3270. If curing and conditioning are different than previous conditions, it shall be clearly stated in test report and overcoating.

7.1.7. Scribe line

Scribe lines, which are required to evaluate paint performance in C5-M corrosion environments, and when introduced into paint samples as described below (§ 7.3), shall cut through the non-skid coating system down into the substrate.
A scribe line shall be made on the test panel using a scribing machine such as drill press with cobalt slot drills. In such a case, a 2 mm width is recommended for the drill and shall be used for calculation of undercutting with the formula given in annex A of ISO 12944-6 (use W = 2 mm). In accordance of ISO 12944-6 annex A, these scribe lines shall be diagonal and at least 50 mm long and 20 mm from any edges.

7.2. PERFORMANCES TESTS

Before non-skid coating application on panels for performance tests, Table 7-1, the storage stability of non-skid coatings shall be checked.

7.2.1. Storage stability

Non-skid coatings shall not exhibit on delivery or during shelf life : hard settling, skinning, , phase separation, corrosion of container, persistent foam after mix or other properties indicating unfitness for use. (see appendix B.1)

7.2.2. Performance tests

PERFORMANCE TESTS ON NON-SKID COATING SYSTEM			
N°	NATURE	DURATION	STANDARD
1	Coefficient of friction	See Annex B.2	
2	Cable wear (carrier landing areas only) for landing area when applicable	See Annex B.3	
3	Wear resistance for landing area when applicable	See Annex B.4	
4	Impact resistance for landing area when applicable	See Annex B.5	
5	Resistance to chemical solutions	See Annex B.6	
6	Salt spray (1)	1440 h (ISO 12944-6)	ISO 9227, paragraph 3.2.2 neutral salt spray
7	Condensation	720 h (ISO 12944-6)	ISO 6270
8	UV resistance	150 Cycles	ISO 11507 Lamp Type 2 (UVA 340 nm) – Method A
9	Colour stability (See Annex A 2.7)	12 month	ISO 2810
10	Natural aging in C5-M environment (See Annex A 2.8) (1)	at least 2 years	ISO 12944-2 & ISO 2810
11	Fire resistance	As per standard	STANAG 4602 or MIL-STD-1623 (for U.S.)

Minimum 2 panels per test
(1) – Scratch line is made on a minimum of one panel

Table 7 - 1 Performance Tests on Non-skid Coating System

7.3. ACCEPTANCE CRITERIA

Acceptance criteria are identified in Table 7-2.

ACCEPTANCE CRITERIA					
	NATURE OF TEST	Tests before and after qualification tests N°	Level before qualification tests	Level after qualification tests	STANDARD
A	Pull off test	6,7,8,10	No adhesive failure ≥ 4 MPa	≥ 50 % of original value (only cohesive failure)	ISO 4624
B	Degree of delamination from scribe line	after qualification test N° 6,10	-	M < 3 mm (scribing machine with 2 mm width)	ISO 12944-6 Annex A
C	Degradations Blistering Rusting Cracking, Flaking Chalking	 6,7,8,10 6,7,8,10 6,7,8,10 8,9,10	No coating application and drying defects	No failure 0 (S0) 0 (Ri0) 0 (S0) ≤ 1	ISO 4628
D	Colour stability Total colour difference ΔE *	8, 9,10	See Annex A.5	See Annex A.6	ISO 7724/1-2-3
E	COF	N/A	See Annex B.2	See Annex B.2	N/A
F	Cable abrasion	N/A	See Annex B.3	See Annex B.3	N/A
G	Wear resistance	N/A	See Annex B.4	See Annex B.4	N/A
H	Impact resistance	N/A	See Annex B.5	See Annex B.5	N/A
I	Resistance to chemical solutions	N/A	See Annex B.6	See Annex B.6	N/A
J	Fire reaction	N/A	N/A	As per standard	STANAG 4602 or MIL-STD-1623 (for U.S.)

Table 7 - 2 Acceptance Criteria for Non-skid Coating System

CHAPTER 8 PAINT IDENTIFICATION

Each coating constituting non-skid coating system submitted to the qualification process should be checked according to Table 8-1 (the different values are given by the non-skid coating manufacturer).

Tests	Method reference	Expression of results ("x value")
Density	ISO 2811	x ± 0.05 g·cm-3 (1)
Solids content (% by weight)	ISO 3251	x ± 2.0 %
Ash content (% by weight)	ISO 14680-2 (900 ± 20 °C)	x ± 3.0 %
Pigment (including extender) and binder (% by weight)	ISO 14680-1 (solvent paint) ISO 3251 (waterborne paint)	x ± 2.0 %
Infrared spectra of binder	ASTM D2372 ASTM D2621	Compare with reference spectra
Functional pigments contents (% by weight):		
Aluminium	ISO 1247	x ± 1.0 %
Iron Oxide (red oxide)	ISO 1248	x ± 1.0 %
Micaceous iron oxide	ISO 10601	x ± 1.0 %
Zinc dust	ISO 3549	x ± 1.0 %
Zinc phosphate	ISO 6745	x ± 1.0 %
Characteristic index:		
Epoxy	ISO 3001	x %
OH	ISO 4629	x %
Acidic	ISO 3682	x %
Amine	ISO 11908	x %
Isocyanate	ISO 11909	x %
Drying time:	ISO 9117	
Dry to touch		≤ x h
Hard time		≤ x h
Flash point	ISO 3679	≥ x °C
Pot life	ISO 9514	≥ x h
VOC:		
Primer	ISO 11890 -1, -2	≤ x g/L
Non-skid		≤ x g/L
Non-skid Marking Paint		≤ x g/L

NB : For two components products, tests are done on each component.
(1) – For density greater than 2,0 g/ cm3 the relevant tolerance is ± 0,1 g/cm3 and lower than 1,0 g/cm3 relevant tolerance is ± 0,03 g/cm3
x - Value given by non-skid coating manufacturer and agreed between parties (contractor and manufacturer)

Table 8 - 1 Paint Identification Tests

CHAPTER 9 TEST REPORT

The test report shall contain at least the following information:

a. test laboratory (name and address)

b. date of tests

c. description of the non-skid coating system (see § 6.1)

d. environment where the non-skid coating system is applicable, and qualification tests carried out

e. description of the preparation and conditioning of the test panels (see Chapter 7)

f. assessment of the test panels before ageing

g. assessment of the test panels after ageing for each qualification test

h. any deviation from the test methods specified.

ANNEX A

A.1 Technical data sheet of non-skid coating system

A.2 Required product information

A.3 Use references

A.4 Evolution of the product formula or non-skid coating system

A.5 Colour requirements

A.1. TECHNICAL DATA SHEET OF NON-SKID COATING SYSTEM

	Name of non-skid coating system :											N° :						
	DESCRIPTION :											EDITION :						
	SURFACE PREPARATION : Steel plating (ISO 8501-3), Cleanliness (ISO 8501-1), Level of pollution [dust, humidity , oil, grease, soluble salts](ISO 8502), Roughness (ISO 8503) Coatings are required to be applied onto properly prepared surfaces which are dry and free of contaminants in accordance with ISO 8502.																	
Non-skid coating system		Colour	Number of coats	Dry thickness : per coat (µm)			Weight of dry film ($g/m^2/c$) ①	Application Density ($g/m^2/c$)	Solid content by volume (%)	Spreading rate (m^2/l)		Provisioning prediction ($l/m^2/c$) ②	Application modes ③					
Non-skid coating reference	Data sheet reference			Nom;	mini	maxi							B	R	P	T	E	
Non-skid coating characteristics		Contractual Dry thickness (µm)						Total weight of dry non-skid coating system (g/m^2)				Duration before service life :						
Non-skid coating Reference		Name of products						Drying time (dry to touch) 20 °C	Overcoating time at 20 °C		Pot life④	Minimum Temperature for Application		Flash Point (°C)		Thinner		
									minimum	maximum								
REMARKS																		

① - For nominal Thickness, ② - Average loss : ≈ 30 % (indicative value), ③- B : Brush, R: Roller, P: Spray, T: Trowel, E: Electrostatic gun, ④ - Using time after mix

A.2. REQUIRED PRODUCT INFORMATION (ISO 20340)

At least the following information, in addition to the material Safety data sheet, shall be provided with each product submitted to qualification procedure

Date of issue	
Name of the product	
Name of manufacturer	
Generic name for the non-skid coating	
Generic name for curing agent	
Generic name for each additional component	
Colour of coating material	
Mixing ratio	
Mixing instructions (including the induction time)	
Shelf life under the recommended storage conditions	
Non-volatile matter by volume of mixed product (ISO 3233)	
Density of mixed product (ISO 2811)	
Pot life	
Flash point of each separate component	
Drying time	
Time to full curing	
Recommended thinner	
Flash point of the recommended thinner	
Maximum quantity of thinner allowed for application	
Surface preparation (ISO 8501-1) and profile (ISO 8503)	
Recommended application mode	
Mini and maxi over-coating time	
Recommended minimum and maximum drying time in accordance with environmental temperature	
Solvent for cleaning	
Application conditions (temperature, RH)	
VOC	
Reference to the material safety data sheet	
Theoretical spreading rate	

A.3. USE REFERENCES

Date of issue	
Name of manufacturer	
Name of non-skid coating system	
Description of non-skid coating system (name and number of coat, thickness)	
Name of the structure where the non-skid coating system is applied	
Date of non-skid coating system application	
Environmental conditions of the structure	
Non-skid coatings and coat thickness on structure	
Locations	
General behaviour of non-skid coating system (date)	
Failures (rusting, blistering, cracking, chalking, …..)	
Adhesive properties of non-skid coating system on structure	
Others tests or checking done on the structure coated by non-skid coating system)	
Works of maintenance (nature, non-skid coating quantity, area, date, ...)	

A.4. EVOLUTION OF THE PRODUCT FORMULA OR NON-SKID COATING SYSTEM

Designation			Edition
Manufacturer			
Formula index		Date of formulation	
New index of formulation		New Date of formulation	
Nature of the deviation			
Reasons			
Analysis of consequences			
Qualification tests done			
Use References for the new product			
Conclusions			

A.5. COLOUR REQUIREMENTS

Reference			Acceptance criteria		
Colour	Colour chips reference	Nation	ΔE *	ΔL *	Standard
Grey	RAL 7012	BEL	≤ 5		ISO 7724/1-2-3
Medium Grey	RAL 7046	BEL	≤ 5		
Black	RAL 9005	BEL	≤ 5		
White	RAL 9016	BEL	≤ 5		
Yellow	RAL 1023	BEL	≤ 5		
Green	RAL 6005	BEL	≤ 5		
Red	RAL 3020	BEL	≤ 5		
Blue	RAL 5010	BEL	≤ 5		
Grey/blue middle	AFNOR A625	FRA	≤ 1	± 0,7	
Dark gray/blue	AFNOR A605	FRA	≤ 1,5	± 0,7	
Extra dark sea grey	BS 381C:640	GBR	≤ 1,5		
Dark Admiralty Grey	BS 381C: 632	GBR	≤ 1,5		
Middle Gray	FED STD 595 B 26373	ITA	<1		
Grey	KN 01020	NLD			
Grey	FSD 7416	SWE	≤ 1,5		
Haze gray	FED STD 595 Colour 36270	USA	(1)		
Red	FED STD 595 Colour 31136	USA	(1)		
Yellow	FED STD 595 Colour 33538	USA	(1)		
Olive drab	FED STD 595 Colour 34088	USA	(1)		
Dark gray	FED STD 595 Colour 36076	USA	(1)		
Ocean gray	FED STD 595 Colour 36173	USA	(1)		
Black	FED STD 595 Colour 37038	USA	(1)		
Green	FED STD 595 Colour 14062	USA	(1)		
White	FED STD 595 Colour 37875	USA	(1)		

NB: The colour stability must be in accordance with criteria given in table on delivery and during shelf life.
(1) – No visible color difference

A.6. COLOUR ACCEPTANCE AFTER QUALIFICATION TESTS (COMPARE TO REFERENCE PANEL)

Nation	ΔE *	Standard
AUS		ISO 7724/1-2-3
BEL	≤ 5	
CAN		
DEU		
FRA	≤ 2	
GBR	N/A	
ITA		
NLD		
NZL		
SWE	N/A	
USA	N/A (1)	

(1) – No visible colour difference

ANNEX B SPECIFIC TEST METHODS

B.1. STORAGE STABILITY

- Non-skid coatings shall not exhibit on delivery or during shelf life : hard settling, skinning, phase separation, corrosion of container, persistent foam after mix or other properties indicating unfitness for use.
- This is evaluated by the accelerated storage stability method :

  A previously unopened original container of non-skid coating, after exposure to a temperature of 60°C for 30 days) shall readily mix with a mechanical mixer within 5 minutes to a smooth uniform condition.

  Non-skid coating shall be free of seed, tough or gummy sediment, skin, hard pigment settling and persistent foam.

  Non-skid coating aged by this method shall not vary from the required applicability characteristics (application condition, NWFT, drying time, colour,…)

B.2. EVALUATION OF COEFFICIENT OF FRICTION

B.2.1. SCOPE

The aim of this method is to determine if the coefficient of friction is sufficient to prevent sliding of equipment and personnel under the normal shipboard operating conditions.

B.2.2. FIELD OF APPLICATION

This method covers all types of non-skid coating systems.

B.2.3. TEST PROCEDURE

The coefficient of static friction of the non-skid system shall be determined on topcoats that have been subjected to 50 cycles of wear (conditioning of surface) and on topcoats which have completed the wear test as specified in Appendix A 2-4. The test shall be performed on dry, wet and oily substrates.

B.2.3.1. Standard conditions.

24 ± 2 ºC and a relative humidity of 50 % ± 5 %.

B.2.3.2. Panels and surface preparation

Six steel panels of E 24 quality and of a size 150 by 300 by 3 mm are required for this test.

The surface preparation of panels is in accordance with the technical data sheet of non-skid coating system submitted to qualification. If levels of surface preparation are not specified the following levels are used :

- Visual cleanliness: A Sa 2½ (ISO 8501-1),
- Roughness: MG (ISO 8503),
- Surface pollution (ISO 8502):
  - Chlorides <5µg/cm2,
  - Dust < Rating 2, Class 2 (ISO 8502-3),
  - Oil, grease 0.

The panels used for the wear test procedure of Appendix 2-4 for the “worn” condition of this test.

B.2.3.3. Non-skid coating Application

Panels prepared as specified in 3.2 shall be primed, if required, designated by the manufacturer. The primer film thickness on test panels shall be measured in accordance with ISO 2808 and shall be within a tolerance of ± 0.025 mm of the manufacturer's recommended thickness. The primer thickness shall be listed in the test report. The primer shall be allowed to dry for the time specified by the manufacturer. The intermediate coats, if any, and topcoat shall be mixed, kept at standard conditions during the induction time, if any, applied, as specified in the manufacturer's instructions. Non-skid coating materials applied by roller shall be applied such that the ridges run parallel to the 300 mm dimension.

B.2.3.4. Panel conditioning before test

The panels shall be allowed to cure for 14 days at standard conditions. At that time three of the test panels shall be subjected to 50 cycles of wear, which are designated as “unworn”, and three shall be subjected to 500 cycles of wear, designated as “worn”, in the cable abrasion tester in accordance with the requirements of Appendix A 2-4.

B.2.3.5. Test apparatus

The COF testing device shall be in accordance with STANAG 1278.

B.2.3.6. Test procedure

The test shall be conducted on the six panels prepared as above. Each panel shall be subjected to the test procedure in STANAG 1278 under the following three conditions:

a. COF test shall first be run with the panel dry;
b. After completion of the dry condition test, the panels shall be wetted with synthetic sea water in accordance with ASTM D1141, and the tests shall be repeated; and
c. After completion of the wet condition, the panels shall be rinsed in tap water to remove the synthetic sea water, dried at 120 ºC for 1 hour, and cooled to standard conditions. The panel shall then be wetted with aircraft turbo shaft engine oil in accordance with NATO Code Number 0-156, and the test shall be repeated.

Five replicate measurements shall be made; the panel shall then be turned 90 degrees and five additional measurements shall be made. The average of the ten readings for each panel condition, unworn and worn, (30 in total) shall be computed.

B.2.3.7. Behaviour valuation and acceptance criteria

The minimum COF values shall be defined at the national level but shall be in agreement with STANAG 1278.

B.2.4. TEST REPORT

Test report includes reference to this method and the following indications:

- Identification of non-skid coating products and non-skid coating systems
- Substrate characteristics
- Conditions of application, drying, de conditioning
- Coats and non-skid coating system Thickness and measurement method
- Test conditions and all differences with this document
- Type and reference apparatus
- Coefficient of friction values in accordance with the different conditions
- Operating details not written in this document.

B.3. EVALUATION FOR CABLE WEAR

B.3.1. SCOPE

The aim of this method is to determine the propensity of the non-skid coating to cause wear on the arresting cable used on aircraft carriers for arresting landing aircraft.

B.3.2. FIELD OF APPLICATION

This method covers non-skid coating systems applied in the aircraft landing areas of aircraft carriers

B.3.3. TEST PROCEDURE

B.3.3.1. Standard conditions

24 ± 2 ºC and a relative humidity of 50 % ± 5 %.

B.3.3.2. Panels and surface preparation

Three steel panels of E 24 quality and of a size 300 by 150 by 3 mm are required for this test.

The surface preparation of panels is in accordance with the technical data sheet of non-skid coating system submitted to qualification. If levels of surface preparation are not specified the following levels are used :

- Visual cleanliness: A Sa 2½ (ISO 8501-1),
- Roughness: MG (ISO 8503),
- Surface pollution (ISO 8502):
  - Chlorides <5µg/cm2,
  - Dust < 2,
  - Oil, grease 0.

B.3.3.3. Non-skid coating Application

Panels prepared as specified in 3.2 shall be primed, if required, designated by the manufacturer. The primer film thickness on test panels shall be measured in accordance with ISO 2808 and shall be within a tolerance of ± 0.025 mm of the manufacturer's recommended thickness. The primer thickness shall be listed in the test report. The primer shall be allowed to dry for the time specified by the manufacturer. The intermediate coats, if any, and topcoat shall be mixed, kept at standard conditions during the induction time, if any, and applied as specified in the manufacturer's instructions. Non-skid coating materials applied by roller shall be applied such that the ridges run parallel to the 300 mm dimension.

B.3.3.4. Panel conditioning before test

The panels shall be allowed to cure for 14 days at standard conditions. At that time the test panels shall be subjected to 50 cycles of wear in the cable abrasion test apparatus as described herein.

B.3.3.5. Test apparatus

The test apparatus shall be constructed so that there will be relative motion between the steel rod and the test panel, and shall have the following features:

a. A carriage or jig on which either the test panel, or the steel rod is mounted. The test panel and the rod shall be securely fastened to preclude movement within the carriage or jig during the

test, and shall be moved in a reciprocating motion 225 mm along the long axis of the sample panel.

b. The steel rod shall be in contact with the test panel, with the axis of the rod horizontal and at a right angle to the direction of the reciprocating motion. The clamps holding the rod shall not come into contact with the test panel, and shall not permit the rod to bend, twist, or rotate during the test.
c. The contact force between the rod and the sample is 13.6 ± 0.1 kg during the test.

B.3.3.6. Test procedure

Each preconditioned panel shall be abraded by a new 3 mm (nominal) diameter cold-rolled ASTM A 229 Class 2 steel rod of sufficient length to completely span the width of the sample plate. Before use, the diameter of each rod shall be measured to the nearest 0.0025 mm in a minimum of ten places that will come in contact with the test panel. After completion of 200 cycles in the abrasion machine, the rod shall be removed from the jig and the diameter of the rod measured to the nearest 0.0025 mm in the same places as measured before the rod was abraded. The mean difference in thickness of the rod shall be computed and that number shall be recorded as the wear value for that rod. The average of the wear of the three rods shall be computed, and this value shall be used to determine conformance to the requirements. The device used for the measurement of the rods shall have a minimum precision of 0.0025 mm and shall be capable of measuring an irregular surface.

B.3.3.7. Behaviour valuation and acceptance criteria

When tested in accordance with this procedure, the aircraft landing area non-skid coating system shall produce a maximum average wear of the arresting cable test wire of 0.025 mm.

B.3.4. TEST REPORT

Test report includes reference to this method and the following indications:

- Identification of non-skid coating products and non-skid coating systems
- Substrate characteristics
- Conditions of application, drying, de conditioning
- Coats and non-skid coating system Thickness and measurement method
- Test conditions and all differences with this document
- Type and reference apparatus
- Average maximum wear average values
- Operating details not written in this document.

B.4. EVALUATION OF WEAR RESISTANCE

B.4.1. SCOPE

The aim of this method is to determine the propensity of the non-skid coating to resist wear caused by the arresting cable used on aircraft carriers for arresting landing aircraft.

B.4.2. FIELD OF APPLICATION

This method covers non-skid coating systems applied in the aircraft landing areas of aircraft carriers

B.4.3. TEST PROCEDURE

B.4.3.1. Standard conditions

24 ± 2 ºC (75 ºF ± 5 ºF) and a relative humidity of 50 % ± 5 %.

B.4.3.2. Panels and surface preparation

Three steel panels of E 24 quality and of a size 300 by 150 by 3 mm are required for this test.

The surface preparation of panels is in accordance with the technical data sheet of non-skid coating system submitted to qualification. If levels of surface preparation are not specified the following levels are used :

- Visual cleanliness: A Sa 2½ (ISO 8501-1),
- Roughness: MG (ISO 8503),
- Surface pollution (ISO 8502):
  - Chlorides <5µg/cm2,
  - Dust < 2,
  - Oil, grease 0.

After surface preparation the mass of each panel shall be measured to the nearest 0.5 g before application of the coating system and that mass shall be designated as “M1”.

B.4.3.3. Non-skid coating Application

Panels prepared as specified in 3.2 shall be primed, if required, designated by the manufacturer. The primer film thickness on test panels shall be measured in accordance with ISO 2808 and shall be within a tolerance of ± 0.025 mm of the manufacturer's recommended thickness. The primer thickness shall be listed in the test report. The primer shall be allowed to dry for the time specified by the manufacturer. The intermediate coats, if any, and topcoat shall be mixed, kept at standard conditions during the induction time, if any, and applied as specified in the manufacturer's instructions. Non-skid coating materials applied by roller shall be applied such that the ridges run parallel to the 300 mm dimension.

B.4.3.4. Panel conditioning before test

The panels shall be allowed to cure for 14 days at standard conditions. At that time the test panels shall be subjected to 50 cycles of wear in the cable abrasion test apparatus as described herein.

After each panel has been subjected to 50 wear cycles the mass shall be determined to the nearest 0.5 g and that mass shall be designated as “M2”.

B.4.3.5. Test apparatus

The test apparatus shall be constructed so that there will be relative motion between the steel rod and the test panel, and shall have the following features:

a. A carriage or jig on which either the test panel, or the steel rod is mounted. The test panel and the rod shall be securely fastened to preclude movement within the carriage or jig during the test, and shall be moved in a reciprocating motion 225 mm along the long axis of the sample panel.
b. The steel rod shall be in contact with the test panel, with the axis of the rod horizontal and at a right angle to the direction of the reciprocating motion. The clamps holding the rod shall not come into contact with the test panel, and shall not permit the rod to bend, twist, or rotate during the test.
c. The contact force between the rod and the sample is 13.6 ± 0.1 kg during the test.

B.4.3.6. Test procedure

Each preconditioned panel shall be abraded by a new 3 mm (nominal) diameter cold-rolled ASTM A 229 Class 2 steel rod of sufficient length to completely span the width of the sample plate. Before use, the diameter of each rod shall be measured to the nearest 0.0025 mm in a minimum of ten places that will come in contact with the test panel. After completion of 200 cycles in the abrasion machine, the rod shall be removed from the jig and the diameter of the rod measured to the nearest 0.0025 mm in the same places as measured before the rod was abraded. The mean difference in thickness of the rod shall be computed and that number shall be recorded as the wear value for that rod. The average of the wear of the three rods shall be computed, and this value shall be used to determine conformance to the requirements. The device used for the measurement of the rods shall have a minimum precision of 0.0025 mm and shall be capable of measuring an irregular surface.

The preconditioned panel shall be worn for an additional 450 cycles in the cable abrasion tester. A new wire shall be used. For abrasive coatings such as may be used in non aircraft carrier landing areas (general purpose non-skid), the wire in the cable abrasion tester shall be replaced after every 150 cycles. After completion of the wear test, the final sample plate mass, designated as “M3,” shall be determined. The percent of determined mass loss is calculated as follows:

$$\text{Percent mass loss} = 100 \times (M2 - M3) / (M2 - M1)$$

The average percent of determined mass loss of the three panels shall be computed.

B.4.3.7. Behaviour valuation and acceptance criteria

When tested in accordance with this procedure, the average percent of determined mass loss shall not be less than 2%.

B.4.4. TEST REPORT

Test report includes reference to this method and the following indications:

- Identification of non-skid coating products and non-skid coating systems
- Substrate characteristics
- Conditions of application, drying, de conditioning
- Coats and non-skid coating system Thickness and measurement method
- Test conditions and all differences with this document
- Type and reference apparatus
- Average percent mass loss values
- Operating details not written in this document.

B.5. EVALUATION OF IMPACT RESISTANCE

B.5.1. SCOPE

The aim of this method is to determine relative resistance to damage from impact of objects that fall, are dropped, or from operation of equipment such as aircraft under normal shipboard operating conditions.

B.5.2. FIELD OF APPLICATION

This method covers all types of non-skid coating systems

B.5.3. TEST PROCEDURE

The impact resistance of the non-skid system shall be determined on complete non-skid systems to determine their relative resistance to damage caused by impact. The test shall be conducted on samples in unexposed and immersion in seawater conditions on both steel and composite substrates.

B.5.3.1. Standard conditions.

24 ± 2 ºC (75 ºF ± 5 ºF) and a relative humidity of 50 % ± 5 %.

B.5.3.2. Panels and surface preparation

Four steel panels of E 24 quality and of a size 150 by 150 by 6 mm are required for this test.

The surface preparation of panels is in accordance with the technical data sheet of non-skid coating system submitted to qualification. If levels of surface preparation are not specified the following levels are used :

- Visual cleanliness: A Sa 2½ (ISO 8501-1),
- Roughness: MG (ISO 8503),
- Surface pollution (ISO 8502):
  - Chlorides <5µg/cm2,
  - Dust < 2,
  - Oil, grease 0.

B.5.3.3. Non-skid coating Application

Panels prepared as specified in 3.2 shall be primed with the primer, if any, designated by the manufacturer. The primer film thickness on test panels shall be measured in accordance with ISO 2808 and shall be within a tolerance of ± 0.025 mm of the manufacturer's recommended thickness. The primer thickness shall be listed in the test report. If a range is given for the primer thickness, the **maximum** number shall be used for testing purposes. The primer shall be allowed to dry for the time specified by the manufacturer. The intermediate coats, if any, and topcoat shall be mixed, kept at standard conditions during the induction time, if any, applied, as specified in the manufacturer's instructions.

B.5.3.4. Panel conditioning before test

The panels shall be allowed to cure for 14 days at standard conditions. Immediately before testing, two panels shall be subjected to each of the following treatments: (a) no treatment and (b) 15 days of immersion at room temperature in either natural seawater, or synthetic seawater in accordance with ASTM D1141. Panels that are immersed shall have an epoxy anticorrosive coating applied to the edges and back side of the panels.

B.5.3.5. Test apparatus

The impact test shall be conducted with a device similar to that depicted in ASTM G14, except that the v-block securing device shall be replaced with a steel base that is at least 40 mm thick, is capable of securing the sample plate without allowing movement when impacted

and allows alignment of the plate with the designated impact locations. A machinist's magnetic vice has been demonstrated to have this capability. The tup nose shall have a 15.9 mm hemispherical head and the weight of the tup shall be modified so that it is 1.8 kg.

B.5.3.6. Test procedure

B.5.3.6.1. Impacting the sample

Immediately upon removal from treatment, each panel shall be subjected to 25 impacts by the tup dropped from a distance of 1.2 meters. The impacts on the panel shall be made in the sequence specified on Figure 1. Successive points of impact shall form a 5 by 5 pattern, enclosed within an area of about 58 square centimetres, in which the impacts are equally spaced 20 ± 1.5 mm centre-to-centre from their nearest neighbours.

2	15	11	7	3
6	19	23	20	16
10	22	25	24	12
14	18	21	17	8
1	5	9	13	4

FIGURE 1. Impact sequence for the impact resistance test.

B.5.3.6.2. Removal of loosened non-skid coating

Upon completion of each series of impacts, the panel shall be probed by hand with a hand held, sharpened, 25 mm (nominal) steel cold chisel in an area that received no impacts in order to Judge the force needed to remove the coating. The panel shall then be probed in the impact area with the chisel, using a force less than that used in the non-impact area, and coating which has been loosened by the impact of the steel ball shall be removed from the panel.

B.5.3.7. Behaviour valuation and acceptance criteria

The percentage of coating system remaining intact and tightly adhering to the panel shall be evaluated as follows: In the 5 by 5 pattern of impacts, there are 40 pairs of impacts separated by 20 mm centre to centre. In every case in which one or more layers of the coating system has been removed with the chisel, so as to connect one pair of impacts, the percentage of intact coating system is reduced by 2.5. Thus, a passing value of 90 percent indicates that no more than four pairs of adjacent impacts are connected. Results for duplicate panels tested under the same conditions shall be averaged. Failure of one of the two conditions constitutes failure of this test.

B.5.4. TEST REPORT

Test report includes reference to this method and the following indications:

- Identification of non-skid coating products and non-skid coating systems
- Substrate characteristics
- Conditions of application, drying, de conditioning
- Coats and non-skid coating system Thickness and measurement method
- Test conditions and all differences with this document
- Type and reference apparatus
- Impact values in accordance with the different conditions
- Operating details not written in this document.

B.6. EVALUATION FOR RESISTANCE TO CHEMICAL SOLUTIONS

B.6.1. SCOPE

The aim of this method is to determine the relative resistance of non-skid coatings to chemical solutions that may be experienced under normal shipboard operating conditions.

B.6.2. FIELD OF APPLICATION

This method covers all types of non-skid coating systems

B.6.3. TEST PROCEDURE

The relative resistance to chemical solutions of the non-skid system shall be determined by immersing sample plates in chemical solutions as detailed herein.

B.6.3.1. Standard conditions.

24 ± 2 ºC and a relative humidity of 50 % ± 5 %.

B.6.3.2. Panels and surface preparation

Sixteen steel panels of E 24 quality and of a size 150 by 50 by 3 mm (nominal) are required for this test.

The surface preparation of panels is in accordance with the technical data sheet of non-skid coating system submitted to qualification. If levels of surface preparation are not specified the following levels are used :

- Visual cleanliness: A Sa 2½ (ISO 8501-1),
- Roughness: MG (ISO 8503),
- Surface pollution (ISO 8502):
  - Chlorides <5µg/cm2,
  - Dust < 2,
  - Oil, grease 0.

B.6.3.3. Non-skid coating Application

Panels prepared as specified in 3.2 shall be primed with the primer, if any, designated by the manufacturer. The primer film thickness on test panels shall be measured in accordance with ISO 2808 and shall be within a tolerance of ± 0.025 mm of the manufacturer's recommended thickness. The primer thickness shall be listed in the test report. If a range is given for the primer thickness, the **maximum** number shall be used for testing purposes. The primer shall be allowed to dry for the time specified by the manufacturer. The intermediate coats, if any, and topcoat shall be mixed, kept at standard conditions during the induction time, if any, applied, as specified in the manufacturer's instructions.

B.6.3.4. Panel conditioning before test

The panels shall be allowed to cure for 14 days at standard conditions. Eight panels shall be subjected to two impacts from the impact test apparatus (see Appendix A 2-5); the impacts shall be 100 mm ± 6 mm apart and equidistant from the edges and sides of the panels.

B.6.3.5. Test apparatus

The test apparatus consists of eight wide mouth jars of sufficient size to completely contain two test panels and shall have tightly fitting caps. Each of the jars shall be filled to a depth of 75 mm (nominal) with one of the following materials:

a. Grease G-460 in accordance with STANAG 1135;
b. Jet fuel F-44 (JP-5) in accordance with STANAG 1135;
c. Hydraulic fluid H-537 in accordance with STANAG 1135;

d. Ethyl alcohol S-738 in accordance with STANAG 1135;
e. Aircraft engine turbo shaft lubricating oil O-156 in accordance with STANAG 1135;
f. De-icing – defrosting fluid S-1717 in accordance with STANAG 1135;
g. Aqueous fire fighting foam (AFFF) in accordance with MIL-F-24385, 10 percent solution in synthetic sea water in accordance with ASTM D 1141.

B.6.3.6. Test procedure

Two panels, one impacted and one unimpacted for each primer thickness, shall be placed in each jar, each panel resting on its 50 mm side, with one-half immersed and one-half above the test material and in such a manner as to not touch each other. The jars shall be sealed tightly and kept at standard conditions for 4 weeks for all fluids except JP-5, ethyl alcohol and de-icing-defrosting fluid, which shall be tested for 24 hours only. Upon removal from the immersion medium, the panels shall be probed with a sharp, 25 mm wide blade, wood chisel and compared with the identical untested control panel to detect signs of softening, loss of adhesion, or separation between layers of coating. The panels immersed in JP-5, ethyl alcohol and de-icing-defrosting fluid shall be allowed a 6-hour recovery period before evaluation. All other panels shall be examined for conformance immediately after removal from the immersion medium.

B.6.3.7. Behaviour valuation and acceptance criteria

The coating system shall show no softening, loss of adhesion, separation between coats of the system, discoloration, or other signs of deterioration.

B.6.4. TEST REPORT

Test report includes reference to this method and the following indications:

- Identification of non-skid coating products and non-skid coating systems
- Substrate characteristics
- Conditions of application, drying, de conditioning
- Coats and non-skid coating system Thickness and measurement method
- Test conditions and all differences with this document
- Type and reference apparatus
- Results of the evaluation for each of the chemical agents
- Operating details not written in this document.

B.7. COLOUR STABILITY EXPOSURE SITE

Nation	Location of the exposure site (colour stability	Exposure Duration	Contact (address, phone)
CAN	Victoria BC	12 months	1-250-363-2849
DEU	Bavarian Alps, Reiteralpe, 1640 m above sea level	12 months	Wehrtechnische Dienststelle für Sprengmittel und Sondertechnik, Oberjettenberg, D-83458 Schneizlreuth, c/o tel. 0049/8651/79/1220, fax 0049/8651/1600
FRA	Florida	12 months	Sub Tropical Testing Service Fax 00.1.305.233.53.42
ITA	La Spezia – Mar Ligure	12 months	MARIPERMAN I.C.A. Viale S. Bartolomeo 19100 LA SPEZIA + 39.0187.787203
SWE	Bohus Malmön (west coast)	2 years	Swerea KIMAB AB Box 55970 102 16 Stockholm Sweden Phone: 46 8 440 48 00, Fax: 46 8 440 45 35
USA	NRL Key-West	12 months	Naval Research Laboratory, 4555 Overlook Ave S.W. Washington DC 20375

B.8. NATURAL SITE FOR AGING IN C5-M

Nation	Location of the site (Natural aging in C5-M)	Exposure Duration	contact (Organisation, name, address, phone e-mail)
CAN	Victoria BC	2 years	1-250-363-2849
DEU	Wilhelmshaven, north sea, sea dike area	2 years	Wehrwissenschaftliches Institut für Werk-, Explosiv- und Betriebsstoffe, Marinearsenal Wilhelmshaven, D-26379 Wilhelshaven, c/o tel. 0049/4421/49/3450, fax…/3456 or tel. 0049/8122/9590-3620, fax…/3602
FRA	Pippady – Toulon	2 years (min)	ISITV – La Valette 83 phone 33.1.94.14.25.68
FRA	Brest	2 years (mini)	Institut de la Corrosion Technopôle de Brest Iroise 220, rue Pierre Rivoalon 29200 Brest (France) T: +33. 2. 98 .05. 15. 52 F: +33 .2 .98. 05 .08 .94
ITA	La Spezia	1 year (alkyd)	CSSN Nucleo Pitture. Viale S. Bartolomeo +39.0187.787203
SWE	Bohus Malmön (west coast)	2 years	Swerea KIMAB AB Box 55970 102 16 Stockholm Sweden Phone: 46 8 440 48 00, Fax: 46 8 440 45 35
USA	NASA Kennedy Space Center	2 years	Naval Research Laboratory, 4555 Overlook Ave S.W. Washington DC 20375.