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Ships and marine technology — Large yachts — Measurement and assessment of the visual appearance of coatings

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Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO document should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 8 *Ships and marine technology,* Subcommittee SC 12, *Large yachts.*

This second edition cancels and replaces the first edition (ISO 11347:2012) which has been technically revised.

The main changes are as follows:

— updated normative references and bibliography;

— updated the terms and definitions in Clause 3;

— updated the test and recording methods.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

This document defines the measurement and assessment processes used for above waterline exterior surface appearance and quality requirements for large yachts. The purpose of this document is to provide practical measurement processes for the assessment of agreed acceptance criteria for the visual appearance of yacht coatings.

Measurement processes are based on known generic inspection equipment that is available at the time of producing this document. It is not the purpose of this document to provide an exhaustive list of inspection equipment which is available at the time of publication.

Ships and marine technology — Large yachts — Measurement and assessment of the visual appearance of coatings

1 Scope

This document specifies technical requirements for the measurement and assessment of the visual appearance of the superficial coating of large yachts. It is valid for coatings above the waterline.

For the purpose of this document, large yachts are of length of hull (L_H) higher or equal to 24 m (as defined according to ISO 8666), in use for sport or leisure and commercial operations.

This document describes how the final finish can be evaluated before its acceptance.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 2813, *Paints and varnishes — Determination of gloss value at 20°, 60° and 85°*

ISO 4618, *Paints and varnishes — Vocabulary*

ISO 4628-2, *Paints and varnishes — Evaluation of degradation of coatings — Designation of quantity and size of defects, and of intensity of uniform changes in appearance — Part 2: Assessment of degree of blistering*

ISO 4628-4, *Paints and varnishes — Evaluation of degradation of coatings — Designation of quantity and size of defects, and of intensity of uniform changes in appearance — Part 4: Assessment of degree of cracking*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 4618 and the following apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

3.1
clouding
appearance of lighter and darker patches in a *top coat* (3.12) film, most commonly observed in special effect (metallic flake) coatings

3.2
curing
term in polymer chemistry that refers to the toughening or hardening of a polymer material by cross linking of polymer chains

3.3
cut line
visible, raised, hard edge of a coating created when the applied coating borders masking/fine line tape

3.4
fairness
particular range of wavelengths of defects from 300 mm to 1 000 mm

3.5
fingerprint
damage of wet film due to accidental contact by either operators or objects, or both

3.6
hull
main body of a yacht which provides flotation

3.7
polishing mark
mark from *top coat* (3.12) polishing, resulting in low gloss areas

3.8
print through
visual effect of inconsistencies or faults in the underlying coating/substrate structure

3.9
sanding mark
raised or indented lines (curved or straight) visible in the *top coat* (3.12) as a result of the sanding process under the top coat

3.10
striping
appearance of lighter and darker repetitive shades in a *top coat* (3.12) film, most commonly observed in special effect (metallic flake) coatings

3.11
surface texture
local deviation of a surface from a perfectly flat plane, generally measured in terms of its roughness, waviness and form

3.12
top coat
final coat of a coating system

3.13
visual observation
process conducted by an observer with normal or corrected-to-normal vision without magnification under a uniform artificial illuminance between 500 lx and 1 000 lx, or normal daylight

Note 1 to entry: Visual observations should be conducted at a distance of >75 cm (or approximate arm's length) and at an incident angle of ≥30°.

3.14
wipe mark
surface disturbance in the *top coat* (3.12) paint film as a result of a substrate contamination

4 Evaluations

4.1 General

This document specifies methods for evaluating the appearance of the external coating of large yachts. This evaluation can be carried out by using a combination of measurements using either equipment or visual observations, or both.

Even if measured separately, measurements and visual observations should converge to determine the overall assessment of visual appearance.

4.2 Measurable effects

The following effects should be measured when evaluating fairness:

— distinction of image (DOI)

— orange peel

— microstructure

— colour

— gloss (see ISO 2813)

— particulate contamination

For the above parameters provide descriptions, measurement and test methods.

4.3 Visually assessed effects

4.3.1 Group 1: point defects

— Cratering

— Fisheyes

— Dimples

— Pinholes

4.3.2 Group 2: localized defects

— Sags/runs

— Brush marks

— Sanding marks

— Wipe marks

— Polishing marks

— Water marks

— Cut lines

— Tape marks

— Blistering, which shall be measured in accordance with ISO 4628-2

— Cracking/crazing, which shall be measured in accordance with ISO 4628-4

4.3.3 Group 3: generalized defects

— Blushing

— Blooming

— Print through

— Over spray

— Cissing

— Striping/Clouding

Other visual effects including wrinkling, flaking, peeling, cracking, fish eyes, fingerprints, and lack of opacity should not be present in the coated surfaces of large yachts.

5 Measurable effects and visually assessed effects (including test and recording methods)

5.1 Measurable effects

5.1.1 Fairness

5.1.1.1 Description

Fairness relates to the large-scale smoothness and smooth distribution of reflection lines on both a flat and a curved surface.

Fairness may be measured at any point during the fairing and coating processes.

5.1.1.2 Test method

For the purposes of this document, a measurement by linear bar and feeler gauge shall be performed.

Fairness measurement shall be in accordance with the test method outlined in Annex A.

5.1.2 Distinction of image

5.1.2.1 Description

Distinction of image (DOI) is a measure of how clearly a reflected image appears in a reflective surface.

5.1.2.2 Test method

For the purposes of this document, an optoelectronic measurement device (such as wave-scan technology, goniophotometer, or equivalent) shall be used.

DOI measurement shall be in accordance with the test method outlined in Annex B.

5.1.3 Orange peel

5.1.3.1 Description

Orange peel is a coating property resulting in a surface appearance characteristic of the skin of an orange. The coarseness of the resulting texture can vary and has a significant influence on the image-forming qualities of the finish. Surface profiles of gloss and high gloss coatings are measured in wavelengths in the range of 0,1 mm to 30 mm.

5.1.3.2 Test method

For the purposes of this document, an optoelectronic measurement device shall be used.

Orange peel measurement shall be in accordance with the test method outlined in Annex C.

5.1.4 Microstructure

5.1.4.1 Description

Microstructure refers to structures smaller than 0,1 mm within the paint film that influence the visual perception.

5.1.4.2 Test method

For the purposes of this document, an optoelectronic measurement device (such as wave-scan technology, goniophotometer, or equivalent) shall be used. A wave-scan device measures dullness, while a goniophotometer measures haze value.

Microstructure measurement shall be in accordance with the test method outlined in Annex D.

5.1.5 Colour

5.1.5.1 Description

Visual colour perception is influenced by varying colour sensitivity in each person and by varying environmental conditions such as lightness and colour. Colour perception mainly depends on three factors: light source, observer and surface condition.

The light source and observer are defined by the International Commission on Illumination (CIE) and their spectral functions are stored in the spectrophotometers for colour measurement. Optical properties of a surface are then the only variables that are required to be measured.

To monitor colour consistency in a project, a standard reference shall be established and evaluated in terms of deviation from the standard and not in absolute value.

5.1.5.2 Test method

For the purposes of this document, a spectrophotometer shall be used unless otherwise specified. The spectrophotometer measures the amount of light reflected by a coated surface along the wavelength spectrum of visible light, and the readings are taken from the spectrum data.

The colour measurement shall be in accordance with the test method outlined in Annex E.

5.1.6 Gloss

5.1.6.1 Description

Gloss is an optical property of a surface, characterized by its ability to reflect light specularly. The factors involved in visual evaluation are the surface condition, the illumination and the observer. On a glossy surface, the majority of the light is reflected in the specular direction. The specular gloss, or specular reflection measurement, is a reading of the amount of reflected light intensity and is compared to the amount of reflected light from a black glass standard with a defined refractive index.

5.1.6.2 Test method

For the purposes of this document, a specular gloss-meter shall be used as defined in ISO 2813. The gloss-meter measures the specular reflection. The light intensity is registered over a small range of reflection angles.

NOTE There are three different geometries defined. Within super yacht measurements, typically 60 degree geometry is used. For high gloss, 20 degree geometry can be used and for low gloss, 85 degree geometry can also be used. All measurement values are in gloss units (GU).

Gloss measurement shall be in accordance with the test method outlined in Annex F.

5.1.7 Particulate contamination

5.1.7.1 Description

Particulate contamination is when particles of dust, hair or fibres are embedded within the coating during application or before complete curing.

Surface particles on the coating that can be removed through washing or wiping with a chamois, without leaving a mark may be excluded from the scope of this document.

Visibility of particles can vary according to the observation point with respect to the surface and the light conditions.

5.1.7.2 Test method

For the purposes of this document, a measurement by a magnifier with a scale or a ruler shall be performed.

Particle number and size measurement shall be in accordance with the test method outlined in Annex G.

5.2 Visually assessed effects

5.2.1 General

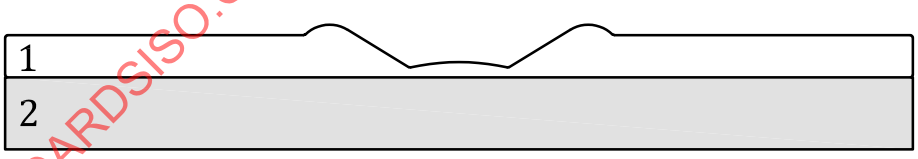
Visibility of the defects can vary according to the observation point with respect to the surface and the light conditions. Group 1 (5.2.2) consists of point defects which are typically isolated or observed in small clusters. Group 2 (5.2.3) consists of localized defects which can be observed as a single defect or a cluster of defects in one or more localized areas. Group 3 (5.2.4) consists of generalized defects typically observed over large areas.

5.2.2 Group 1: point defects

5.2.2.1 Cratering

5.2.2.1.1 Description

Formation in a film or coat of small circular depressions that persist after drying. Figure 1 illustrates cratering.



Key

1 coating layer

2 substrate

Figure 1 — Cratering

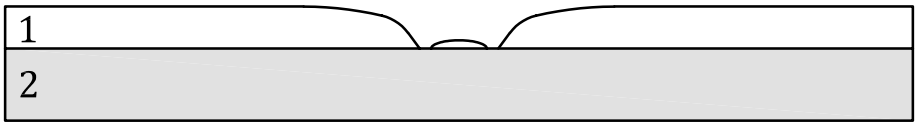
5.2.2.1.2 Recording method

Cratering shall be recorded in accordance with the method outlined in Annex H.

5.2.2.2 Fisheyes

5.2.2.2.1 Description

A fisheye is a small spot of lack of paint, occasionally encircled by a ring of paint thicker than the surrounding paint film, caused by a contamination on the surface before application. Figure 2 shows a fisheye.



Key

1 coating layer
2 substrate

Figure 2 — Fisheye

5.2.2.2.2 Recording method

Fisheyes shall be recorded in accordance with the method outlined in Annex H.

5.2.2.3 Dimples

5.2.2.3.1 Description

Dimples are a small circular depression in a top coat paint film that does not reach the underlying substrate. Figure 3 illustrates a dimple.

Key

1 coating layer
2 substrate

Figure 3 — Dimple

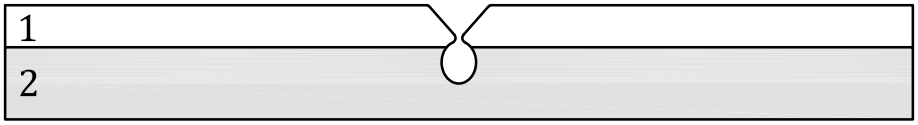
5.2.2.3.2 Recording method

Dimple recording requirements shall be in accordance with the recording method outlined in Annex H.

5.2.2.4 Pinholes

5.2.2.4.1 Description

A pinhole is the presence of a small hole in the film or coat, resembling that made by a pin (see ISO 4618). Figure 4 shows a pinhole.



Key

1 coating layer

2 substrate

Figure 4 — Pinhole

5.2.2.4.2 Recording method

Pinhole shall be recorded in accordance with the method outlined in Annex H.

5.2.3 Group 2: localized defects

5.2.3.1 Sags

5.2.3.1.1 Description

Sags occur when a number of factors influencing the flow of the wet coat film result in visible downward movements before paint curing.

5.2.3.1.2 Recording method

To record the extent of a sag, a straight ruler or similar equipment shall be used.

Sags shall be recorded in accordance with the method outlined in Annex I.

5.2.3.2 Brush marks

5.2.3.2.1 Description

Brush marks are ridges in the paintwork following a brush application, where the paint has not flowed out and still exhibits the brush tip marks.

5.2.3.2.2 Recording method

Brush marks shall be recorded in accordance with the method outlined in Annex I.

5.2.3.3 Sanding marks

5.2.3.3.1 Description

Sanding marks occur when scratches and lines originating from mechanical or manual sanding, performed as a means of preparing the surface of the substrate or a previous paint layer, appear in the surface after the top coat has been applied.

5.2.3.3.2 Recording method

Sanding marks shall be recorded in accordance with the method outlined in Annex I.

5.2.3.4 Wipe marks

5.2.3.4.1 Description

Wipe marks are a surface disturbance in the top coat paint film as a result of a substrate contamination, i.e. typically residual cleaning solvent or other wipe residues.

5.2.3.4.2 Recording method

Wipe marks shall be recorded in accordance with the method outlined in Annex I.

5.2.3.5 Polishing marks

5.2.3.5.1 Description

Polishing marks are ultra-fine scratches and marks on polished areas.

5.2.3.5.2 Recording method

Polishing marks shall be recorded in accordance with the method outlined in Annex I.

5.2.3.6 Water marks

5.2.3.6.1 Description

Water marks occur when water stains or etchings appear on the coated surface. They are usually circular, white- or light-coloured, caused by mineral deposits and pollutants from the environment.

5.2.3.6.2 Recording method

Watermarks shall be recorded in accordance with the method outlined in Annex I.

5.2.3.7 Cut lines

5.2.3.7.1 Description

Cut lines are the visible, raised, hard edge of a coating created when the applied coating borders masking/fine line tape.

When the masking tape is removed, a raised, hard edge is created. If the applied wet film thickness and the consequent dry film thickness are high, then this raised edge can be highly visible.

5.2.3.7.2 Recording method

Cut lines shall be recorded in accordance with the method outlined in Annex I.

5.2.3.8 Tape marks

5.2.3.8.1 Description

A tape mark is a down-glossing (sometimes contaminated with tape residues) as a result of tape being applied to an insufficiently cured paint coating or left on the coating for too long.

5.2.3.8.2 Recording method

Tape marks shall be recorded in accordance with the method outlined in Annex I.

5.2.3.9 Blistering

5.2.3.9.1 Description

Blisters appear as bubbles protruding from the coated surface, or as small holes and craters in the top coat, due to opening or release of bubbles.

5.2.3.9.2 Recording method

For the purposes of this document, counting and sizing by a measuring magnifier shall be performed.

To record the number and size of blisters, the test method outlined in Annex I shall be used.

5.2.3.10 Cracking/crazing

5.2.3.10.1 Description

Cracks are a rupturing of a dry film or coat. Cracks can occur in one preferential direction but also without preferential directions. Crazing (also known as crocodiling) is the conglomeration of fine lines or cracks in the coating.

5.2.3.10.2 Recording method

The quantity (density) and size of the cracks in a coating shall be defined in accordance with the pictural standards provided in the ISO 4628-4:2016, Figures A.1 to A.9.

For the purposes of this document, counting and sizing by a measuring magnifier shall be performed.

To record the number and size of cracks, the method outlined in Annex I shall be used.

5.2.4 Group 3: generalized defects

5.2.4.1 Blushing

5.2.4.1.1 Description

Blushing, sometimes referred to as water spotting, occurs when moisture condenses on a coating surface during the curing process. Sometimes the moisture originates from within the porous substrate. It manifests itself as white patches or a milky, hazy effect in clear coatings and can cause lack of gloss in pigmented coatings.

5.2.4.1.2 Recording method

The presence of blushing shall be recorded using the method outlined in Annex J.

5.2.4.2 Blooming

5.2.4.2.1 Description

Blooming occurs when the amount of condensate causes water-soluble compounds to migrate from the body of the coating to the coating surface. When the moisture evaporates, the leached components appear on the surface as sticky deposits.

5.2.4.2.2 Recording method

The presence of blooming shall be recorded using the method outlined in Annex J.

5.2.4.3 Print through

5.2.4.3.1 Description

Print through of underlying coating/substrate structure is the visual effect in a high gloss or semi-gloss finish caused by inconsistencies or faults in the underlying coatings. This effect can occur both in yacht refinish and yacht new builds.

5.2.4.3.2 Recording method

The presence of print through shall be recorded using the method outlined in Annex J.

5.2.4.4 Overspray

5.2.4.4.1 Description

Overspray occurs when particles of paint adhere to the coated surface or do not completely absorb into the paint, causing a visual reduction of gloss due to increase of surface texture.

The effect of overspray can be felt by touch with a clean bare hand.

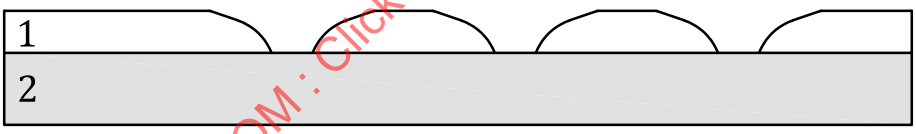
5.2.4.4.2 Recording method

Overspray shall be recorded using the method outlined in Annex J.

5.2.4.5 Cissing

5.2.4.5.1 Description

Cissing consists of the appearance in a film of areas of non-uniform thickness, often exposing the underlying substrate, which vary in extent and distribution. Figure 5 shows cissing.



Key

1 coating layer

2 substrate

Figure 5 — Cissing

5.2.4.5.2 Recording method

Cissing shall be recorded using the method outlined in Annex J.

5.2.4.6 Striping/clouding

5.2.4.6.1 Description

Striping and clouding refer to the appearance of lighter and darker patches in a top coat film, most commonly observed in special effect (metallic flake) coatings.

5.2.4.6.2 Recording method

The presence striping shall be recorded using the method outlined in Annex J.

Annex A
(normative)

Test method for measuring the fairness of coatings

A.1 General

This annex establishes a method for measuring the fairness of external surfaces.

A.2 Measuring equipment

Measurements shall be taken by means of a flexible bar and a set of feeler gauges. Depending on the surface extension and shape, bars from 2 m to 6 m long may be used.

The construction material of the bar and its cross-section shape may differ, provided that physical properties allow measurements within tolerance.

As a reference, a hollow flat aluminium bar which is 20 mm × 100 mm × 3 mm thick can prove suitable.

The bar shall be linear in order to obtain correct measurements.

A.3 Test method

The measurement shall be made by placing one of the bar edges against the surface. This test may be conducted in a horizontal and or vertical plane. The bar shall be brought into contact with the surface by hand pressure, and the maximum clearance between surface and bar shall be measured along the full bar length by the feeler gauge.

Clearance areas can be more easily identified by using a portable light placed at the opposite side of the bar, with respect to the observation side.

A.4 Acceptance criteria and report

All readings are in absolute value.

Measurement results exceeding the acceptance criteria shall be recorded, together with the corresponding measurement-point locations.

A.5 Limitation

None.

Annex B
(normative)

Test method for measuring the distinction of image of coatings

B.1 General

This annex establishes a method for measuring the distinction of image (DOI) of the coated surfaces.

B.2 Measuring instrument

For the purposes of this document, an optoelectronic measurement device, such as wave-scan technology, gonio-photometer, or equivalent shall be used. Its measurement range shall be within 0 to 100. Resolution shall be to at least 1 decimal place (0,1) and the structure spectrum shall be between 0,1 mm and 30 mm (Wa – We) wavelength.

Conduct necessary referencing as recommended by the manufacturer of the instrument.

B.3 Test method

The readings shall be taken following a complete cure of the entire coating and in accordance with the coating manufacturer's technical data.

Each measurement consists of three parallel readings taken at three different positions within the same square decimetre (10 cm x 10 cm). The average of these three readings is the measurement result.

The measurements shall be equally spaced in accordance with the following minimum criteria:

— for yachts with hull length between 24 m and 30 m, the prescribed measuring points shall be every 4 m^2 of the coated area;

— for yachts with hull length between 30 m and 70 m, the prescribed measuring points shall be every 6 m^2 of the coated area;

— for yachts with a hull length from 70 m, the prescribed measuring points shall be every 10 m^2 of the coated area.

For complex structures, additional measuring points should be considered. Measurements shall be taken on vertical, horizontal and sloping areas in accordance with the above spacing criteria.

B.4 Acceptance criteria and report

The value required in terms of DOI shall be specified.

All the measurement results shall be recorded.

B.5 Limitation

This method is valid for solid and effect colours (e.g. metallics and pearlescent).

To be valid, this test shall be conducted on gloss surfaces ≥70 gloss units (GU) at 60°.

Since measurements can be influenced by surface curvature, the maximum curvature where readings can be performed shall be in line with the manufacturer's recommendations of the instrument used.

If the area is too small or unsuitable for readings, the DOI shall be compared visually with a reference area already tested.

Annex C
(normative)

Test method for measuring orange peel of coatings

C.1 General

This annex establishes a method for measuring the appearance of the coated surfaces.

C.2 Measuring instrument

For the purposes of this document, an optoelectronic measurement device, such as wave-scan technology or equivalent shall be used. The scan length shall be no less than 100 mm. Resolution shall be to at least one decimal place (0,1). Its measurement range shall be within 0 to 100 and the structure spectrum between 0,1 mm and 30 mm (Wa – We) wavelength.

The measurement device simulates visual perception similar to that of the human eye. The instrument optically scans the waves reflected from the wavy light/dark pattern of a coating film. The contemporary survey of the large waves and the small waves representing the reflected beam simulates the visual assessment.

A laser point light source illuminates the surface at an angle and a detector measures the reflected light intensity at the equal but opposite angle. The measurement device analyses the surface structure according to size in order to simulate the resolution of the human eye. The measurement is divided into several ranges using mathematical filter functions.

Conduct necessary referencing as recommended by the manufacturer of the instrument.

C.3 Test method

The readings shall be taken following a complete cure of the entire coating and in accordance with the coating manufacturer's technical data.

Each measurement consists of three parallel readings taken at three different positions within the same square decimetre (10 cm x 10 cm). The average of these three readings is the measurement result.

The measurements shall be equally spaced in accordance with the following minimum criteria:

— for yachts with hull length between 24 m and 30 m, the prescribed measuring points shall be every 4 m^2 of the coated area;

— for yachts with hull length between 30 m and 70 m, the prescribed measuring points shall be every 6 m^2 of the coated area;

— for yachts with a hull length from 70 m, the prescribed measuring points shall be every 10 m^2 of the coated area.

For complex structures, additional measuring points should be considered. Measurements shall be taken on vertical, horizontal and sloping areas in accordance with the above spacing criteria.

C.4 Acceptance criteria and report

The value required in terms of orange peel for the structure spectrum between 0,1 mm and 30 mm wavelength shall be specified.

All the measurement results shall be recorded.

C.5 Limitation

This method is valid for solid and effect colours (e.g. metallics and pearlescent).

To be valid, this test shall be conducted on gloss surfaces ≥ 70 GU at 60°.

Since measurements can be influenced by surface curvature, the maximum curvature where readings can be performed shall be in line with the manufacturer's recommendations of the instrument used.

If the area is too small or unsuitable for readings, the orange peel shall be compared visually with a reference area already tested.

Annex D
(normative)

Test method for measuring microstructure of coatings

D.1 General

This annex is to establish a method for measuring the microstructure of the coated surfaces.

D.2 Measuring instrument

For the purposes of this document, an optoelectronic measurement device, such as wave-scan technology, gonio-photometer, or equivalent shall be used. Its measurement range shall be within 0 to 100. Resolution shall be to at least 1 decimal place (0,1) and the structure spectrum between 0,1 mm and 30 mm (Wa – We) wavelength.

Conduct necessary referencing as recommended by the manufacturer of the instrument.

D.3 Test method

The readings shall be taken following a complete cure of the entire coating and in accordance with the coating manufacturer's technical data.

Each measurement consists of three parallel readings taken at three different positions within the same square decimetre (10 cm x 10 cm). The average of these three readings is the measurement result.

The measurements shall be equally spaced in accordance with the following minimum criteria:

— for yachts with hull length between 24 m and 30 m, the prescribed measuring points shall be every 4 m^2 of the coated area;

— for yachts with hull length between 30 m and 70 m, the prescribed measuring points shall be every 6 m^2 of the coated area;

— for yachts with a hull length from 70 m, the prescribed measuring points shall be every 10 m^2 of the coated area.

For complex structures, additional measuring points should be considered. Measurements shall be taken on vertical, horizontal and sloping areas in accordance with the above spacing criteria.

D.4 Acceptance criteria and report

The value required in terms of microstructure shall be specified.

All the measurement results shall be recorded.

D.5 Limitation

This method is valid for solid and effect colours (e.g. metallics and pearlescent).

To be valid this test shall be conducted on gloss surfaces ≥ 70 GU at 60°.

Since measurements can be influenced by surface curvature, the maximum curvature where readings can be performed shall be in line with the manufacturer's recommendations of the instrument used.

If the area is too small or unsuitable for readings, the microstructure shall be compared visually with a reference area already tested.

Annex E
(normative)

Test method for colour measurement of coatings

E.1 General

This annex establishes a method for measuring the colour and or colour difference of the external coated surfaces.

E.2 Measuring instrument

For the purposes of this document, a spectrophotometer shall be used. See the ISO/CIE 11664 series for details.

The recommended illuminant is D 65. Accuracy shall be to at least one decimal place (0,1).

Calibration shall be conducted as recommended by the manufacturer of the instrument.

The circular measuring aperture should have a minimum diameter of 11 mm.

The instrument shall include the specular reflectance.

E.3 Test method

When measuring top coat colour on a project, if a reference panel of the delivered colour exists, this should be used as the test comparator for all project colour measurements.

Alternatively, or when working on a project where no reference panel exists, a reference area on the vessel may also be agreed upon. This reference area should be used as the test comparator for all project colour measurements.

NOTE For guidance on delivered paint and batches, see ISO 19494.

Colour measurements should be taken following complete cure of the entire coating in accordance with the coating manufacturer's technical data. The coating shall be clean and free of any surface contamination.

The measurements shall be equally spaced according to the following minimum criteria:

— for yachts with hull length between 24 m and 30 m, the prescribed measuring points shall be every 4 m^2 of the coated area;

— for yachts with hull length between 30 m and 70 m, the prescribed measuring points shall be every 6 m^2 of the coated area

— for yachts with a hull length from 70 m, the prescribed measuring points shall be every 10 m^2 of the coated area.

For complex structures, additional measuring points should be considered. Measurements shall be taken on vertical, horizontal and sloping areas in accordance with the above spacing criteria.

E.4 Acceptance criteria and report

The colour difference, if any, between the acceptance value and the standard reference shall be specified.

All measurement results shall be recorded.

E.5 Limitation

Different equipment manufacturers and models of spectrophotometers may have limitations on the types of coatings for which colour values can be accurately and repeatably recorded. It is necessary to consult with spectrophotometer technical specifications for guidance on the suitability of specific coating types such as effect colours (metallics and pearlescent).

Since measurements can be influenced by surface curvature, manufacturers of the instruments used shall recommend the maximum curvature where readings may be performed.

Annex F
(normative)

Test method for gloss measurement of coatings

F.1 General

This annex provides a method for proof testing the specular gloss of the external surface coatings as specified in ISO 2813.

F.2 Measuring instrument

For the purposes of this document, a specular gloss-meter shall be used. There are three different geometries defined. Within super yacht measurements, typically 60 degree geometry is used. It is also permitted to use 20 degree geometry for high gloss and 85 degree geometry for low gloss.

Calibration shall be conducted as recommended by the manufacturer of the instrument.

The gloss meter is verified by measuring the corresponding test plate supplied with the instrument. If the difference between the reading and its reference value is not accurate as stated by the instrument, or is greater than 1,0 gloss unit, the apparatus shall be adjusted.

The instrument aperture is then placed over the coated area and its gloss reading noted.

F.3 Test method

Gloss measurements should be taken following complete cure of the entire coating in accordance with the coating manufacturer's technical data. The coating shall be clean and free of any surface contamination.

Each measurement consists of three readings taken at three different positions within the same square decimetre (10 cm x 10 cm). The average of these three readings is the measurement result.

In the event that any single measurement is anomalous, two more measurements within the same area should be carried out. If these two measurements give the same result, the average of these three measurements shall be reported as the average value for that measurement point. If these two measurements are different, the anomalous measurement should be disregarded.

The measurements shall be equally spaced according to the following minimum criteria:

— for yachts with hull length between 24 m and 30 m, the prescribed measuring points shall be every 4 m^2 of the coated area;

— for yachts with hull length between 30 m and 70 m, the prescribed measuring points shall be every 6 m^2 of the coated area;

— for yachts with a hull length from 70 m, the prescribed measuring points shall be every 10 m^2 of the coated area.

For complex structures additional measuring points should be considered. Measurements shall be taken on vertical, horizontal and sloping areas in accordance with the above spacing criteria.

F.4 Report

All measurement values shall be in GU. Resolution shall be to at least one decimal place (0,1).

All measurement results shall be recorded.

F.5 Limitation

This method is valid for gloss and semi-gloss surfaces, and also for solid and effect colours (e.g. metallics and pearlescent).

If the area is too small or unsuitable for readings, the gloss shall be compared visually with a reference area already tested.

Since measurements may be influenced by surface curvature, the maximum curvature where readings can be performed shall be in line with the manufacturer's recommendations of the instrument used.