Surface Finish Quality Work Instruction

2022

1.0 PURPOSE

1.1 The purpose of this work instruction is to establish a system of surface finish classifications for components and products and to describe the acceptance criteria for the surface finish quality associated with each classification.

2.0 SCOPE

2.1 This work instruction applies to the surface finish quality of components, subassemblies, devices, etc. purchased or produced by Otometrics worldwide. The surface finish quality requirements defined in this document are used to conduct receiving, in-process, and final inspection activities. In the event of any conflict between this document and product-specific drawing/specifications, the drawings/specifications apply.

2.2 Drawings/specifications may be further supported by golden samples and/or standards identifying acceptable defects which may or may not exceed those allowed by the drawings/specifications and classification defined in this work instruction.

3.0 RESPONSIBILITY

3.1 Research and Development must ensure that appropriate surface finish requirements are defined for all new components/products.

3.2 Production Engineering is responsible for communicating the requirements of this document to vendors who supply products with surface finish requirements to GNO.

3.3 Production Engineering is responsible for complying with the requirements of this work instruction when conducting receiving inspection of products with surface finish requirements.

3.4 Manufacturing is responsible for complying with the requirements of this work instruction when conducting in-process and final inspection of products with surface finish requirements.

4.0 RELATED DOCUMENTS

4.1 N/A

5.0 DEFINITIONS

5.1 N/A

6.0 PROCEDURE

6.1 General Surface Finish Requirements

6.1.1 Surface finish quality classification is typically determined during the Company's Design and Development process. One of five different classifications (1-5) for surface finish quality may be assigned, with 1 being the highest quality and 5 being the lowest.

6.1.1.1 The following are examples of common applications of the different surface finish quality classifications:

a) Class 1: Only for front panels with very high quality requirements.

b) Class 2: Typical for front, top, and side panels.

c) Class 3: Typical for rear panels.

d) Class 4: Typical for base panels.

e) Class 5: Internal surfaces.

6.1.2 The required surface quality must be clearly specified on mechanical drawings used in production [e.g., by highlighting the relevant surfaces by means of a dot-and-dash line or by other visual means in the drawing (see Appendix A)]. Special notes within drawings are added when criteria for surface finish quality exceed that specified in the description of a particular classification (i.e., Class 1, 2, 3…).

6.1.3 Golden samples representing the desired surface finish quality (i.e., appearance, texture, color, etc.) and standards demonstrating defect levels that require further clarification beyond that provided in the surface class definitions below may also be created and used.

6.1.3.1 Golden samples and standards are created following the first mass production build by either GNO or its vendor. From this build, first article inspection (FAI) samples should be collected, as well as proposed golden samples and/or standards. All efforts should be made to run a sufficient number of parts in the first mass build so that a set of samples representing the range of production output can be collected. This is important because only in rare cases will new golden samples and standards be accepted following the submission of FAI parts at the start of a program.

6.1.3.2 Prior to their use, golden samples and standards must be approved by GNO's Incoming Quality Control Supervisor and the affected Business Manager or Product Owner. If a vendor is responsible for the manufacture of the parts, then a matching set of golden samples and/or standards must be provided to the vendor for use in their inspection activities.

6.2 Class 1 Surface Finish Requirements (Cl.1)

6.2.1 Cl.1: Painted Surfaces

6.2.1.1 The surface must have no impurities or burrs that are visible in the specified lighting (see 6.7). The surface must have a uniform surface texture.

6.2.2 Cl.1: Plastic

6.2.2.1 The surface must have no impurities in the surface that are visible in the specified lighting (See 6.7). The surface must have a uniform surface texture. There must be no other casting defects such as delamination, fins, weld lines, blotches, scratches, burrs, shrink marks, flames, etc.

6.2.3 Cl.1: Other Surfaces

6.2.3.1 The surface must have no processing marks, blotches, scratches or reflections from lesions in the surface that are visible in the specified lighting (See 6.7). The surface must have a uniform surface texture.

6.2.4 Cl.1: Text/Print

6.2.4.1 Letters and numbers must be clearly formed and may not be defective, nor may there be any filling between (or inside) characters or residual printing ink in the form of splashes or stains.

6.3 Class 2 Surface Finish Requirements (Cl.2)

6.3.1 Cl.2: Painted Surfaces

6.3.1.1 Scratches and impurities that are visible in the specified lighting may have a maximum diameter of 0.4mm or a maximum length x width of 5 x 0.02 mm. There may be a maximum of one defect within a 40mm diameter test circle and a maximum of 3 per object.

6.3.2 Cl.2: Plastic

6.3.2.1 Impurities, blotches, fins, weld lines and other casting defects that are visible in the specified lighting may have a maximum diameter of 0.4 mm or a maximum length x width of 5 x 0.2 mm. There may be a maximum of one defect within a 40mm diameter test circle and a maximum of 3 per object. Any delamination is not acceptable.

6.3.3 Cl.2: Other Surfaces

6.3.3.1 Blemishes and blotches that are visible in the specified lighting may have a maximum diameter of 0.4mm or a maximum length x width of 5 x 0.05 mm. There may be a maximum of one defect within a 40mm diameter test circle and a maximum of 3 per object.

6.3.4 Cl.2: Text/Print

6.3.4.1 Letters and numbers must be clearly formed and may not be defective, nor may there be any filling between (or inside) characters or residual printing ink in the form of splashes or stains (as appropriate for the specified surface texture).

6.4 Class 3 Surface Finish Requirements (Cl.3)

6.4.1 Cl.3: Painted Surfaces

6.4.1.1 Scratches, impurities, runs and burrs that are visible in the specified lighting may have a maximum diameter of 1.0 mm or a maximum length x width of 10 x 1.0 mm; however, scratches may neither form burrs nor reach the underlying layer. There may be a maximum of 5 defects within a 40mm diameter test circle and a maximum of 10 per object.

6.4.2 Cl.3: Plastic

6.4.2.1 Scratches, impurities, blotches, fins, weld seams and other casting defects that are visible in the specified lighting may have a maximum diameter of 1.0 mm or a maximum length x width of 10 x 1.0 mm; however, scratches may not form burrs. There may be a maximum of 5 defects within a 40mm diameter test circle and a maximum of 10 per object. Any delamination is not accepted.

6.4.3 Cl.3: Other Surfaces

6.4.3.1 Blemishes, scratches, and blotches that are visible in the specified lighting may have a maximum diameter of 1.0 mm or a maximum length x width of 10 x 1.0 mm; however, scratches may neither form burrs nor reach the underlying layer. There may be a maximum of 3 defects within a 40mm diameter test circle and a maximum of 5 per object.

6.4.4 Cl.3: Text/Print

6.4.4.1 Text must be easily legible and the print must not appear duplicated. Parts of numbers, letters or graphics must not be missing.

6.5 Class 4 Surface Finish Requirements (Cl.4)

6.5.1 Cl.4: Painted Surfaces

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6.5.1.1 Scratches, impurities and runs as well as blemishes and blotches that are visible in the specified lighting may have a maximum diameter of 2.0 mm and a maximum length x width of 20 x 1.0 mm; however scratches may neither form burrs nor reach the underlying layer. There may be a maximum of 5 defects within a 40mm diameter test circle and a maximum of 10 per object. Repairs are permitted.

6.5.2 Cl.4: Plastic

6.5.2.1 Casting defects that are visible in the specified lighting may have a maximum length x width of 20 x 1.0 mm. There may be a maximum of 5 defects within a 40mm diameter test circle and a maximum of 10 per object.

6.5.3 Cl.4: Other Surfaces

6.5.3.1 Scratches, blemishes and blotches that are visible in the specified lighting may have a maximum length x width of 20 x 1.0 mm; however the scratches may not form burrs or reach the underlying layer. There may be a maximum of 5 defects within a 40mm diameter test circle and a maximum of 10 per object.

6.5.4 Cl.4: Text/Print

6.5.4.1 Same as Class 3: Text must be easily legible and the print must not appear duplicated. Parts of numbers, letters or graphics must not be missing.

6.6 Class 5 Surface Finish Requirements (Cl.5)

6.6.1 Cl.5: Painted Surfaces

6.6.1.1 There are no restrictions for surface finish quality of painted surfaces. Dust particles, painting defects and processing marks that reach the base material are permitted. Repairs to painted surfaces are unnecessary.

6.6.2 Cl.5: Plastic

6.6.2.1 There are no restrictions for surface finish quality of plastic surfaces. Casting defects and processing marks are permitted. Repairs are unnecessary.

6.6.3 Cl.5: Other Surfaces

6.6.3.1 Processing marks and lesions in the surface are permitted. If the objects are surface-treated, marks may reach the base material.

6.6.4 Cl.5: Text/Print

6.6.4.1 Text must be legible and the print must not be misleading.

6.7 Assessing Surface Finish Quality

6.7.1 To achieve a uniform assessment, light conditions and viewing distance must be specified.

6.7.1.1 The distance to the surface to be assessed must be approx. 40 cm, and the surface must be placed horizontally. When the assessment is made the object must be placed in a way that all surfaces can be seen in a proper way. The object must not be turned to create light reflections to reveal irregularities that would not be visible during the user's normal operation of the product.

6.7.1.2 The assessment should take place at a workplace using a Judge Viewing System light box (or equivalent) with a daylight D65 bulb.

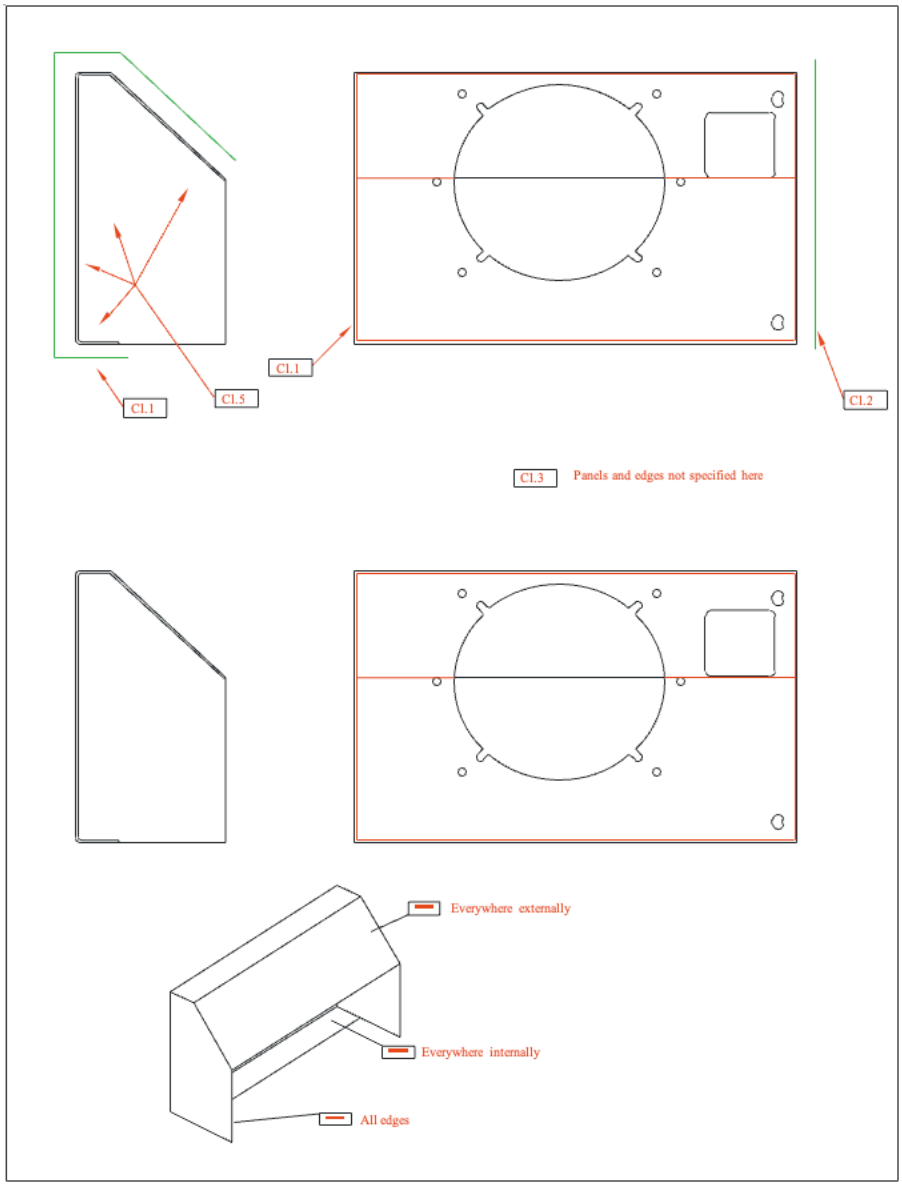
6.7.1.3 A maximum of 10 seconds should be used to evaluate each surface.

6.7.2 As an auxiliary tool for the assessment of surface finish, Mekoprint has produced a Surface Finish Quality Checking Aid template with various dot and scratch sizes. Thus, you can place the template directly onto the object and thereby assess whether the quality of the finish corresponds to specifications.

6.7.2.1 The Surface Finish Quality Checking Aid template contains visually identical dots consisting of a circle and two ovals. A 1.0mm circle has the same weight as the ellipses with the same dimensions. The template also contains 3 lines and a ruler which makes it possible to compare scratches with specifications. Finally, there is an observation circle of 40 mm, which can be placed over the area to be assessed. See a representation of the Surface Finish Quality Checking Aid template in Appendix B.

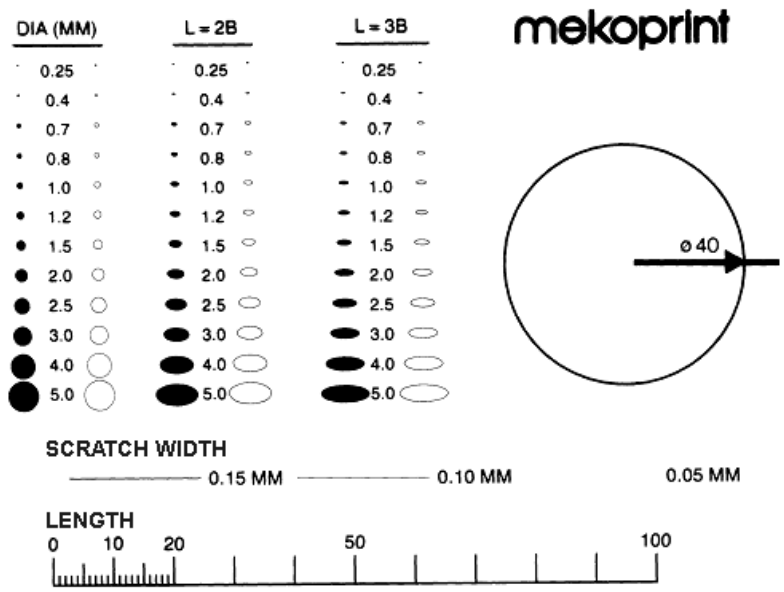
6.7.3 When assessing color, an RAL number and approved color chip/sample must be used. Parts may be evaluated visually against the approved color chip/sample in the light box referenced above in 6.7.1.2. An alternative or supplementary approach to evaluating color would be through the use of a spectrophotometer. When using a spectrophotometer, a number (e.g., 8-10) of readings are taken and an average is calculated to determine whether the RAL color has been matched.

Appendix A: Drawing Example



The dot-and-dash line can be dimensioned, if the extent of the area in question is not clear from the drawing.

Appendix B: Surface Finish Quality Checking Aid



Copy of template only (not in scale – only controlled copies of checking aid template should be used for evaluation of surface finish quality).