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Guideline

Roughness evaluation according to ISO 21920

How to read and comply with the latest standard

ISO 21920

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Until now, anyone dealing with profile-based roughness evaluation - whether as a design engineer or as a quality inspector – had difficult times to keep the overview. Standardization of profile-based roughness evaluation was spread across several documents, and its definitions were sometimes hard to understand with some room left for interpretation. The new ISO 21920 series (featuring three parts) replaces some of the standards, some of which are decades old, consolidating information and providing greater clarity in many areas. At the same time, there is a harmonization with the American ASME standard and ISO 25178 for surface finishes.

In general, ISO 21920 provides only slight changes in content. Technical drawings prepared based on the previous standard will not lose their validity, nor are there any significant differences in the result of most roughness measurements due to the update. On the contrary, the new series of standards expands a designer's options while eliminating ambiguities in roughness measurement and functional description.

ISO 21920-1: The relevance of technical drawings (replacing ISO 1302)

According to the new standard, the drawing not only defines the characteristics and their limits, but also sets the conditions for component testing. The filter settings relevant for roughness measurement can be specified explicitly or by selecting a setting class. For some commonly used parameters, it is sufficient to specify the characteristic tolerance. With regard to the tolerance acceptance rule, the standardization adapts to actual practice: Unless otherwise specified, the maximum tolerance acceptance rule is now the default. If the measured roughness value violates the specification only once, the sample must be rejected. On the other hand, the application of the 16 % tolerance acceptance rule, which is often misunderstood and not applied in practice, must be explicitly requested. As two different specifications could therefore be interpreted as the same, ISO 21920 introduces a new graphical symbol for specifying the surface finish. In addition, further information can be added to the symbol for clarity.

ISO 21920-2: More than just Ra (replaces ISO 4287 and ISO 13565-2/-3)

The demands regarding surface quality control increase further. ISO 21920 now offers a range of new parameters to extend the toolbox for describing increasingly complex surfaces. However, these parameters are not completely new, they just serve as a counterpart to the areal surface parameters of ISO 25178. The categorization into evaluation length and section length parameters is new. With a few exceptions, the parameters now refer to the evaluation length; averaging over several sections is largely eliminated. The previously frequently used "mean roughness depth" Rz is now referred to as "maximum height" with an unchanged definition, but other terms have also been added or adapted.

ISO 21920-3: How to achieve valid measurement results (replacing ISO 4288)

The settings to be used for roughness measurements must be clearly defined in order to achieve user-independent measurement results and decisions. To ensure this, Part 3 of ISO 21920 specifies a number of default settings. These apply if the technical drawing does not specify otherwise. The biggest change is that the default settings for the most important filter settings are no longer determined on the basis of the component, but are derived directly from the drawing specification. For frequently used parameters such as Ra, Rq and Rz, the specified characteristic tolerance is decisive; for other parameters, the settings are determined on the basis of a setting class Scn to be specified in the drawing. At the same time, by removing the distinction between periodic and aperiodic profiles, the influence of the inspector's subjective perception on a measurement result and the inspection decision is eliminated. Surface imperfections are no longer to be excluded, but to be considered in the inspection decision.

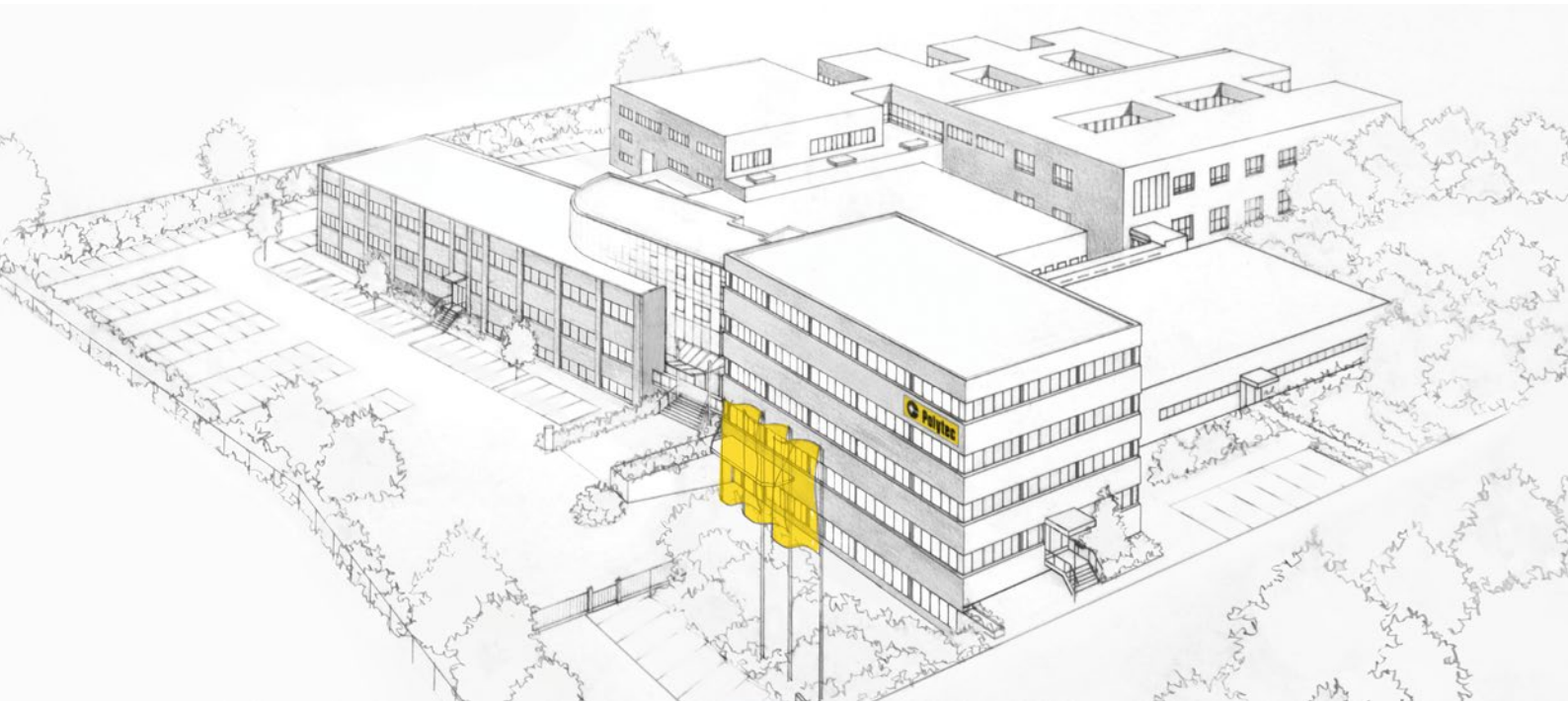
Setting classes Sc1 to Sc5 define the settings for both roughness measurement and evaluation.

		Sc1	Sc2	Sc3	Sc4	Sc5
S-filter (N_{is})	µm	2.5	2.5	2.5	8	25
L-filter (N_{ic})	mm	0.08	0.25	0.8	2.5	8
Section length l_{sc}	mm	0.08	0.25	0.8	2.5	8
Number of sections n_{sc}	-	5	5	5	5	5
Evaluation length l_e	mm	0.4	1.25	4	12.5	40
Max. sampling distance d_x	µm	0.5	0.5	0.5	1.5	5

		Sc1	Sc2	Sc3	Sc4	Sc5
Ra	µm	≤ 0.02	... ≤ 0.1	... ≤ 2	... ≤ 10	> 10
Rq	µm	≤ 0.032	... ≤ 0.16	... ≤ 3.2	... ≤ 16	> 16
Rz	µm	≤ 0.16	... ≤ 0.8	... ≤ 16	... ≤ 80	> 80
Rp	µm	≤ 0.06	... ≤ 0.3	... ≤ 6	... ≤ 30	> 30
Rv	µm	≤ 0.10	... ≤ 0.5	... ≤ 10	... ≤ 50	> 50
Rzx	µm	≤ 0.23	... ≤ 1.15	... ≤ 23	... ≤ 115	> 115
Rt	µm	≤ 0.26	... ≤ 1.3	... ≤ 26	... ≤ 130	> 130

Terms of ISO 21920 explained

- Section length, l_{sc}: Replaces the term "sampling length".
- Number of sections, n_{sc}: Replaces the term "Number of sampling lengths".
- Nesting index N_{is}, N_{ic}: Generic term for the degree of refinement by a mathematical model; the "cut-off wavelength" is an example of a nesting index
- Profile-S filter: low-pass filter, depending on the nesting index it corresponds to the λs or λc profile filter (waviness)
- Profile-L-Filter: high-pass filter, corresponds to the λc-profile filter (roughness)
- Setting class S_{cn}: Comprises a set of default settings, where n denotes classes 1 to 5 (Sc1 to Sc5).



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