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Quality Criteria for Enlargers and Enlarger Objectives

The number of proposed quality criteria, enables a better than up to now classification of enlargers and enlarger objectives. The quality assesment is illustrated by some examples.

The criteria and quality measures for enlargers and enlarger objectives used so far are this much versatile that any comparative assesment of this kind of products is practically impossible.

An attempt of unifying requirements and quality evaluation methods of enlargers and enlarger objectives for amateur use have been made. The criteria and measures have been selected on the basis of a comparative analysis of a series of selected enlargers and enlarger objectives made in Poland and abroad.

The measurable and unmeasurable properties of enlargers and enlarger objectives have been determined. As regards the measurable properties of enlargers the chosen features include:

Table 1

Measurable features	The lowest admissible requirements	The number of points corres-ponding to the lowest admissible requirements	The requirements corresponding to the highest world standard	The number of points corresponding to the highest world standard
Parallel position of the negative plane with respect to the supporting plane of the objective and the bed plate	1°	16	30′	25
Cooperation of the units and details	Assuring correct functioning	12	Assuring optimal functioning	20
Lightproofness	1 minute under working conditions	10	Absolute	15
Illumination intensity distribution	Vignetting 55%	8	Vignetting 45%	10
Electric installation requirements	Typical for temperature climate	8	Corresponding to tropical climatic conditions	10
Exploitation period and reliability of the focussing and the head shifting mechanismus	1000 working cycles	8	2000 working cycles	10
Thermal and climatic requirements	Typical for temperature climate	8	Corresponding to tropical climatic conditions	10
		70		100

-- parallel position of the negative with respect to the resistance plane of the objective and the base plate,

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Table 2

Measurable features	The lowest admissible requirements	The number of points corresponding to the lowest admissible requirements	The requirements corresponding to the highest world standard	Number of points corresponding to the highest world standard
Photographic resolving power in line/mm for the field center, medium zone and edge zone	32; 12,5; 8	18	$\geqslant$ 50; $\geqslant$ 20; $\geqslant$ 12.5	28
Axial and offaxis aberrations determined interferentially for the wavelength λ = 546 nm	2λ	18	1λ	28
Vignetting	Tolerance 55%	12	Tolerance 45%	15
Relative aperture	Tolerance 15%	6	Tolerance 10%	8
Focal length	Tolerance 3.5%	6	Tolerance 2.5%	8
Exploitation period and reliability of diaphragm mechanismus	7500 working cycle	5	12 000 working cycle	6
Thermal and climatic requirements	Typical for temperature climate	5	Corresponding to tropical climatic condition	7
		70		100

- coordination of sets and parts,
- closeness of the light cover,
- distribution, of illumination intensity,
- electric installation requirements,
- durability and reliability of the focussing and head shifting mechanisms,
- thermal and climatic requirements;

as regards enlarger objectives the following properties were considered:

- photographic resolving power,
- axial aberrations,
- vignetting,
- f-number (relative apertures),
- focal lengths,
- durability and reliability of the diaphragm operating mechanism,
- thermal and climatic requirements.

Parameters which can not be treated numerically or those for which the numerical approach would be too complex have been categorized as nonmeasurable, e.g. the quality of the paint or galvanic coats or appearance of the product. A typical organoleptic evaluation based on comparison with the corresponding standards has been proposed for these parameters.

Numerical values of the measurable properties of enlargers and their objectives together with the suggested measures expressed in conventional points are presented in Tables 1 and 2.

Two numerical values are attributed to each of the measurable properties according to their importance: one – corresponds to the lowest permissible requirements and the other to the highest world level standards.

70 points have been accepted as a minimum requirement so that none of the numerical values of properties could be lower than the minimum value. The value of 100 points describes the highest world standard.

The classification embraces three grades of quality: 1) the products representing the highest world standard (100 points), 2) the products of moderate quality (85–99 points) and 3) the products fulfilling minimum requirements (70–84 points).

To illustrate the sugested way of quality assesment the numerical values of the measurable properties for five optional enlarger objectives 4.5/105 of different make are presented in the Table 3.

As may be seen in the Table 3 the objectives "Belar" 4.5/105 made in Czechoslovak and "Comparon" 4.5/105 of German make correspond to products for which the sum of the numerical values amounts to 100. The medium class is represented by the Polish "Amar" 4.5/105 and the British "Dallmayer" 4.5/102 since their numerical values are within the range of 85–99 points, while the Japanese "Ewar" 4.5/105 with 78 points, belongs to the third group of products satisfying the minimum exploatation requirements.

Table 3

Objective measurable properties	Ewar 4.5/105 Japan	Point value	Amar 4.5 /105 Poland	Point value	Dallmeyer 4.5/102 Great Britain	Point value	Belar 4.5/105 Czechoslovakia	Point value	Comparon 4.5/105 West Germany	Point value
Photographic resolving power in line/mm field center,		18		18		28		28		28
medium zone,	32		32		50		50		50	
edge zone	20		16		25		20		40	
	8		12.5		16		16			
Axial aberrations determined interferentially for $\lambda = 546$ nm	1.25λ	18	1λ	28	0.75λ	28	0.5λ	28	0.5λ	28
Vignetting for an angle $\lambda = 20°$	43%	15	42%	15	40%	15	33.4%	15	43.5%	15
Relative aperture	within the tolerance 15%	6	within the tolerance 10%	8	within the tolerance 15%	6	within the tolerance 10%	8	within the tolerance 10%	8
Focal length	105.8	8	106.3	8	101.5	8	105.5	8	104.5	8
Exploitation period and reliability of the diaphragma mechanismus	12 000 working cycle	6	12 000 working cycle	6	12 000 working cycle	6	12 000 working cycle	6	12 000 working cycle	6
Thermal and climatic requirements [1]		7		7		7		7		7
Sum of points		78		90		98		100		100

1) Objectives included in Table 3 were not examined under tropical conditions. Their numerical values corresponding to the highest world standard are presented only sa an illustration.

By selecting measurable parameters for enlarger objectives the measurement possibilities of moderately equipped laboratories were considered so the modulation transfer function was not taken into account.

It may be expected that the unification of the methods of quality evaluation for enlargers and enlarger objectives will facilitate a classification of products in a more uniform way by different institutions. In the authors opinion the proposed criteria may be extented to classify other products.