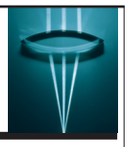

Back vertex power measurement tolerances for spectacle lenses

Ron Rabbetts explains the implications for back vertex power adjustments outlined in a new British Standard for spectacle lens tolerance

Tolerances on the back vertex power of single-vision and multifocal lenses (values in dioptres)

Power of principal meridian with higher absolute back vertex power	Tolerance on the back vertex power of each principal meridian	Tolerance of the cylindrical power			
		≥0,00 and ≤0,75	>0,75 and ≤4,00	> 4,00 and ≤6,00	>6,00
≥0,00 and ≤3,00	±0,12	±0,09			-
>3,00 and ≤6,00					
>6,00 and ≤9,00	±0,12		± 0,18		

The table above shows an excerpt from BS EN ISO 21987 on the tolerances for back vertex power of single-vision and multifocal lenses

For a spherical power lens, there is a single parameter to measure, ie the tolerance on the BVP which is given in the second column. For an astigmatic-power lens, however, there are three powers that have to be toleranced as well as the direction of the cylinder axis.

To take an example, suppose one were verifying the single-vision lens +2.75/-1.75 x 50. The power of the principal meridian with higher absolute back vertex power is +2.75, so the tolerances in the row labelled ≥0,00 and ≤3,00 are chosen. The tolerance on the powers of the two principal meridians, ie on +2.75 and on +1.00 are both ±0.12D. The cylinder power must also be within its tolerance of ±0.09D. One can think of this as being that the principal meridional tolerance applies to the sphere power in both the plus and minus transpositions of the lens, while the cylinder power must also not be in error. If on verification, the actual powers are +2.80 and +0.90, then although these are within tolerance, the cylinder power of 1.90D is outside tolerance. Similarly, if the actual powers measure +2.85 for the sphere and –1.67 for the cylinder, then the second meridional power would be +1.18D, which again is outside tolerance.

Let us take a second example of a bifocal lens ordered as –4.50/-3.00 x 50. If the lens is transposed to 7.50/+3.00 x 140, then it is obvious that the row >6,00 and ≤9,00 should be selected. In this case, the tolerances to be applied to the principal meridional powers are again ±0.12D, while that for the cylinder power is now larger at ±0.18D. These are applied in the same manner as before.

A separate table found within the Standard gives the tolerances for PPLs.

Thus for selecting the appropriate row for the tolerances, the lens powers should be expressed in a minus cylinder transposition for positive powers, and a plus power transposition for negative powered lenses – often termed the 'opposite cylinder transposition' in lens range and price charts. As agreed in ISO rules, the tables in the Standard use commas for the decimal point even though it looks strange to us.

If a lens has its powers compensated for the 'as-worn' position, then the tolerances apply to this compensated power, not to the originally ordered power. For example, a lens of power ordered as +3.50/+1.00 x 180 was designed to be +3.61/+1.02 x 2, so the tolerances should be applied to these powers and axis when verifying the lens on a focimeter, even though it should behave as +3.50/+1.00 x 180 when the wearer looks straight ahead. Confusingly, some manufacturers print their 'as-worn' corrected dioptric powers in crossed cylinder form, eg +3.61 +4.63 axis 2.

Although these two powers are seen when verifying using a manual focimeter, a lens analyser will display the powers only in standard sphero-cylindrical form. A suggestion is that if the verifier hits the transpose button, then the powers shown should now be +4.63/-1.02 x 92, thus allowing the other principal meridional power to be displayed without having to calculate what it should be, although one will have to be careful over which of the two transpositions should give the expected axis.

Addition power

The measurement of addition power on multifocal lenses was described in Rabbetts (2009).[1] While the same technique can be used for measurement of addition power in PPLs, the members of the British Standards Committee for spectacles recommends that for traditional lenses but not for free-form lenses, the verifier relies on the engraved addition power. As PD ISO TR 28980, also described in this reference, points out, placing a PPL lens in a slightly incorrect position for add measurement is liable to give a significant error. The semi-finished lens blank manufacturers take great care to ensure that their blanks are accurate, whereas it is possible for a multifocal semi-finished lens blank to get put into a wrong lens packet, and proceed all the way through surfacing and arrive in practice with an incorrect addition unspotted.

Reference

1 Rabbetts R. New British Standards' publication, *Optician*, 2009; 237, (6197), 10.04.09, 26-28.

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