

ORLAB Technical Note



Ophthalmic Product
Series
Issue 6

A series of technical notes to aid understanding of standards, reasons for failure to comply and hints on avoiding the problem.



Accreditation number
1923
Accredited since 1985

Differences between AS2228.1-1992 and AS/NZS ISO 21987:2011 as they relate to AS/NZS1337.6:2007

General

AS2228.1-1992 has been replaced by a suite of AS/NZS ISO standards, not all of which are necessary to have to work with AS/NZS1337.6, since this deals with finished and mounted lenses. AS/NZS ISO 21987 is the direct equivalent for the purposes of working to AS/NZS1337.6.

These standards are available from <http://www.saiglobal.com>.

AS 2228.1-1992 Spectacles - Spectacle lenses
(pdf \$70.75 hardcopy \$78.61)

AS/NZS ISO 21987:2011 Ophthalmic optics - Mounted spectacle lenses
(pdf \$95.87 hardcopy \$106.52)

Differences

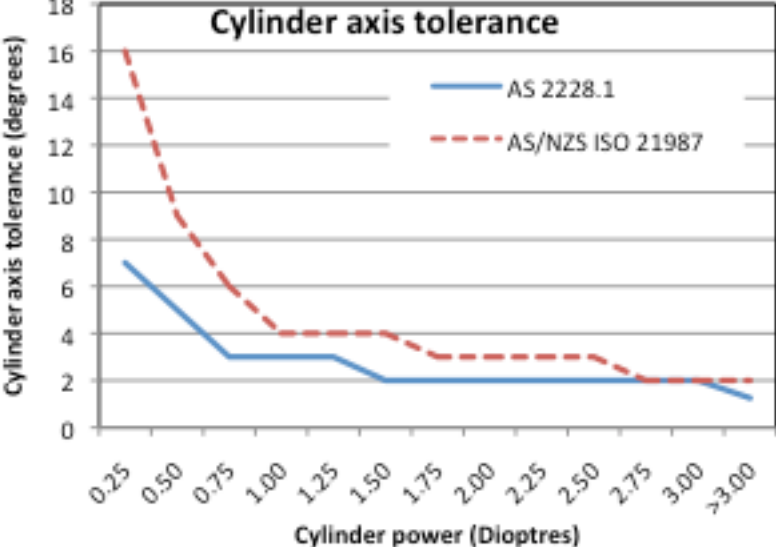
This tech note will only address the provisions of AS 2228.1 relevant to finished lenses (Section 4) as applicable in AS/NZS1337.6 although this refers to the provisions for finished uncut lenses (Section 3) quite widely.

The testing of plano prescription eye protectors in AS/NZS1337.6 is for the purposes of evaluating the frame and, as such, they are tested fully according to AS/NZS1337.1 not AS/NZS1337.6.

AS 2228.1 Clause	AS/NZS 21987 clause	Comments and differences																																										
3.2.1 & .2 Back vertex power	5.3.2 Back vertex power tolerance	<p>AS/NZS ISO 21987 has tables that include both spherical power and astigmatic power requirements. The tolerances depend on the nominal spherical power and the nominal cylindrical power. The easiest way to represent the changes is in a set of graphs. The tolerance in AS/NZS 1337.1 for the nominally plano lenses has also been included. In a nutshell and with one exception, the provisions of AS/NZS ISO 21987 are the same as AS 2228.1 or less stringent. The tolerances reported here are for single vision and multifocal lenses. Tolerances for progressive (degressive are included in AS/NZS ISO 21987 but did not exist at the time of the writing of AS 2228.1) are also included in the standards. Refer to Tables 3.1 & 3.2 of AS 2228.1 and Table 2 of AS/NZS ISO 21987.</p> <p>A table of comparisons is available.</p> <div style="display: flex; justify-content: space-around;"> <div data-bbox="741 788 1402 1257"> <p>Spherical power tolerances</p> <table border="1"> <caption>Data for Spherical Power Tolerances</caption> <thead> <tr> <th>Higher principal meridian power (D)</th> <th>AS 2228.1 (D)</th> <th>AS/NZS ISO 21987 (D)</th> <th>AS/NZS 1337.1 (D)</th> </tr> </thead> <tbody> <tr><td>0</td><td>0.09</td><td>0.12</td><td>0.09</td></tr> <tr><td>3</td><td>0.12</td><td>0.12</td><td>0.09</td></tr> <tr><td>9</td><td>0.18</td><td>0.18</td><td>0.09</td></tr> <tr><td>12</td><td>0.25</td><td>0.25</td><td>0.09</td></tr> <tr><td>20</td><td>0.37</td><td>0.37</td><td>0.09</td></tr> </tbody> </table> </div> <div data-bbox="1442 788 2103 1257"> <p>Meridional power tolerances</p> <table border="1"> <caption>Data for Meridional Power Tolerances</caption> <thead> <tr> <th>Higher principal meridian power (D)</th> <th>AS 2228.1 (D)</th> <th>AS/NZS ISO 21987 (D)</th> </tr> </thead> <tbody> <tr><td>0</td><td>0.09</td><td>0.12</td></tr> <tr><td>3</td><td>0.12</td><td>0.12</td></tr> <tr><td>6</td><td>0.18</td><td>0.18</td></tr> <tr><td>9</td><td>0.25</td><td>0.25</td></tr> <tr><td>20</td><td>0.37</td><td>0.37</td></tr> </tbody> </table> </div> </div>	Higher principal meridian power (D)	AS 2228.1 (D)	AS/NZS ISO 21987 (D)	AS/NZS 1337.1 (D)	0	0.09	0.12	0.09	3	0.12	0.12	0.09	9	0.18	0.18	0.09	12	0.25	0.25	0.09	20	0.37	0.37	0.09	Higher principal meridian power (D)	AS 2228.1 (D)	AS/NZS ISO 21987 (D)	0	0.09	0.12	3	0.12	0.12	6	0.18	0.18	9	0.25	0.25	20	0.37	0.37
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AS 2228.1 Clause	AS/NZS 21987 clause	Comments and differences
<p>3.2.1 & .2</p> <p>Back vertex power</p> <p>Continued.</p>	<p>5.3.2</p> <p>Back vertex power tolerance</p> <p>Continued.</p>	
<p>3.2.3</p> <p>Addition power – Multifocal and progressive lenses</p>	<p>5.3.4</p> <p>Addition power tolerance for multifocal and progressive lenses</p>	<p>These are the same in both standards.</p> <p>Add Tolerance</p> <p>≤4.00 ±0.12</p> <p>>4.00 ±0.18</p>
<p>3.2.6</p> <p>Surface power</p>	<p>No provision</p>	<p>When the surface power is specifically ordered</p>
<p>4.1.2</p>	<p>6.6</p>	<p>These are general requirements and untestable in a quantitative sense.</p>

AS 2228.1 Clause	AS/NZS 21987 clause	Comments and differences
Material and surface quality Refers to 3.1.1	Material and surface quality. Refers to Annex A	AS/NZS ISO 21987 is much more prescriptive about how the inspection is to take place. But the Annex is informative not normative. AS/NZS1337.1 is more specific and should be given precedence (given that it is a safety standard).
4.1.3 Edge quality	6.1 General Note 2 refers to Annex B	These are general requirements and untestable in a quantitative sense. The clause contains only a note (which is not part of the standard) and the Annex is informative only. AS/NZS1337.1 is more specific and should be given precedence (given that it is a safety standard).
4.1.4 Mounted lenses	Annex B.2 Recommendations on glazing	Essentially the same. AS2228.1 uses “should”, which is advisory, and the Annex of AS/NZS ISI 21987 is informative.
4.1.5 Monograms, logos and decorations	No provision	The provisions of AS2228.1 echo those developed for AS1067 Sunglasses at the time. Previous editions of the standards lacked this clause and it could be interpreted that anything added to the lens as decoration was a defect. The clause was added as a permissive clause that says, in a nutshell, the central 30mm of the lens cannot contain such things but anywhere else on the lens it is OK. It remains to be seen how AS/NZS ISO 21987 is to be interpreted in this respect.

AS 2228.1 Clause	AS/NZS 21987 clause	Comments and differences
4.2.1 Cylinder axis	5.3.3 Cylinder axis direction tolerance	 <p>The graph shows that AS/NZS ISO 21987 has a significantly higher tolerance (up to 16.5 degrees) compared to AS 2228.1 (7.5 degrees) for low cylinder powers. Both standards converge to a similar tolerance of approximately 2 degrees for powers above 1.50 dioptres.</p>
4.2.2 Optical centration and prism— Single mounted lenses		Applies to single lenses. Not applicable.

AS 2228.1 Clause	AS/NZS 21987 clause	Comments and differences																																																						
<p>4.2.3 Optical centration and prism—Lens pairs</p>	<p>5.3.5 Prism imbalance (relative prism error) for pairs of single-vision and multifocal lenses</p> <p>5.3.6 Prism imbalance (relative prism error) for progressive-power lenses and degressive-power lenses</p>	<p>Note: Testing is normally carried out on prescription eye protectors with a PD of 64 (medium head) or 54mm (small head) as required in AS/NZS1337.1. Compliance authorities may set these PDs as the prescribed PD for the purposes of samples for testing.</p> <div style="display: flex; justify-content: space-around;"> <div data-bbox="741 459 1391 882"> <p>Tolerances on horizontal prismatic power</p> <table border="1"> <caption>Data for Horizontal Prismatic Power Tolerances</caption> <thead> <tr> <th>Horizontal meridional power (dioptr)</th> <th>AS 2228.1 (prism dioptr)</th> <th>AS/NZS ISO 21987 (prism dioptr)</th> <th>AS/NZS 1337.1 base out (prism dioptr)</th> <th>AS/NZS 1337.1 base in (prism dioptr)</th> </tr> </thead> <tbody> <tr><td>0</td><td>1</td><td>0.5</td><td>1</td><td>0.5</td></tr> <tr><td>5</td><td>1</td><td>1</td><td>1</td><td>0.5</td></tr> <tr><td>10</td><td>1</td><td>2</td><td>1</td><td>0.5</td></tr> <tr><td>15</td><td>1</td><td>3</td><td>1</td><td>0.5</td></tr> <tr><td>20</td><td>1</td><td>4</td><td>1</td><td>0.5</td></tr> </tbody> </table> </div> <div data-bbox="1451 469 2078 890"> <p>Tolerances on vertical prismatic power</p> <table border="1"> <caption>Data for Vertical Prismatic Power Tolerances</caption> <thead> <tr> <th>Vertical meridional power (dioptr)</th> <th>AS 2228.1 (prism dioptr)</th> <th>AS/NZS ISO 21987 (prism dioptr)</th> <th>AS/NZS 1337.1 (prism dioptr)</th> </tr> </thead> <tbody> <tr><td>0</td><td>1</td><td>0.5</td><td>0.5</td></tr> <tr><td>5</td><td>1</td><td>1</td><td>0.5</td></tr> <tr><td>10</td><td>1</td><td>1.5</td><td>0.5</td></tr> <tr><td>15</td><td>1</td><td>2</td><td>0.5</td></tr> <tr><td>20</td><td>1</td><td>2.5</td><td>0.5</td></tr> </tbody> </table> </div> </div> <p>Tolerances on prism are the same whether it is a limit on prism where none is prescribed and the tolerance of the prescribed prism does not exceed 2^Δ.</p> <p>AS/NZS ISO 21987 has greater tolerances for ordered prism in progressive and degressive lenses. See Figures 1 & 2 of AS/NZS ISO 21987.</p>	Horizontal meridional power (dioptr)	AS 2228.1 (prism dioptr)	AS/NZS ISO 21987 (prism dioptr)	AS/NZS 1337.1 base out (prism dioptr)	AS/NZS 1337.1 base in (prism dioptr)	0	1	0.5	1	0.5	5	1	1	1	0.5	10	1	2	1	0.5	15	1	3	1	0.5	20	1	4	1	0.5	Vertical meridional power (dioptr)	AS 2228.1 (prism dioptr)	AS/NZS ISO 21987 (prism dioptr)	AS/NZS 1337.1 (prism dioptr)	0	1	0.5	0.5	5	1	1	0.5	10	1	1.5	0.5	15	1	2	0.5	20	1	2.5	0.5
Horizontal meridional power (dioptr)	AS 2228.1 (prism dioptr)	AS/NZS ISO 21987 (prism dioptr)	AS/NZS 1337.1 base out (prism dioptr)	AS/NZS 1337.1 base in (prism dioptr)																																																				
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<p>4.2.4 Prism base setting for mounted lenses</p>	<p>No provision.</p>	<p>AS/NZS ISO 21987 relies on assessing the horizontal and vertical components separately.</p>																																																						

AS 2228.1 Clause	AS/NZS 21987 clause	Comments and differences
4.3.1 Minimum lens thickness	No provision	AS/NZS1337.6 requires the minimum thickness to be declared.
4.3.2 Maximum lens thickness	No provision	AS 2228.1 provisions are advisory.
4.3.3 Lens thickness	5.4 Thickness tolerance	Tolerance on ordered thickness AS 2228.1 ± 0.2mm AS/NZS ISO 21987 ± 0.3mm
4.3.5 Tolerances for multifocal segment location	5.5 1 Multifocal lenses	Tolerance on ordered segment height or distance below datum or segment inset AS 2228.1 ± 0.5mm AS/NZS ISO 21987 ± 1.0mm
4.3.6 Mounting of progressive lenses	5.5.2 Progressive-power and degressive-power lenses	Tolerance on height and horizontal location of fitting cross AS 2228.1 ± 0.5mm AS/NZS ISO 21987 ± 1.0mm
Section 5 Special requirements		When dealing with AS/NZS1337.6, AS/NZS1337.1 will apply. Especially Clause 5.5 lenses for use in eye protectors.
Appendix A Lens power measurement	6 Test methods	AS2228.1 is silent on the quality of the focimeter. AS/NZS ISO 21987 requires a focimeter complying with ISO 8598.

AS 2228.1 Clause	AS/NZS 21987 clause	Comments and differences
		<p>Aperture of measurement: AS 2228.1 = 3-6mm and AS/NZS ISO 21987 = Not prescribed but “shall not adversely affect the accuracy of measurement by introducing excessive sagittal error”.</p> <p>Wavelength: AS 2228.1 = not set. AS/NZSISO 21987 (by ISO 8598) = mercury green line (546.07nm) or helium yellow line (587.56nm).</p> <p>Calibration AS 2228.1 is silent. AS/NZS ISO 21987 requires calibration using the lenses specified in ISO 9342. The test procedure differs in the words used but is much the same in principle in the two standards.</p>
<p>A4.2 Addition power of multifocal lens blanks and lenses</p> <p>A4.3 Progressive power lens blanks and lenses</p>	<p>6.4 Addition power measurement</p>	<p>In particular, both specify difference in front vertex power as the appropriate method when the segment or progressive surface is on the front surface (a point not grasped by many people). The only exception is if the manufacturer specifies otherwise.</p>
<p>No provision</p>	<p>5.5.1.3 Segment tilt for straight-top and curved-top segments</p>	<p>$\pm 2^\circ$</p>

AS 2228.1 Clause	AS/NZS 21987 clause	Comments and differences
No provision	5.5.2.3 Alignment marking tilt	$\pm 2^\circ$ (progressive and degressive).
Appendix C Lens flammability	No provision	With AS/NZS1337.6, the resistance to ignition requirements may apply in some circumstances.
Appendix E Photochromics	See AS/NZS ISO 8980.3:2011	AS/NZS ISO 8980.3:2011 Ophthalmic optics - Uncut finished spectacle lenses - Transmittance specifications and test methods. When dealing with AS/NZS1337.6, AS/NZS1337.1 will apply.
Appendix F Fatigue of photochromics	See AS/NZS ISO 8980.3:2011	Fatigue in photochromics is a very fraught subject and th industry seems to want to avoid the issue. Results are very test method dependent.
Appendix G Adhesion test for surface coatings	No provision	I am sure there is an ISO method somewhere.
Appendix H Chemical stability test	No provision	
Appendix I Thermal stability test for surface coatings	No provision	When dealing with AS/NZS1337.6, AS/NZS1337.1 will apply.

Compensated powers

Where the completed spectacle has a significant amount of wrap around resulting in a high face form angle the line of sight in the primary position through the spectacle lens will not intersect the lens at normal incidence. This will give rise to oblique effects and can be compensated for by changing the lens power. To measure the effective power of the lens, the direction of measurement must be the same as in normal wear. *ie* measured in the as-worn position. Neither AS2228.1 nor AS/NZS ISO 21987 provide a test method by which this can be assessed but AS/NZS21987 does state, in clause 5.2 (last para) that the tolerances apply to the actual prescription not the power of the compensated lenses. The combination of the frame styles in the eye protection field with the need for prescription lenses has highlighted this problem.

It is not obvious how measurements on compensated lenses should be made. It is not appropriate simply to tilt the lens on the focimeter aperture since it will pivot on one side of the rim of the aperture and the measurement point (being the centre of the aperture) will not be in the plane of the entrance aperture of the focimeter and an error will be introduced.

At this stage it is an open question as to how compensated lenses should be assessed, probably until someone submits compensated lenses for certification. At that stage there should be a discussion between the manufacturer, the certifying authority and a test authority. The chair of Committee MS-24, which is responsible for spectacle lens standards, will probably have to be involved too.

Disclaimer

These notes are of a general nature, you should investigate how these standards changes apply to you and your products yourself and not rely solely on these general guidelines.

Questions on use of the Standards Mark and how this might affect your current licences to use the mark, contact www.saiglobal.com or www.benchmarkcertification.com.au

Stephen Dain

Brian Cheng

Thao Ngo

Data tables

Values that differ between standards are in red, bold and italic

Table 1 Tolerances on mean sphere

Higher principal meridian (dioptries) (+ or -)	Mean sphere tolerance (dioptries)		
	AS 2228.1	AS/NZS ISO 21987	AS/NZS 1337.1
≤3.00	<i>0.09</i>	<i>0.12</i>	<i>0.09</i>
>3.00 to ≤9.00	0.12	0.12	
>9.00 to ≤12.00	0.18	0.18	
>12.00 to ≤20.00	0.25	0.25	
>20.00	0.37	0.37	

Table 2 Tolerances on meridional values

Higher principal meridian (dioptries) (+ or -)	Mean sphere tolerance (dioptries)	
	AS 2228.1	AS/NZS ISO 21987
≤3.00	<i>0.09</i>	<i>0.12</i>
>3.00 to ≤6.00	0.12	0.12
>6.00 to ≤9.00	<i>0.12</i>	<i>0.18</i>
>9.00 to ≤12.00	0.18	0.18
>12.00 to ≤20.00	0.25	0.25
>20.00	0.37	0.37

Table 3 Tolerances on cylindrical power

Cylinder power (dioptries)	Ordered 0.00 cyl cyl limit			Ordered 0.25 to 0.75 cyl cyl tolerance		Ordered 1.00 to 4.00 cyl cyl tolerance		Ordered 4.25 to 6.00 cyl cyl tolerance		Ordered > 6.00 cyl cyl tolerance	
	AS 2228.1	AS/NZS ISO 21987	AS/NZS 1337.1	AS 2228.1	AS/NZS ISO 21987	AS 2228.1	AS/NZS ISO 21987	AS 2228.1	AS/NZS ISO 21987	AS 2228.1	AS/NZS ISO 21987
0.0	0.06	0.09	0.09								
>0.00 to ≤3.00	0.06	0.09		0.09	0.12	0.12	0.18	0.18	0.18	0.25	0.25
>3.00 to ≤6.00	0.06	0.12		0.12	0.12	0.12	0.18	0.18	0.18	0.25	0.25
>6.00 to ≤9.00	0.09	0.12		0.12	0.18	0.18	0.18	0.25	0.18	0.25	0.25
>9.00 to ≤12.00	0.06	0.12		0.12	0.12	0.12	0.18	0.18	0.18	0.25	0.25
>12.00 to ≤20.00	0.09	0.18		0.12	0.18	0.18	0.18	0.25	0.25	0.25	0.25
>20.00	0.12	0.37		0.25	0.25	0.25	0.25	0.37	0.37	0.37	0.37

Table 4 Tolerances on cylindrical axis

Cylindrical power (dioptre)	Cylinder axis tolerance	
	AS 2228.1	AS/NZS ISO 21987
0.25	7	16
0.50	5	9
0.75	3	6
1.00	3	4
1.25	3	4
1.50	2	4
1.75	2	3
2.00	2	3
2.25	2	3
2.50	2	3
2.75	2	2
3.00	2	2
>3.00	1.25	2

Table 5 Tolerances on prism power (not progressive or degressive)

Principal power	Horizontal prism tolerance				Principal power	Vertical prism tolerance		
	AS 2228.1	AS/NZS ISO 21987	AS/NZS 1337.1 base out	AS/NZS 1337.1 base in		AS 2228.1	AS/NZS ISO 21987	AS/NZS 1337.1
0.00	0.50	0.67	1.00	0.25	0.00	0.50	0.50	0.25
≤3.25		0.67			≤5.00	0.50	0.50	
>3.25		0.2*power			>5.00	1.00	0.2*power	
≤5.00	0.50							
>5.00	1.00							