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TEST REPORT

Client:	BOLLE' PROTECTION
Address:	95 rue Louis Guérin - 69 100 VILLEURBANNE FRANCE
Article:	Spectacle
Model:	RAIDER Clear lenses
Job no.:	C100378
Report no.:	101328
Receiving Date:	13/04/2010
Date of Test Begin:	22/04/2010
Date of Test End:	17/05/2010
Issuing Date:	09/06/2010
Standard Applied:	EN 170:2002 - Ultraviolet Filters

Note 1: This Test Report is valid exclusively for the specimens utilized for tests and any modification shall be solely performed with the issuing of a new test report.
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Note 4: The tests were performed on specimens that sampled the customer.

Table of Results

Synthesis of Results

Test results are summarized in the following table:

Test	Clause	Samples	Result
Quality of Material and Surface	EN166 Clause 7.1.3	101328 15,16,17	Comply
Diffusion of Light	EN166 Clause 7.1.2.3	101328 15,16,17	Comply
Transmittance	EN170 Clause 5	101328 15,16,17	Comply
Resistance to Ultraviolet Radiation (Oculars Only)	EN166 Clause 7.1.5.2	101328 15,16,17	Comply
Refractive Powers	EN166 Clause 7.1.2.1	101328 12,13,14	Comply
Stability at an Elevated Temperature	EN166 Clause 7.1.5.1	101328 12,13,14	Comply
Resistance to Surface Damage by Fine Particles	EN166 Clause 7.3.1	101328 41,42	Comply
Resistance to Ignition	EN166 Clause 7.1.7	101328 1,2,3	Comply
Resistance to Fogging of Oculars	EN166 Clause 7.3.2	101328 37,38	Comply
Field of Vision	EN166 Clause 7.1.1	101328 1,2,3	Comply
Design and Manufactoring Requirements	EN166 Clause 6	101328 1,2,3	Comply
Lateral Protection	EN166 Clause 7.2.8	101328 1,2,3	Comply
Increased Robustness	EN166 Clause 7.1.4.2	101328 1...11,19	Comply
Protection Against High-Speed Particles at Extremes of Temperature	EN166 Clause 7.3.4	101328 20...31	Comply

Overall Result

The examined equipment does **Comply** with standard EN 170:2002 - Ultraviolet Filters .

Optical Tests

Quality of Material and Surface

EN166 Clause 7.1.3

Requirements

Except for a marginal area 5 mm wide, oculars shall be free from any significant defects likely to impair vision in use.

Outcomes

The examination of oculars are given the following results:

Sample	Notes	Test
101328 15sx	—	Pass
101328 15dx	—	Pass
101328 16sx	—	Pass
101328 16dx	—	Pass
101328 17sx	—	Pass
101328 17dx	—	Pass

Diffusion of Light

EN166 Clause 7.1.2.3

Requirements

The measurement of the Luminance Reduced Factor, ℓ^* , index of the light diffused by the filter, is performed with the so called simplified method. The reduced luminance factor, ℓ^* , shall be not higher than 1, 0.75, 0.5 $cd\,m^{-2}\,lx^{-1}$ respectively for welding filters, ocular for protection against high-speed particles, for all other type of oculars.

Outcomes

Standard values of ℓ^* , expressed in $cd\,m^{-2}\,lx^{-1}$ and the results of their related tests are:

Sample	ℓ^* ($cd\,m^{-2}\,lx^{-1}$)	Test
101328 15dx	0.09	Pass
101328 15sx	0.08	Pass
101328 16dx	0.10	Pass
101328 16sx	0.08	Pass
101328 17dx	0.11	Pass
101328 17sx	0.10	Pass
101328 41dx	0.09	Pass
101328 41sx	0.09	Pass
101328 42dx	0.10	Pass
101328 42sx	0.10	Pass

Transmittance

EN170 Clause 5

Spectral Transmittance Measument Method

Spectral Transmittance is measured in the ultraviolet and visible by mean a spectrophotometer from 210 to 780 nm, at step of 1 nm and with 2 nm spectral bandwidth.

Computing Methods

The computation of the transmissive sizes, whose measurement values are listed below, if not differently stated, are performed by distinguishing in summations the possible integrals present in definitions.
The highest values of the spectral transmittance in the intervals from 210 to 313 nm, from 315 to 365 nm and from 365 to 405 nm are computed from the measure values obtained every nanometer.

Luminous Transmittance

Requirements

Luminous Transmittance, Tv, shall be not inferior to 1.2 %. For each shade number minimum and maximum limits are reported in Table 1 of standard.

Outcomes

The Tv measurement values in percent and relative tests are:

Sample	Tv (%)	Test
101328 15sx	91.0	Pass
101328 15dx	90.3	Pass
101328 16sx	90.4	Pass
101328 16dx	90.1	Pass
101328 17sx	90.3	Pass
101328 17dx	89.9	Pass

Spectral Transmittance in the Ultraviolet and Visible Regions

Requirements

The maximum value of spectral transmittance from 210 to 313 nm, here indicated with Tmax210_313, and the maximum value of spectral transmittance from 313 to 365 nm, here indicated with Tmax313_365, must be inferior to limit specificated in Table 1 of standard.
The maximum value of spectral transmittance from 365 to 405 nm, here indicated with Tmax365_405, must be inferior to Tv.

Outcomes

Measurement values and relative test are:

Sample	Tmax210_313 (%)	Test	Tmax313_365 (%)	Test	Tmax365_405 (Tv)	Test
101328 15sx	0.0003	Pass	0.0003	Pass	0.72	Pass
101328 15dx	0.0002	Pass	0.0003	Pass	0.71	Pass
101328 16sx	0.0002	Pass	0.0004	Pass	0.79	Pass
101328 16dx	0.0002	Pass	0.0004	Pass	0.78	Pass
101328 17sx	0.0002	Pass	0.0004	Pass	0.78	Pass
101328 17dx	0.0002	Pass	0.0004	Pass	0.79	Pass

Q-factors

Requirements

Note: This clause is optional and apply to filters "with semaforic signals recognition superior ability".
The value of the Q-factor of red, yellow, green and blue signals shall not be lower than 0.8 for filters declared appropriate for driving and use on the road. Quotients according to various signals are here identified as: Qred, Qyellow, Qgreen and Qblue.

Outcomes

The measurement values of Qred, Qyellow, Qgreen, Qblue and the results of the relative tests are:

Sample	Qred	Test	Qyellow	Test	Qgreen	Test	Qblue	Test
101328 15sx	1.01	Pass	1.00	Pass	1.00	Pass	1.00	Pass
101328 15dx	1.00	Pass	1.00	Pass	1.00	Pass	1.00	Pass
101328 16sx	1.01	Pass	1.00	Pass	1.00	Pass	1.00	Pass
101328 16dx	1.00	Pass	1.00	Pass	1.00	Pass	1.00	Pass
101328 17sx	1.00	Pass	1.00	Pass	1.00	Pass	1.00	Pass
101328 17dx	1.00	Pass	1.00	Pass	1.00	Pass	1.00	Pass

Spectral Transmittance from 500 to 650 nm

Requirements

Note: This clause is optional and apply to filters "with semaforic signals recognition superior ability".
The minimun value of the spectral transmission factor in the wavelength interval from 500 to 650 nm, here named Tmin500_650, shall not be inferior to 0.2 Tv for filters declared appropriate for driving and use on the road.

Outcomes

The minimun value measured of the spectral transmittance from 500 to 650 nm, is:

Sample	Tmin500_650 (Tv)	Test
101328 15sx	0.99	Pass
101328 15dx	0.99	Pass
101328 16sx	1.00	Pass
101328 16dx	0.99	Pass
101328 17sx	1.00	Pass
101328 17dx	0.99	Pass

Variation in Transmittance

EN166 Clause 7.1.2.2.3

Requirements

Note: oculars without filtering action are exempt from this requirement. The relative variation of the luminous transmittance, here named *VarTv*, around the visual centre shall not exceed the value if Table 4 of EN166.

Outcomes

The values of VarTv, expressed in percent unit, and the results of the relative tests are:

Sample	Dtv (%)	Test
101328 15sx	—	Pass
101328 15dx	—	Pass
101328 16sx	—	Pass
101328 16dx	—	Pass
101328 17sx	—	Pass
101328 17dx	—	Pass

Left-Right Tv Relative Difference

EN166 Clause 7.1.2.2.3

Requirements

Note: oculars without filtering action are exempt from this requirement. The relative difference of the luminous transmittance, here named *Dsxdx*, between left and right eye shall not exceed the values of Table 4 of the EN166 or the 20% whichever is greater.

Outcomes

The values of Dsxdx, in percent, and the result of the relative tests are:

Sample	Dsxdx (%)	Test
101328 15	1	Pass
101328 16	0	Pass
101328 17	0	Pass

Scale Number

EN166 Clause 5

Requirements

The scale number of a ultraviolet filter consists of a code number, 2, and of a shade number. The scale number is assigned to the filter if it is conform to Table 1 of the standard.

Outcomes

The scale number of the filters:

Sample	Scale Number
101328 15sx	2C - 1,2
101328 15dx	2C - 1,2
101328 16sx	2C - 1,2
101328 16dx	2C - 1,2
101328 17sx	2C - 1,2
101328 17dx	2C - 1,2

Resistance to Ultraviolet Radiation (Oculars Only)

EN166 Clause 7.1.5.2

Requirements

The external surface of the filters is exposed to radiation of a 450W XBO Xenon lamp. The exposure time is 50 hours, the distance between filter and lamp is 300 mm, and the test equipment operate at environment temperature of 23 ± 5 Celsius degree.
The absolute value of the relative variation of Tv after radiation shall not be greater than the values specified in Table 6 of EN166.
Measurement value of ℓ^* after radiation shall be not higher than 1, 0.75, 0.5 $cd\,m^{-2}\,lx^{-1}$ respectivily for welding filters, ocular for protection against high-speed particles, for all other type of oculars.

Outcomes

Measurement values of Tv and ℓ^* after irradiation, the relative variation of Tv and the test results are:

Sample	Tv (%)	$\Delta Tv/Tv$ (%)	Test	ℓ^* ($cd\,m^{-2}\,lx^{-1}$)	Test
101328 15sx	90.8	0	Pass	0.14	Pass
101328 15dx	90.6	0	Pass	0.14	Pass
101328 16sx	90.6	0	Pass	0.18	Pass
101328 16dx	90.5	0	Pass	0.12	Pass
101328 17sx	90.6	0	Pass	0.17	Pass
101328 17dx	89.7	0	Pass	0.18	Pass

Resistance to Surface Damage by Fine Particle

EN166 Clause 7.3.1

Requirements

The ocular is fixed onto a revolving plate. Whilst the plate is rotated, 3 Kg of grain size quarz sand with between 500 and 710 μm is tickled onto the sample.
The test of the light diffusion is performed after the abrasion according to the basic method. The Reduced Luminance Factor, ℓ^* , of the sample must be less than 5 $cd\,m^{-2}\,lx^{-1}$.

Outcomes

The measument values of ℓ^* and the results of their related tests are:

Sample	ℓ^* ($cd\,m^{-2}\,lx^{-1}$)	Test
101328 41sx	1.62	Pass
101328 41dx	1.98	Pass
101328 42sx	1.50	Pass
101328 42dx	1.50	Pass

Refractive Powers

EN166 Clause 7.1.2.1

Requirements

Table 3 of the EN166 reports the values permitted for Spherical, Astigmatic, and Prismatic Refractive Powers which are relative to the relative points of each ocular and those for the horizontal and vertical Prismatic Differences.
The cover plates must be conform to requirements for optical class One in Table 3 of EN166.

Outcomes

The measurement values of Spherical, Astigmatic, and Prismatic Refractive Powers, their relative tests and the possible optical class are:

Sample	Sph. Refr. Pow. (D)	Test	Ast. Refr. Pow. (D)	Test
101328 12dx	-0.03	Pass	0.03	Pass
101328 12sx	-0.03	Pass	0.04	Pass
101328 13dx	-0.04	Pass	0.03	Pass
101328 13sx	-0.02	Pass	0.04	Pass
101328 14dx	-0.03	Pass	0.03	Pass
101328 14sx	-0.02	Pass	0.05	Pass

Measurement values of the differences of the horizontal and vertical refractive prismatic powers, the base, the relative tests and the possible optical class, are:

Sample	Base	Horiz. Pris. Diff. (cm/m)	Test	Ver. Pris. Diff. (cm/m)	Test	Optical Class
101328 12	out	0.25	Pass	0.00	Pass	One
101328 13	out	0.20	Pass	0.00	Pass	One
101328 14	out	0.20	Pass	0.00	Pass	One

Stability at an Elevated Temperature

EN166 Clause 7.1.5.1

Requirements

The protective equipment conditioned at the temperature of 55 ± 5 Celsius degrees for 60 ± 5 minutes, after 60 minutes at the environment temperature shall show no apparent deformation.

Outcomes

The test has given the following results:

Sample	Deformations	Test
101328 12	—	Pass
101328 13	—	Pass
101328 14	—	Pass

Mechanical Tests

Resistance to Ignition

EN166 Clause 7.1.7

Requirements

The several external parts of the test sample except elastic headbands and textile edging, are put into direct contact for 5 ± 0.5 seconds with a steel bar risen to the temperature of 650 ± 20 Celsius degrees. During the test, a visual exam is performed to establish if the test sample ignite or continue to glow after the removal of the steel bar.

Outcomes

The visual exam has given the following results:

Sample	Notes	Test
101328 1	—	Pass
101328 2	—	Pass
101328 3	—	Pass

Resistance to Fogging of Oculars

EN166 Clause 7.3.2

Requirements

The oculars shall remain free from fogging for a minimum of 8 s when tested according to clause 16 of EN 168:2001.

Outcomes

The tested samples have given the following results:

Sample	Time (s)	Test
101328 37sx	24	Pass
101328 37dx	24	Pass
101328 38sx	60	Pass
101328 38dx	32	Pass

Field of Vision

EN166 Clause 7.1.1

Requirements

Eye-protectors shall have a field of vision including for each eye the field defined by a cone having its vertex in the pupil and such to form an ellipse with its section on the plane parallel to the two pupils and orthogonal to the horizontal sight axis. The ellipses have the following geometric features: horizontal axis 22 mm, vertical axis 20 mm. The horizontal axis shall be parallel to and 0.7 mm below the height of the line connecting the centres of the two eyes; horizontal displacement of 3 mm toward the external eye side, with respect to the horizontal sight axis.

Outcomes

The performed tests have given the following results:

Sample	Test	Note
101328 1	Pass	—
101328 2	Pass	—
101328 3	Pass	—

Design and Manufacturing

EN166 Clause 6

Requirements

Eye-protectors shall meet the general construction requirements consisting in being free from projections, sharp edges or other defects which can cause discomfort or injury during normal use.
Protectors shall be made of materials which do not cause skin irritation in case of contact with the wearer. Headbands, when used as the principal means of retention, shall be at least 10 mm wide.

Outcomes

The samples examination have given the following results.

Sample	Construction Test	Materials Test	Headband Test	Notes
101328 1	Pass	Pass	—	—
101328 2	Pass	Pass	—	—
101328 3	Pass	Pass	—	—

Lateral Protection

EN166 Clause 7.2.8

Requirements

The eye-protector shall give lateral protection of the ocular region. The test consists in verifying that the lateral and the frontal impact point of the headform are protected by the device to test, into an area of radius 10 mm.

Outcomes

The results of the test are:

Sample	Notes	Test
101328 1	—	Pass
101328 2	—	Pass
101328 3	—	Pass

Increased Robustness

EN166 Clause 7.1.4.2.2

Requirements

The eye protector shall be submitted to an impact of a 22 mm diameter steel ball, of 43 g minimum mass at a speed of 5.1 m/s. The impact occurs in correspondance to the visual centers and the eye-sides.
As a consequence of the test, the sample shall not present any ocular fractures or deformations, ocular housing fractures, frame fractures, lateral protection failure.
Before the test, samples are pre-conditioned for at least one hour at -5 or +55 Celsius degrees.
The possible impact points are the ocular centres and the lateral protection.
A new sample shall be used for each impact point.

Outcomes

The results of the test are:

Sample	Impact Point	Temperature ($°C$)	Defects	Test
101328 1	right frontal	+55°	—	Pass
101328 2	left frontal	+55°	—	Pass
101328 3	right side	+55°	—	Pass
101328 4	left side	+55°	—	Pass
101328 5	right frontal	+55°	—	Pass
101328 6	left side	+55°	—	Pass
101328 7	right frontal	-5°	—	Pass
101328 8	left frontal	-5°	—	Pass
101328 9	right side	-5°	—	Pass
101328 10	left side	-5°	—	Pass
101328 11	left frontal	-5°	—	Pass
101328 19	right side	-5°	—	Pass

Protection Against High Speed Particles at Extremes of Temperature

EN166 Clause 7.3.4

Requirements

If an increased impact resistance is required, the complete eye-protector shall withstand the impact of a 6 mm nominal diameter steel ball of 0.86 g minimum mass striking the ocular at one of the speeds 45, 120 or 190 m/s according to the robustness declared.
The impact are carried out after the protector have been conditioned at $+55 \pm 2$ and -5 ± 2 Celsius degrees, in correspondence to the visual centre and of the lateral protection.

Outcomes

The performed tests have given the following results:

Sample	Impact point	Temperature ($°C$)	Speed (m/s)	Defects	Test
101328 20	right frontal	+55	45.0	—	Pass
101328 21	left frontal	+55	45.0	—	Pass
101328 22	right side	+55	45.0	—	Pass
101328 23	left side	+55	45.0	—	Pass
101328 24	right frontal	+55	45.0	—	Pass
101328 25	left side	+55	45.0	—	Pass
101328 26	right frontal	-5	46.0	—	Pass
101328 27	right frontal	-5	46.0	—	Pass
101328 28	right side	-5	46.0	—	Pass
101328 29	left side	-5	45.0	—	Pass
101328 30	left frontal	-5	45,0	—	Pass
101328 31	right side	-5	45.0	—	Pass

Optical Tests - Checked by: Renato Battistin

Mechanical Tests - Checked by: Dr. Fabiano Nart

Laboratory Technical Manager: Dott. Giorgio Sommariva

Figure 1: Specimen picture.