



CERTOTTICA

Istituto Italiano per la Certificazione dei Prodotti Ottici Scarl
Loc. Villanova Zona Industriale - 32013 LONGARONE BL
Tel.: +39 0437 573157 - TeleFAX: +39 0437 573131
Web: www.certottica.it **E-mail:** info@certottica.it

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TEST REPORT

Client:	BOLLE' PROTECTION
Address:	95 rue Louis Gurin - 69 100 VILLEURBANNE FRANCE
Article:	Spectacle
Model:	8229 Smoke lens
Job no.:	C100486
Report no.:	101703
Receiving Date:	03/05/2010
Date of Test Begin:	31/05/2010
Date of Test End:	10/06/2010
Issuing Date:	11/06/2010
Standard Applied:	EN 172:1994+A1:2000+A2:2001 - Sunglare filters for industrial use

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	101703 15,16,17	Comply
Diffusion of Light	EN166 Clause 7.1.2.3	101703 15,16,17	Comply
Transmittance	EN172 Clause 4	101703 15,16,17	Comply
Resistance to Ultraviolet Radiation (Oculars Only)	EN166 Clause 7.1.5.2	101703 15,16,17	Comply
Refractive Powers	EN166 Clause 7.1.2.1	101703 12,13,14	Comply
Stability at an Elevated Temperature	EN166 Clause 7.1.5.1	101703 12,13,14	Comply
Resistance to Ignition	EN166 Clause 7.1.7	101703 1...3	Comply
Field of Vision	EN166 Clause 7.1.1	101703 1,2,3	Comply
Design and Manufacturing Requirements	EN166 Clause 6	101703 1,2,3	Comply
Lateral Protection	EN166 Clause 7.2.8	101703 1,2,3	Comply
Increased Robustness	EN166 Clause 7.1.4.2	101703 1...11,19	Comply
Protection Against High-Speed Particles at Extremes of Temperature	EN166 Clause 7.3.4	101703 20...31	Comply

Overall Result

The examined equipment does **Comply** with standard EN 172:1994+A1:2000+A2:2001 - Sunglare filters for industrial use .

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
101703 15dx	—	Pass
101703 15sx	—	Pass
101703 16dx	—	Pass
101703 16sx	—	Pass
101703 17dx	—	Pass
101703 17sx	—	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
101703 15dx	0.07	Pass
101703 15sx	0.08	Pass
101703 16dx	0.07	Pass
101703 16sx	0.07	Pass
101703 17dx	0.06	Pass
101703 17sx	0.10	Pass

Transmittance

EN172 Clause 4

Measurement Method of the Spectral Transmittance

The spectral transmittance is measured at least from 280 to 780 nm and at no more than from 280 to 2000 nm, always with the step of 1 nm through a spectrophotometer using a spectral band width not superior to 2 nm in the ultraviolet and in the visible and not over 20 nm in the infrared.

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 sum step is equal to 10 nm for T_v , for T_{sir} and for Q-factors; is equal to 5nm for solar radiation transmittance in ultraviolet regions A (from 315 to 380 nm) and B (from 280 to 315 nm) and in the blue region (from 380 to 500 nm). The highest values of the spectral transmittance in the intervals from 280 to 315 nm and from 315 to 350 nm are computed from the measure values obtained every nanometer in the spectrum interval from 280 to 350 nm.

Sample Labeling and Measurement Point

The sample labeling and the measurement points are explained as following.

The measurement point on a filter is the standard's reference point if not otherwise specified. The reference point is the visual point or the geometric point if the first is unknown.

The spectral transmittance measurement points are labeled by mean a serie of strings.

The strings s_x e d_x identified the left and the right oculars respectively.

The mounted gradient filters generally are measured in the reference point and in the points at the most 15 mm up and below the reference point and along the two parallels to the line through the right and the left reference points of the protective equipment.

In the case of unmounted singular filter the measurement are performed along the gradient direction.

The two measurement points apart the reference point are labeled s and c .

Photochromic filters can to be measured at different conditions of temperature, T (unit Celsius degree), and illumination, L (unit lux), and the labeling is performed with a suffix.

Luminous Transmittance

Requirements

The superior and inferior limits of T_v relative to a filter shade number are showed in the Tables 1 and 2 of the standard.

Outcomes

The measurement values of T_v , expressed in percent, and the relative test are:

Sample	T_v (%)	Test
101703 15sx	11.3	Pass
101703 15dx	11.1	Pass
101703 16sx	11.4	Pass
101703 16dx	10.7	Pass
101703 17sx	10.6	Pass
101703 17dx	11.2	Pass

Ultraviolet and Visible Spectral Transmittance

Requirements

The superior values of the spectral transmittance , $T(\lambda)$, from 280 to 315 nm, here named Tmax280_315, and of the transmittance , $T(\lambda)$, from 315 to 350 nm, here named Tmax315_350, must be conform to the requirements in the Tab. 1 and 2 of the standard.

The mean value of $T(\lambda)$ from 315 to 380 nm, here named Tmean315_380, must be conform to the requirements in the Tab. 1 and 2 of the standard.

The minimum value of $T(\lambda)$ from 500 to 650 nm, here named Tmin500_600, must be not inferior to 1/5 of the T_V .

Outcomes

Measurement values and the result of the tests are:

Sample	Tmax280_315 (Tv)	Test	Tmax315_350 (Tv)	Test	Tmean315_380 (Tv)	Test
101703 15sx	0.00	Pass	0.00	Pass	0.03	Pass
101703 15dx	0.00	Pass	0.00	Pass	0.03	Pass
101703 16sx	0.00	Pass	0.00	Pass	0.03	Pass
101703 16dx	0.00	Pass	0.00	Pass	0.03	Pass
101703 17sx	0.00	Pass	0.00	Pass	0.03	Pass
101703 17dx	0.00	Pass	0.00	Pass	0.03	Pass

Q-factors

Requirements

Note: these specifications are applicable to filters with shade number from 1 to 3,1.

The Q-factor of the semaphoric signals red, yellow, green and blue, here named respectively Qred, Qyellow, Qgreen e Qblue, must be not inferior to 4/5.

Outcomes

The measurements values of Qred, Qyellow, Qgreen e Qblue and the results of the tests are:

Sample	Qred	Test	Qyellow	Test	Qgreen	Test	Qblue	Test
101703 15sx	1.03	Pass	0.95	Pass	1.04	Pass	1.18	Pass
101703 15dx	1.05	Pass	0.95	Pass	1.04	Pass	1.18	Pass
101703 16sx	1.04	Pass	0.95	Pass	1.04	Pass	1.18	Pass
101703 16dx	1.04	Pass	0.95	Pass	1.04	Pass	1.18	Pass
101703 17sx	1.03	Pass	0.94	Pass	1.05	Pass	1.18	Pass
101703 17dx	1.05	Pass	0.95	Pass	1.04	Pass	1.18	Pass

Spectral Transmittance from 500 to 650 nm**Requirements**

Note: these specifications are applicable to filters with shade number from 1 to 3,1.

The minimum value of the spectral transmission factor in the wavelength interval from 500 to 650 nm, here named $T_{min500.650}$, shall not be inferior to 0.2 T_v for filters declared appropriate for driving and use on the road.

Outcomes

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

Sample	$T_{min500.650}$ (T_v)	Test
101703 15sx	0.79	Pass
101703 15dx	0.80	Pass
101703 16sx	0.80	Pass
101703 16dx	0.79	Pass
101703 17sx	0.79	Pass
101703 17dx	0.79	Pass

On road use: day Yes ; night NO .

Left-Right T_v 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 D_{sxdx} , 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 D_{sxdx} , in percent, and the result of the relative tests are:

Sample	D_{sxdx} (%)	Test
101703 15	2	Pass
101703 16	6	Pass
101703 17	6	Pass

Transmittance Uniformity**Requirements**

With exclusion of the marginal zone at 5 mm from border of the filter, the relative difference, here named D_{tv} , between the values of T_v measured on every couple of points within 20 mm of radius from the reference point, shall be differ by not more of 10% of the superior value.

Outcomes

The superior values found for Dtv, expressed in percent unit, and the results of the relative tests are:

Sample	Dtv (%)	Test
101703 15dx	—	Pass
101703 15sx	—	Pass
101703 16dx	—	Pass
101703 16sx	—	Pass
101703 17dx	—	Pass
101703 17sx	—	Pass

Scale Number**Requirements**

The scale number of a sunglare filters for industrial use consists of a code number, 5 or 6 (filters with optional infrared requirements), and of a shade number. The scale number is assigned to the filter if it is conform to Tables 1 and 2 of the standard.

Outcomes

The scale number of the filters:

Sample	Scale Number
101703 15sx	5 - 3,1
101703 15dx	5 - 3,1
101703 16sx	5 - 3,1
101703 16dx	5 - 3,1
101703 17sx	5 - 3,1
101703 17dx	5 - 3,1

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 $cd\ m^{-2}\ lx^{-1}$ respectively for welding filters, ocular for protection against high-speed particles, for all other type of oculars.

Outcomes

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

Sample	T_v (%)	$\Delta T_v / T_v$ (%)	Test	ℓ^* ($cd\ m^{-2}\ lx^{-1}$)	Test
101703 15sx	11.8	4	Pass	0.10	Pass
101703 15dx	11.2	1	Pass	0.08	Pass
101703 16sx	11.8	4	Pass	0.09	Pass
101703 16dx	11.3	7	Pass	0.12	Pass
101703 17sx	11.1	4	Pass	0.11	Pass
101703 17dx	11.7	4	Pass	0.09	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
101703 12dx	-0.01	Pass	0.02	Pass
101703 12sx	-0.01	Pass	0.01	Pass
101703 13dx	-0.01	Pass	0.02	Pass
101703 13sx	0.00	Pass	0.02	Pass
101703 14dx	-0.01	Pass	0.02	Pass
101703 14sx	-0.01	Pass	0.02	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
101703 12	out	0.05	Pass	0.10	Pass	One
101703 13	out	0.05	Pass	0.10	Pass	One
101703 14	out	0.05	Pass	0.10	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
101703 12	—	Pass
101703 13	—	Pass
101703 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
101703 1	—	Pass
101703 2	—	Pass
101703 3	—	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
101703 1	Pass	—
101703 2	Pass	—
101703 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
101703 1	Pass	Pass	—	—
101703 2	Pass	Pass	—	—
101703 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
101703 1	—	Pass
101703 2	—	Pass
101703 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
101703 1	right frontal	+55°	—	Pass
101703 2	left frontal	+55°	—	Pass
101703 3	right side	+55°	—	Pass
101703 4	left side	+55°	—	Pass
101703 5	right frontal	+55°	—	Pass
101703 6	left side	+55°	—	Pass
101703 7	right frontal	-5°	—	Pass
101703 8	left frontal	-5°	—	Pass
101703 9	right side	-5°	—	Pass
101703 10	left side	-5°	—	Pass
101703 11	left frontal	-5°	—	Pass
101703 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
101703 20	right frontal	+55	45.0	—	Pass
101703 21	left frontal	+55	45.0	—	Pass
101703 22	right side	+55	45.0	—	Pass
101703 23	left side	+55	45.0	—	Pass
101703 24	right frontal	+55	45.0	—	Pass
101703 25	left side	+55	45.0	—	Pass
101703 26	right frontal	-5	45.0	—	Pass
101703 27	right frontal	-5	45.0	—	Pass
101703 28	right side	-5	45.0	—	Pass
101703 29	left side	-5	45.0	—	Pass
101703 30	left frontal	-5	45.0	—	Pass
101703 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.