



# CERTOTTICA

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## TEST REPORT

Client:	BOLLE' PROTECTION
Address:	95 rue Louis Gurin - 69 100 VILLEURBANNE FRANCE
Article:	Spectacle
Model:	8229 Smoke polarized lens
Job no.:	C100486
Report no.:	101704
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 3: The Test Report in digital format and the relevant attached file of the digital signatures are official documents. The validity of this Test Report can be checked at <http://www.certottica.org>.

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	101704 15,16,17	Comply
Diffusion of Light	EN166 Clause 7.1.2.3	101704 15,16,17	Comply
Transmittance	EN172 Clause 4	101704 15,16,17	Comply
Polarization Axes	EN172 Clause 4.3.2	101704 15,16,17	Comply
Resistance to Ultraviolet Radiation (Oculars Only)	EN166 Clause 7.1.5.2	101704 15,16,17	Comply
Refractive Powers	EN166 Clause 7.1.2.1	101704 12,13,14	Comply
Stability at an Elevated Temperature	EN166 Clause 7.1.5.1	101704 12,13,14	Comply
Lateral Protection	EN166 Clause 7.2.8	101704 1,2,3	Comply
Protection Against High-Speed Particles at Extremes of Temperature	EN166 Clause 7.3.4	101704 24,25,29...31	Comply

### Overall Result

The examined equipment does **Comply** with standard EN 172:1994+A1:2000+A2:2001 - Sunlare 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
101704 15dx	—	Pass
101704 15sx	—	Pass
101704 16dx	—	Pass
101704 16sx	—	Pass
101704 17dx	—	Pass
101704 17sx	—	Pass

### Diffusion of Light

*EN166 Clause 7.1.2.3*

#### Requirements

The measurement of the Luminance Reduced Factor,  $\ell^*$ , index of the light diffused by the filter, is performed with the so called simplified method. The reduced luminance factor,  $\ell^*$ , 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  $\ell^*$ , expressed in  $cd\ m^{-2}\ lx^{-1}$  and the results of their related tests are:

Sample	$\ell^*$ ( $cd\ m^{-2}\ lx^{-1}$ )	Test
101704 15dx	0.12	Pass
101704 15sx	0.11	Pass
101704 16dx	0.10	Pass
101704 16sx	0.11	Pass
101704 17dx	0.17	Pass
101704 17sx	0.15	Pass

### Polarization Axes

*EN172 Clause 4.3.2*

**Requirements**

The angle  $\alpha$  between the horizontal and the polarization axis of the mounted filter must be not superior to 3 degrees.

**Outcomes**

The measured value of  $\alpha$  for the right (dx) and the left (sx) oculars are:

Samplee	dx (degrees)	Test	sx (degrees)	Test
101704 15	1in	Pass	1in	Pass
101704 16	1out	Pass	0	Pass
101704 17	2in	Pass	1in	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 meean 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 perfomed 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
101704 15sx	13.6	Pass
101704 15dx	13.3	Pass
101704 16sx	13.3	Pass
101704 16dx	13.5	Pass
101704 17sx	14.2	Pass
101704 17dx	13.2	Pass

**Ultraviolet and Visible Spectral Transmittance****Requirements**

The superior values of the spectral transmittance,  $T(\lambda)$ , from 280 to 315 nm, here named  $T_{\max 280\_315}$ , and of the transmittance,  $T(\lambda)$ , from 315 to 350 nm, here named  $T_{\max 315\_350}$ , 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  $T_{\text{mean}315\_380}$ , 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  $T_{\min 500\_600}$ , must be not inferior to 1/5 of the  $T_v$ .

**Outcomes**

Measurement values and the result of the tests are:

Sample	$T_{\max 280\_315}$ (Tv)	Test	$T_{\max 315\_350}$ (Tv)	Test	$T_{\text{mean}315\_380}$ (Tv)	Test
101704 15sx	0.00	Pass	0.00	Pass	0.00	Pass
101704 15dx	0.00	Pass	0.00	Pass	0.00	Pass
101704 16sx	0.00	Pass	0.00	Pass	0.00	Pass
101704 16dx	0.00	Pass	0.00	Pass	0.00	Pass
101704 17sx	0.00	Pass	0.00	Pass	0.00	Pass
101704 17dx	0.00	Pass	0.00	Pass	0.00	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  $Q_{\text{red}}$ ,  $Q_{\text{yellow}}$ ,  $Q_{\text{green}}$  e  $Q_{\text{blue}}$ , must be not inferior to 4/5.

**Outcomes**

The measurements values of  $Q_{\text{red}}$ ,  $Q_{\text{yellow}}$ ,  $Q_{\text{green}}$  e  $Q_{\text{blue}}$  and the results of the tests are:

Sample	Qred	Test	Qyellow	Test	Qgreen	Test	Qblue	Test
101704 15sx	0.97	Pass	0.98	Pass	1.02	Pass	1.06	Pass
101704 15dx	0.98	Pass	0.99	Pass	1.02	Pass	1.06	Pass
101704 16sx	0.98	Pass	0.98	Pass	1.02	Pass	1.06	Pass
101704 16dx	0.97	Pass	0.98	Pass	1.02	Pass	1.06	Pass
101704 17sx	0.99	Pass	0.99	Pass	1.01	Pass	1.05	Pass
101704 17dx	0.96	Pass	0.98	Pass	1.02	Pass	1.07	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<sub>min500\_650</sub>, shall not be inferior to 0.2 T<sub>v</sub> 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 <sub>min500_650</sub> (T <sub>v</sub> )	Test
101704 15sx	0.90	Pass
101704 15dx	0.90	Pass
101704 16sx	0.89	Pass
101704 16dx	0.90	Pass
101704 17sx	0.92	Pass
101704 17dx	0.88	Pass

**On road use: day Yes ; night NO .**

### Polarizing Quotient

#### Clause 4.3.2

#### Requirements

The polarizing quotient, R, between the values of luminous transmittance, T<sub>v</sub>, along the parallel and orthogonal directions to the polarizing axis, must be greater than 20.

#### Outcomes

The values of R are:

Sample	R	Test
101704 15sx	> 20	Pass
101704 15dx	> 20	Pass
101704 16sx	> 20	Pass
101704 16dx	> 20	Pass
101704 17sx	> 20	Pass
101704 17dx	> 20	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  $D_{sdx}$ , 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  $D_{sdx}$ , in percent, and the result of the relative tests are:

Sample	$D_{sdx}$ (%)	Test
101704 15	2	Pass
101704 16	1	Pass
101704 17	7	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  $D_{tv}$ , expressed in percent unit, and the results of the relative tests are:

Sample	$D_{tv}$ (%)	Test
101704 15dx	—	Pass
101704 15sx	—	Pass
101704 16dx	—	Pass
101704 16sx	—	Pass
101704 17dx	—	Pass
101704 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
101704 15sx	5 - 3,1
101704 15dx	5 - 3,1
101704 16sx	5 - 3,1
101704 16dx	5 - 3,1
101704 17sx	5 - 3,1
101704 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  $23 \pm 5$  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  $\ell^*$  after radiation shall be not higher than 1, 0.75,  $0.5 \text{ cd m}^{-2} \text{ lx}^{-1}$  respectively for welding filters, ocular for protection against high-speed particles, for all other type of oculars.

**Outcomes**

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

Sample	$Tv$ (%)	$\Delta Tv / Tv$ (%)	Test	$\ell^*$ ( $\text{cd m}^{-2} \text{ lx}^{-1}$ )	Test
101704 15sx	13.6	0	Pass	0.23	Pass
101704 15dx	13.4	1	Pass	0.17	Pass
101704 16sx	13.3	0	Pass	0.15	Pass
101704 16dx	13.5	0	Pass	0.19	Pass
101704 17sx	14.2	0	Pass	0.20	Pass
101704 17dx	13.2	0	Pass	0.18	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 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
101704 12dx	0.01	Pass	0.02	Pass
101704 12sx	0.01	Pass	0.04	Pass
101704 13dx	0.01	Pass	0.01	Pass
101704 13sx	0.01	Pass	0.01	Pass
101704 14dx	0.01	Pass	0.01	Pass
101704 14sx	0.01	Pass	0.03	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
101704 12	out	0.30	Pass	0.05	Pass	One
101704 13	out	0.30	Pass	0.00	Pass	One
101704 14	out	0.25	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  $55 \pm 5$  Celsius degrees for  $60 \pm 5$  minutes, after 60 minutes at the environment temperature shall show no apparent deformation.

**Outcomes**

The test has given the following results:

Sample	Deformations	Test
101704 12	—	Pass
101704 13	—	Pass
101704 14	—	Pass

## Mechanical Tests

### 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
101705 1	—	Pass
101705 2	—	Pass
101705 3	—	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  $-5 \pm 2$  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 ( $^{\circ}C$ )	Speed (m/s)	Defects	Test
101705 20	right frontal	+55	45.0	—	Pass
101705 21	left frontal	+55	45.0	—	Pass
101705 26	right frontal	-5	45.0	—	Pass
101705 27	right frontal	-5	45.0	—	Pass
101705 28	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.