



# CERTOTTICA

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Rep. No. 163311

## TEST REPORT

Client:	BOLLE' PROTECTION
Address:	95 rue Louis Guérin - 69 100 VILLEURBANNE FRANCE
Article:	Spectacles
Model:	SENTINEL - CSP oculars
Job no.:	C160947
Report no.:	163311
Receiving Date:	19/07/2016
Date of Test Begin:	25/07/2016
Date of Test End:	05/08/2016
Issuing Date:	05/08/2016
Standard Applied:	EN 166:2001 - Personal eye-protection - Specifications

Note 1: This test report is valid only for the tested samples and any changes can be made only with the issuance of a new test report.

Note 2: The partial reproduction of this test report is forbidden without written permission of Certottica.

Note 3: The tests were performed on samples sent by client.

Note 4: This test report is an official document digitally signed according to the current Italian law.

Note 5: The declared uncertainty of the measure is expressed double the spread (which corresponds, in the case of a normal distribution, to a confidence level of about the 95%).

## Optical Tests

### Quality of material and surface

#### 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

Sample	Defects	Test
163311 4dx	—	Pass
163311 4sx	—	Pass
163311 5dx	—	Pass
163311 5sx	—	Pass
163311 6dx	—	Pass
163311 6sx	—	Pass

### Diffusion of light

#### Clause 7.1.2.3

#### Requirements

The measurement of the reduced luminance factor is performed following the method stated in the EN167 Clause 4.2.1 (basic method). The reduced luminance factor shall be not superior than  $1 \text{ cd m}^{-2} \text{ lx}^{-1}$  for welding filters,  $0.75 \text{ cd m}^{-2} \text{ lx}^{-1}$  for oculars used in eye-protectors against high speed particles,  $0.5 \text{ cd m}^{-2} \text{ lx}^{-1}$  for all other oculars.

#### Outcomes

Sample	$\ell^*$ ( $\text{cd m}^{-2} \text{ lx}^{-1}$ )	Test
163311 4dx	0.21	Pass
163311 4sx	0.13	Pass
163311 5dx	0.24	Pass
163311 5sx	0.15	Pass
163311 6dx	0.18	Pass
163311 6sx	0.20	Pass

### Transmittance

#### Clause 7.1.2.2

#### Oculars with filtering action (filters) and housings for oculars with filtering action

#### Clauses 7.1.2.2.2, 7.2.1

#### Requirements

The transmittance requirements for filtering oculars are specified in the EN 169 - *Welding filters*, EN 170 - *Ultraviolet filters*, EN 171 - *Infrared filters*, EN 172 - *Sunglare filters for industrial use* and EN 379, *Welding filters with switchable luminous transmittance*.

Goggles and face-shields mounting filtering oculars shall provide at least the same level of protection as given by the oculars.

## Permissible transmittance and scale numbers

### *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.

#### 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 series of strings.

The strings *sx* e *dx* identified the left and the right oculars reference point 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

### *EN172 - Clause 4.1*

#### 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
163311 4sx	62.5	Pass
163311 4dx	63.3	Pass
163311 5sx	62.2	Pass
163311 5dx	63.4	Pass
163311 6sx	62.6	Pass
163311 6dx	63.3	Pass

#### Ultraviolet and Visible Spectral Transmittance

### *EN172 - Clause 4.1*

#### Requirements

The superior values of the spectral transmittance ,  $T(\lambda)$ , from 280 to 315 nm, here named  $T_{max280\_315}$ , and of the transmittance ,  $T(\lambda)$ , from 315 to 350 nm, here named  $T_{max315\_350}$ , 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  $T_{mean315\_380}$ , 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  $T_{min500\_600}$ , 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
163311 4sx	0.00	Pass	0.00	Pass	0.00	Pass
163311 4dx	0.00	Pass	0.00	Pass	0.00	Pass
163311 5sx	0.00	Pass	0.00	Pass	0.00	Pass
163311 5dx	0.00	Pass	0.00	Pass	0.00	Pass
163311 6sx	0.00	Pass	0.00	Pass	0.00	Pass
163311 6dx	0.00	Pass	0.00	Pass	0.00	Pass

**Recognition of signal lights**

*EN172 - Clause 4.2*

**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
163311 4sx	1.06	Pass	1.04	Pass	0.98	Pass	0.95	Pass
163311 4dx	1.06	Pass	1.04	Pass	0.98	Pass	0.95	Pass
163311 5sx	1.06	Pass	1.04	Pass	0.98	Pass	0.95	Pass
163311 5dx	1.06	Pass	1.04	Pass	0.98	Pass	0.95	Pass
163311 6sx	1.06	Pass	1.04	Pass	0.98	Pass	0.95	Pass
163311 6dx	1.06	Pass	1.04	Pass	0.98	Pass	0.95	Pass

**Spectral transmittance**

*EN172 - Clause 4.2*

**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 Tmin500\_650, shall not be inferior to 0.2 Tv 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	Tmin500_650 (Tv)	Test
163311 4sx	0.91	Pass
163311 4dx	0.90	Pass
163311 5sx	0.90	Pass
163311 5dx	0.90	Pass
163311 6sx	0.90	Pass
163311 6dx	0.90	Pass

On road use: day Yes ; night NO .

### Scale Number

*EN166 Clause 5*

### Requirements

The scale numbers are defined by Table 1 of the EN166.

### Outcomes

The filter scale number determined is:

Sample	Scale Number
163311 4sx	5 - 1,4
163311 4dx	5 - 1,4
163311 5sx	5 - 1,4
163311 5dx	5 - 1,4
163311 6sx	5 - 1,4
163311 6dx	5 - 1,4

### Variations in transmittance (Oculars without filtering action are exempt from this requirement)

*Clause 7.1.2.2.3*

### Oculars without corrective effect

*Clause 7.1.2.2.3.1*

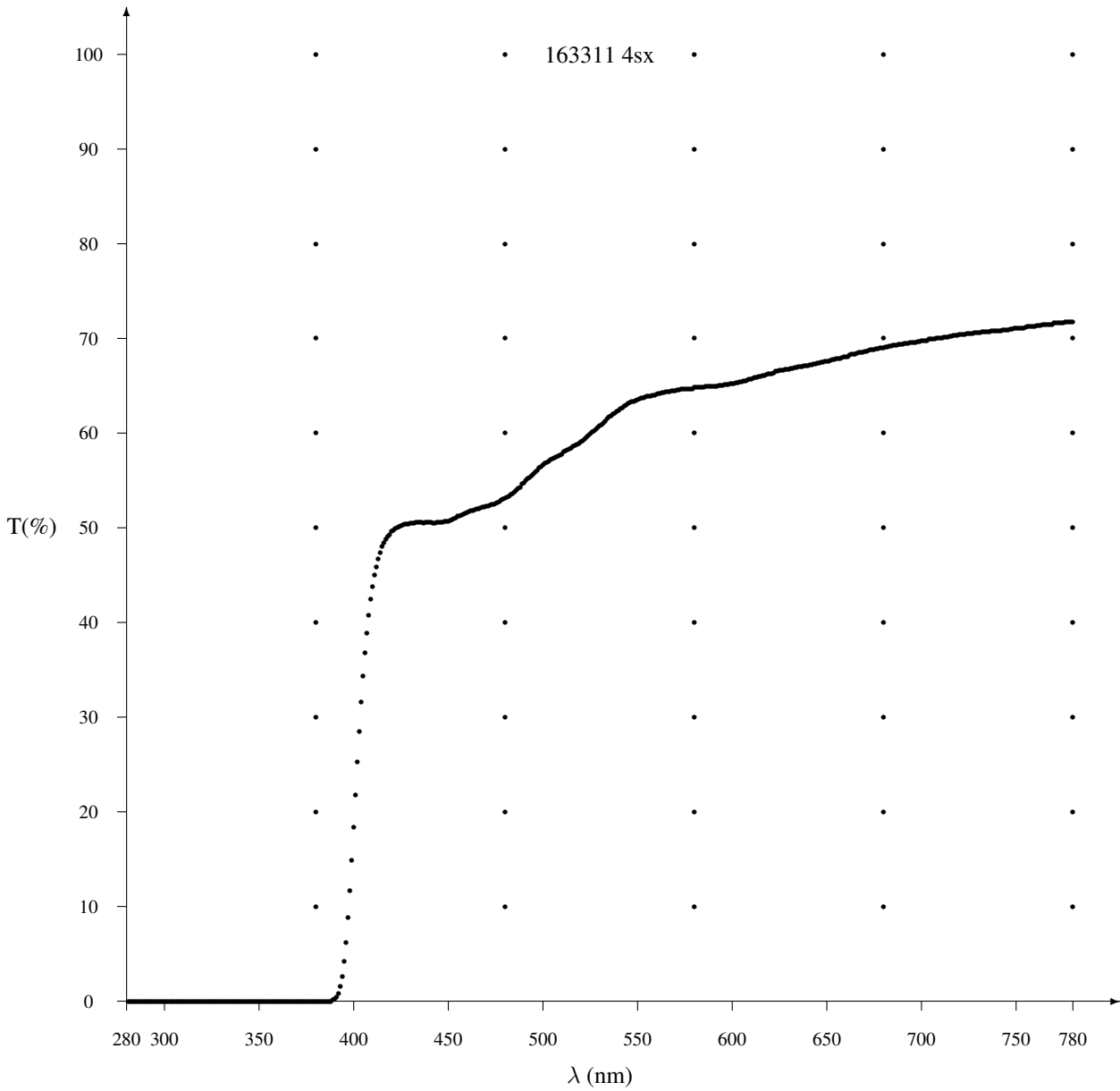
### Requirements

The relative variation of the luminous transmittance around the visual centre(s)  $P_1$  (and  $P_2$ ) shall not exceed the values stated in Table 4 of the standard.

The relative difference in luminous transmittance,  $P_3$ , between left and right oculars shall not exceed the values stated in Table 4 of the standard or 20% whichever is greater.

### Outcomes

Sample	$P_1$ (%)	Test	$P_2$ (%)	Test	$P_3$ (%)	Test
163311 4	0	Pass	0	Pass	1	Pass
163311 5	0	Pass	0	Pass	2	Pass
163311 6	0	Pass	0	Pass	1	Pass



## Resistance to ultraviolet radiation (oculars only)

### Clause 7.1.5.2

#### Requirements

The external surface of the filters is exposed to radiation of a 450W 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 degrees.

The absolute value of the relative variation of  $T_v$  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  $T_v$  and  $\ell^*$  after irradiation, the relative variation of  $T_v$  and the test results are:

Sample	$T_v$ (%)	$\Delta T_v / T_v$ (%)	Test	$\ell^*$ ( $\text{cd m}^{-2} \text{ lx}^{-1}$ )	Test
163311 4sx	62.1	-1	Pass	0.22	Pass
163311 5dx	63.0	-1	Pass	0.31	Pass
163311 6sx	62.2	-1	Pass	0.35	Pass

## Spherical, astigmatic and prismatic powers

### Clause 7.1.2.1

**Note:** The refractive powers of cover plates (see Clause 7.1.2.1.3 of the standard) shall comply with the tolerances for optical class 1 given in Tables 2 and 3 of the standard. The test results in the case of the cover plates here reported are relative to the optical class 1 requirements.

## Mounted oculars and unmounted oculars covering both eyes

### Clause 7.1.2.1.2

#### Requirements

**Note:** The refractive powers of cover plates shall comply with the tolerances for optical class 1 given in Tables 2 and 3 of the standard.

#### Outcomes

Sample	Sph. Refr. Pow. (D)	Test	Ast. Refr. Pow. (D)	Test
163311 1dx	0.00	Pass	0.01	Pass
163311 1sx	-0.01	Pass	0.01	Pass
163311 2dx	-0.01	Pass	0.00	Pass
163311 2sx	-0.01	Pass	0.00	Pass
163311 3dx	-0.01	Pass	0.00	Pass
163311 3sx	-0.01	Pass	0.01	Pass

#### Requirements

**Note:** The refractive powers of cover plates shall comply with the tolerances for optical class 1 given in Tables 2 and 3 of the standard.

**Outcomes**

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	Vert. Pris. Diff. (cm/m)	Test	Optical Class
163311 1	out	0.30	Pass	0.10	Pass	One
163311 2	out	0.35	Pass	0.00	Pass	One
163311 3	out	0.34	Pass	0.00	Pass	One

**Stability at an elevated temperature***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
163311 1	—	Pass
163311 2	—	Pass
163311 3	—	Pass

**Resistance to surface damage by fine particles***Clause 7.3.1***Requirements**

**Note:** This is not a resistance to abrasion test.

The ocular is fixed onto a revolving plate. Whilst the plate is rotated, 3 Kg of grain size quartz sand with between 500 and 710  $\mu\text{m}$  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,  $\ell^*$ , of the sample must be less than  $5 \text{ cd m}^{-2} \text{ lx}^{-1}$ .

**Outcomes**

The measurement values of  $\ell^*$  and the results of their related tests are:

Sample	$\ell^* (\text{cd m}^{-2} \text{ lx}^{-1})$	Test
163311 41sx	1.82	Pass
163311 42dx	1.64	Pass
163311 43sx	2.15	Pass
163311 44dx	2.27	Pass



## Mechanical Tests

### Lateral protection

#### Clause 7.2.8

#### Requirements

The eye-protector shall give lateral protection of the ocular region. The test consists to verify 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	Observations	Test
163311 1	—	Pass
163311 2	—	Pass
163311 3	—	Pass

### Resistance to fogging of oculars

#### Clause 7.3.2

#### Requirements

**Note:** This test does not assess resistance to fogging of the complete of the complete eye-protector.

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
163311 37sx	> 30	Pass
163311 38dx	> 30	Pass
163311 39sx	> 30	Pass
163311 40dx	> 30	Pass

### Protection against high speed particles at extremes of temperature

#### 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 (° C)	Speed (m/s)	Defects	Test
163311 45	right frontal	+55	45.7	—	Pass
163311 46	left frontal	+55	45.2	—	Pass
163311 47	right side	+55	46.5	—	Pass
163311 48	left side	+55	45.3	—	Pass
163311 49	right frontal	+55	45.2	—	Pass
163311 50	left frontal	+55	45.8	—	Pass
163311 51	right frontal	-5	45.7	—	Pass
163311 52	left frontal	-5	45.7	—	Pass
163311 53	right side	-5	45.5	—	Pass
163311 54	left side	-5	45.9	—	Pass
163311 55	right frontal	-5	46.4	—	Pass
163311 56	left frontal	-5	45.8	—	Pass

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Figure 1: Specimen picture.

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