CERTOTTICA

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TEST REPORT

Client:	BOLLE' PROTECTION
Address:	95 rue Louis Guérin - 69 100 VILLEURBANNE FRANCE
Article:	Spectacles
Model:	ASSAULT - CSP oculars
Job no.:	C160950
Report no.:	163313
Receiving Date:	19/07/2016
Date of Test Begin:	28/07/2016
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
163313 4dx	—	Pass
163313 4sx	—	Pass
163313 5dx	—	Pass
163313 5sx	—	Pass
163313 6dx	—	Pass
163313 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 $cd\,m^{-2}\,lx^{-1}$ for welding filters, 0.75 $cd\,m^{-2}\,lx^{-1}$ for oculars used in eye-protectors against high speed particles, 0.5 $cd\,m^{-2}\,lx^{-1}$ for all other oculars.

Outcomes

Sample	ℓ^* ($cd\,m^{-2}\,lx^{-1}$)	Test
163313 4dx	0.18	Pass
163313 4sx	0.17	Pass
163313 5dx	0.16	Pass
163313 5sx	0.12	Pass
163313 6dx	0.20	Pass
163313 6sx	0.16	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 Tv relative to a filter shade number are showed in the Tables 1 and 2 of the standard.

Outcomes

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

Sample	Tv (%)	Test
163313 4sx	62.6	Pass
163313 4dx	63.4	Pass
163313 5sx	63.6	Pass
163313 5dx	64.6	Pass
163313 6sx	62.6	Pass
163313 6dx	63.7	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 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 Tabb. 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 Tabb. 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
163313 4sx	0.00	Pass	0.00	Pass	0.00	Pass
163313 4dx	0.00	Pass	0.00	Pass	0.00	Pass
163313 5sx	0.00	Pass	0.00	Pass	0.00	Pass
163313 5dx	0.00	Pass	0.00	Pass	0.00	Pass
163313 6sx	0.00	Pass	0.00	Pass	0.00	Pass
163313 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
163313 4sx	1.06	Pass	1.04	Pass	0.98	Pass	0.95	Pass
163313 4dx	1.06	Pass	1.04	Pass	0.98	Pass	0.95	Pass
163313 5sx	1.06	Pass	1.04	Pass	0.98	Pass	0.96	Pass
163313 5dx	1.06	Pass	1.04	Pass	0.98	Pass	0.96	Pass
163313 6sx	1.06	Pass	1.04	Pass	0.98	Pass	0.95	Pass
163313 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
163313 4sx	0.90	Pass
163313 4dx	0.91	Pass
163313 5sx	0.92	Pass
163313 5dx	0.92	Pass
163313 6sx	0.91	Pass
163313 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
163313 4sx	5 - 1,4
163313 4dx	5 - 1,4
163313 5sx	5 - 1,4
163313 5dx	5 - 1,4
163313 6sx	5 - 1,4
163313 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

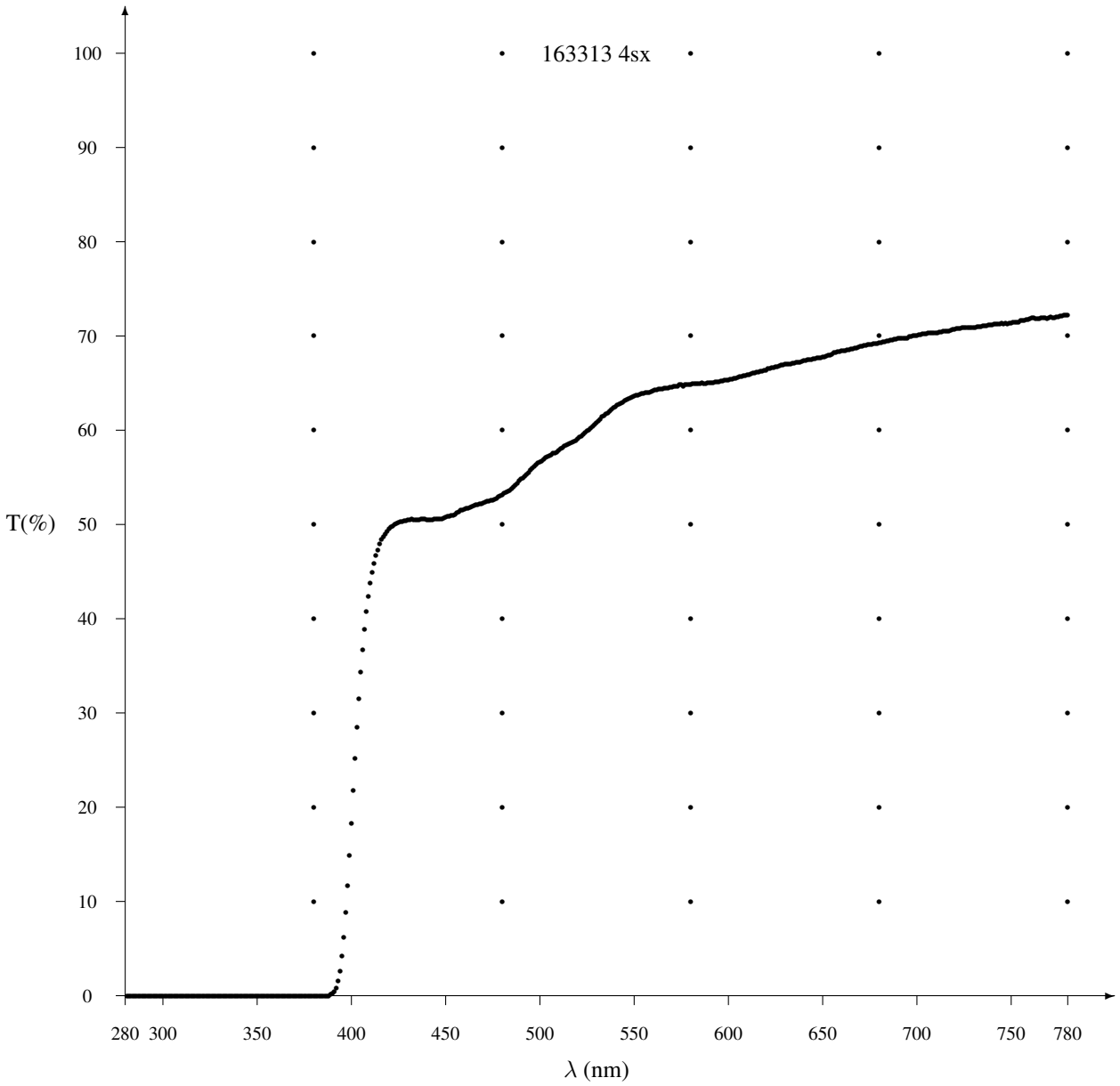
Requirements

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
163313 4	0	Pass	1	Pass	1	Pass
163313 5	0	Pass	1	Pass	2	Pass
163313 6	0	Pass	1	Pass	2	Pass


163313 4sx
T(%)
100
90
80
70
60
50
40
30
20
10
0
280 300 350 400 450 500 550 600 650 700 750 780
λ (nm)

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 ± 5 Celsius degrees.
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 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
163313 4sx	62.4	0	Pass	0.22	Pass
163313 5dx	64.3	-1	Pass	0.32	Pass
163313 6sx	62.3	0	Pass	0.41	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
163313 1dx	-0.01	Pass	0.01	Pass
163313 1sx	-0.02	Pass	0.01	Pass
163313 2dx	-0.02	Pass	0.01	Pass
163313 2sx	-0.02	Pass	0.01	Pass
163313 3dx	-0.02	Pass	0.01	Pass
163313 3sx	-0.02	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
163313 1	out	0.35	Pass	0.00	Pass	One
163313 2	out	0.40	Pass	0.05	Pass	One
163313 3	out	0.40	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 ± 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
163313 1	—	Pass
163313 2	—	Pass
163313 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 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 measurement values of ℓ^* and the results of their related tests are:

Sample	ℓ^* ($cd\,m^{-2}\,lx^{-1}$)	Test
163313 41sx	3.88	Pass
163313 42dx	1.68	Pass
163313 43sx	1.87	Pass
163313 44dx	3.69	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
163313 1	—	Pass
163313 2	—	Pass
163313 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
163313 37sx	> 30	Pass
163313 38dx	> 30	Pass
163313 39sx	13	Pass
163313 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 ± 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
163313 45	right frontal	+55	45.8	—	Pass
163313 46	left frontal	+55	46.0	—	Pass
163313 47	right side	+55	46.3	—	Pass
163313 48	left side	+55	45.9	—	Pass
163313 49	right frontal	+55	45.7	—	Pass
163313 50	left frontal	+55	45.7	—	Pass
163313 51	right frontal	-5	46.0	—	Pass
163313 52	left frontal	-5	45.1	—	Pass
163313 53	right side	-5	46.1	—	Pass
163313 54	left side	-5	46.0	—	Pass
163313 55	right frontal	-5	45.4	—	Pass
163313 56	left frontal	-5	45.7	—	Pass

Figure 1: Specimen picture.

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