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| Specification Physical and chemical properties | PCP D 4150 |
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- p r o v i s i o n a l -

ACE Improved

D 4150

Colour: blue

Application: light tinted sunglare filter with
contrast intensification and
UV - absorption
filter category 1 acc. to DIN EN 1836

The subsequent properties are based primarily upon the measuring results of the very latest standards and measuring methods, which are defined in corresponding "Measuring and Test Procedures".
We retain the right to change the data in keeping with the latest technical standards.
Non-toleranced numerical values are reference values of an average production quality.

Values marked with \diamond do not apply to the type of glass or no values are available.

Requirements deviating from these specifications must be defined in writing in a **customer agreement**.

| Specification | | PCP D 4150 | | | | | |
|----------------------------------|--|-----------------------|--------|-----|-----|-----|-----|
| Physical and chemical properties | | | | | | | |
| 1. | Optical properties | | | | | | |
| 1.1 | Refractive indices (20 °C) | | | | | | |
| | Pretreatment of samples | n_g | 1.5624 | | | | |
| | [x] Condition as supplied | $n_{F'}$ | 1.5569 | | | | |
| | [] annealed at 40 °C/h | n_F | ◇ | | | | |
| | | n_e | 1.5512 | | | | |
| | | n_d | ◇ | | | | |
| | | n_D | 1.5485 | | | | |
| | | $n_{C'}$ | 1.5458 | | | | |
| | | n_C | ◇ | | | | |
| 1.1.1 | Abbe value | v_e | 49.7 | | | | |
| | | v_d | ◇ | | | | |
| 1.2 | Transmittance data | | | | | | |
| 1.2.1 | Spectral transmittance $\tau(\lambda)$ | | | | | | |
| 1.2.1.1 | $\tau(\lambda)$ - curve | | | | | | |
| | Plot of spectral transmittance $\tau(\lambda)$ for $d = 1.9$ mm ($\lambda = 300$ nm to 1500 nm) | see annex | | | | | |
| 1.2.1.2 | $\tau(\lambda)$ - individual values in % ($d = 1.9$ mm) | | | | | | |
| | $\tau(\lambda)_{\max}$ for the λ - range 280 nm to 315 nm | < 0.05 | | | | | |
| | $\tau(\lambda)_{\max}$ for the λ - range 315 nm to 350 nm | < 0.05 | | | | | |
| | τ_{380} | 5.9 | | | | | |
| | $\tau(\lambda)_{\min}$ for the λ - range 500 nm to 650 nm | 8.6 | | | | | |
| | This filter is acc. to DIN EN 1836 and DIN EN 172 "not suitable for driving and road use" | | | | | | |
| 1.2.1.3 | Edge wavelength ($d = 1.9$ mm) | | | | | | |
| | Edge wavelength λ_c ($\tau = 0.46$) in nm | ◇ | | | | | |
| 1.2.2 | Luminous transmittance τ_v | | | | | | |
| 1.2.2.1 | Luminous transmittance τ_{vC} in % at nominal thickness $d = 1.9$ mm | 52* | | | | | |
| | * nominal transmittance | | | | | | |
| | Luminous transmittance as a function of thickness | | | | | | |
| | Thickness in mm | 1.4 | 1.9 | 3.0 | 4.0 | 5.0 | 6.0 |
| | τ_{vD65} in % | ◇ | 52.0 | ◇ | ◇ | ◇ | ◇ |
| | τ_{vA} in % | ◇ | 50.3 | ◇ | ◇ | ◇ | ◇ |
| | τ_{vC} in % | ◇ | 52.1 | ◇ | ◇ | ◇ | ◇ |

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| Physical and chemical properties | | | |
| 1.2.2.2 | Scale number / Filter category | | |
| | N for mean thickness $d =$ mm ($\tau_{vD65} =$ %) | | ◇ |
| | N for mean thickness $d =$ mm ($\tau_{vD65} =$ %) | | ◇ |
| | filter category for luminous transmittance $\tau_{vD65} = 52$ % | | 1 |
| 1.2.3 | Special transmittance values in % ($d = 1.9$ mm) | | |
| 1.2.3.1 | UV - transmittance | | |
| | | τ_{UVA} | 0.6 |
| | | τ_{SUV} | 0.3 |
| | | τ_{SUVA} | 0.5 |
| | | τ_{SUVB} | < 0.05 |
| 1.2.3.2 | IR - transmittance | τ_{SIR} | 83.9 |
| 1.2.3.3 | Solar blue - light transmittance | τ_{sb} | 62.9 |
| 1.3 | Colour | | |
| 1.3.1 | Visual evaluation | | ◇ |
| 1.3.2 | Colorimetry | | |
| | Chromaticity coordinates | x | 0.286 |
| | | y | 0.303 |
| | Chromaticity coordinates (colour locus) are referred to the Standard Illuminant D65 according CIE 10°-observer for nominal thickness ($d = 1,9$ mm) | | |
| 1.3.3 | Signal light recognition | | |
| | Relative visual attenuation coefficient (quotient) Q | Q_{blue} | 1.15 |
| | for signal light recognition for nominal thickness ($d = 1,9$ mm) | Q_{green} | 1.04 |
| | | Q_{yellow} | 0.92 |
| | | Q_{red} | 1.10 |
| 1.3.4 | Yellowness index ($d = 10$ mm) | | |
| | | Y_i | ◇ |

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|---|--|---------------------------------|----------------------------------|
| Physical and chemical properties | | D 4150 | |
| 2. Thermal properties | | | |
| 2.1 Viscosities and corresponding temperatures | | | |
| Designation | | Viscosity $\lg \eta$ in dPas | Temperature ϑ in °C |
| Strain point | | 14.5 | 545 |
| Annealing point | | 13.0 | 574 |
| Softening point | | 7.6 | 750 |
| Forming temperature | | 6.0 | 850 |
| Forming temperature | | 5.0 | 937 |
| Forming temperature | | 4.0 | 1054 |
| 2.2 Transformation temperature T_g in °C | | | 575 |
| 2.3 Coefficient of mean linear thermal expansion $\alpha(20\text{ °C};300\text{ °C})$ in 10^{-6} K^{-1} (Static measurement) | | | 8.7 |
| 2.4 Fuseability | | | ◇ |
| 2.5 Mean specific heat capacity $c_p(20\text{ °C to }100\text{ °C})$ in $\text{J}/(\text{g} \cdot \text{K})$ | | | ◇ |
| | | | |

| Specification | | PCP D 4150 |
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| Physical and chemical properties | | |
| 3. | Mechanical properties | |
| 3.1 | Density ρ in g/cm ³ (annealed at 40 °C/h) | 2.72 |
| 3.2 | Stress optical coefficient C in $1.02 \cdot 10^{-12}$ m ² /N | 2.69 |
| 3.3 | Breaking strength | |
| | A higher mechanical strength can be realized by chemical toughening according to the ion exchange procedure or by thermal toughening. Both toughening methods may cause slight transmittance - and colourchanges. | |
| 3.3.1 | Chemical toughening * | |
| | * Salt bath: 99.5 % KNO ₃ , and 0.5 % H ₂ SiO ₃ (% = Weight percentages) | |
| | Processing temperature ϑ in °C | ◇ |
| | Processing time t in h | ◇ |
| | Compressive stress D_s as birefringence in nm/cm | ◇ |
| | Penetration depth Nz up to neutral zone in μ m | ◇ |
| 3.3.2 | Thermal toughening | |
| | Recommended minimum thickness d in mm for toughened safety glass lenses without corrective effect as per ball drop test (DIN EN 168) | 2.5 |
| 3.4 | Young´s modulus E in kN/mm ² | ◇ |
| 3.5 | Poisson´s ratio μ | ◇ |
| 3.6 | Torsion modulus G in kN/mm ² | ◇ |
| 3.7 | Knoop hardness HK 0.1/20 | 480 |
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| Physical and chemical properties | | D 4150 |
| 4. | Chemical properties | |
| 4.1 | Hydrolytic resistance acc. to DIN ISO 719 | |
| | Hydrolytic class | HGB 3 |
| | Equivalent of alkali (Na ₂ O) per gram of glass grains in µg/g | 128 |
| 4.2 | Acid resistance acc. to DIN 12 116 | |
| | Acid class | S 2 |
| | Half surface weight loss after 6 hours in mg/dm ² | 0.8 |
| 4.3 | Alkali resistance acc. to DIN ISO 695 | |
| | Class | A 2 |
| | Surface weight loss after 3 hours in mg/dm ² | 97 |
| 4.4 | Hazardous Substances | |
| | EC-directive 2002/95/EC (RoHS-directive) | on request |
| 5. | Electrical properties | disregarded |
| 6. | Other properties | disregarded |
| 7. | Annex (diagrams, curves) | |

Form 0050/1e

Specification

Physical and chemical properties

PCP
D 4150

Spectral Transmittance

Type of Glass: ACE Improved
Thickness: 1.9 mm

