

CONTURAN®



Anti-reflective glass
for an absolutely
clear view



Crystal-clear benefits for your products and your customers



CONTURAN® in railroad destination indicators in the main station Hanover

Our most important sensory organs are our eyes. In everyday life we only believe what we can see with our own eyes. If anything stops us seeing clearly, it can cause annoyance and raise doubts in our mind.

Sunlight or artificial light reflected by glass can severely restrict our view and may create a serious hazard.

With CONTURAN®, total vision and, therefore, an absolutely clear view are substantially guaranteed. And that applies to a wide range of applications.

CONTURAN® has already proven itself for instrument and indicator board covers, railroad destination indicators, computer monitor and TV screen anti-glare filters and much more. Basically there is a use for CONTURAN® wherever irritating reflections occur.

Maximize your own clear market benefits by ensuring that your products are put to their best possible use by providing a clear view.

Clearly the best choice

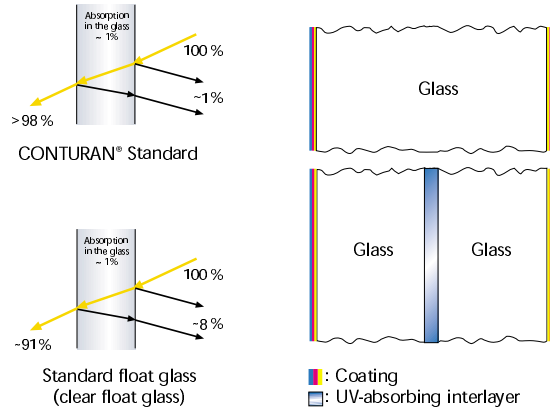
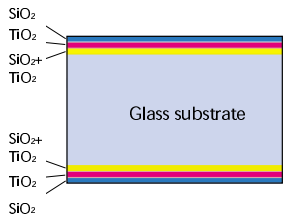
CONTURAN® is an anti-reflective glass with optical interference coatings between 50 nm and 100 nm thick applied to both sides by dip coating. In contrast to conventional, uncoated glass CONTURAN® provides the best view at all times. Use this innovative special glass technology with crystal-clear competitive benefits for your products.

Less reflection – high transmission

See for yourself, with your own eyes, the product benefits that CONTURAN® can offer you compared to standard float glass. Its reduced reflection and resultant high light transmission guarantees an unrestricted view.

Further processing for greater safety

CONTURAN® can be used in the form of thermally toughened glass (for safety glass 4 mm thick) or as laminated safety glass CONTURAN® Protect. The optical properties of the latter are the same as for CONTURAN® Standard or alternatively CONTURAN® Magic of the same total thickness.



Specific applications using different glass substrates

CONTURAN® represents a whole product family that provides solutions for customer-specific problems: the base material for CONTURAN® Standard is ordinary clear float glass; CONTURAN® Magic is made from extra clear low iron float glass and CONTURAN® Grey from grey float glass. Each of these glasses effects a significant reduction in reflection.

| Product group | Substrate | Effect |
|--------------------|--|--|
| CONTURAN® Standard | Standard float glass (clear float glass) | Colour neutrality and significant reduction of reflection |
| CONTURAN® Magic | Extra clear low iron float glass | Colour neutrality and significant reduction of reflection |
| CONTURAN® Grey | Grey float glass with different luminous transmittance | Increase in contrast and significant reduction of reflection |

CONTURAN® lets more light through

CONTURAN® combines two significant benefits: it lets more light through and reduces reflections significantly.

Increased transmission

With CONTURAN® Standard and CONTURAN® Magic the relative increase in luminous transmittance is up to 8%. With CONTURAN® Magic the luminous transmittance value increases from 92% to 99%.

Reduced reflection

The regular spectral reflectance with CONTURAN® differs significantly from the reflectance with ordinary clear float glasses. In the visible range, float glass has an 8% reflectance, CONTURAN® Standard 1% and CONTURAN® Grey for example with blue-violet anti-reflective coating 0.5% reflectance. With a glass thickness of three millimeters, the luminous reflectance with CONTURAN® Grey is reduced from 6% to 0.5%. That corresponds to a relative reduction of the reflection of about 92%.

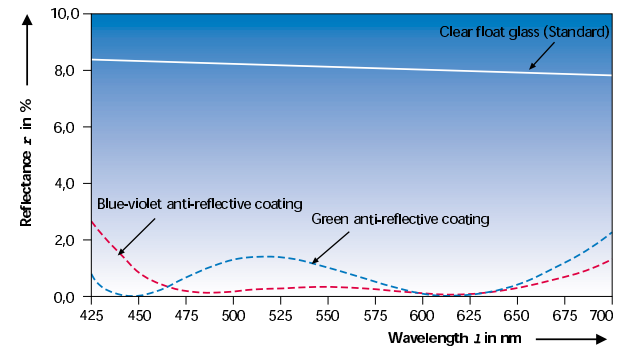
Visual colour impression

In transmission the visual rating of CONTURAN® is colour neutral. CONTURAN® Standard and Magic show a greenish tinge in the reflection. A blue-violet anti-reflective coating can, however, be supplied on request. The reflection from CONTURAN® Grey is basically blue-violet.

| CONTURAN® | Glass thicknesses in mm | Luminous transmittance τ_{VA} in % (absolute) | | Relative increase in the transmittance by |
|-----------|-------------------------|--|-------------------------------|---|
| | | Before anti-reflective coating | After anti-reflective coating | |
| Standard | 2; 3; 4; 5; 6; 8 | 91 to 88 | 98 to 95 | ~ 8 % to 7 % |
| Magic | 2; 3; 4; 6; 8 | 92 to 91 | 99 to 98 | ~ 8 % |
| Grey | 3; 4; 5; 6 | 62 56, 50, 44 | 67 61, 54, 48 | ~ 8 % ~ 9 % to 8 % |

| CONTURAN® | Glass thicknesses in mm | Luminous reflectance r_{VA} in % (absolute) | | Relative reduction in reflectance by |
|-----------|-------------------------|---|-------------------------------|--------------------------------------|
| | | Before anti-reflective coating | After anti-reflective coating | |
| Standard | 2; 3; 4; 5; 6; 8 | 8 | ca. 0.9 | < 90 % |
| Magic | 2; 3; 4; 6; 8 | 8 | ca. 0.9 | < 90 % |
| Grey | 3; 4; 5; 6 | 6 6 to 5 | 0.5 0.5 | ~ 92 % ~ 92 % to 90 % |

Regular spectral reflectance $r(\lambda)$ of CONTURAN® of average production state



CONTURAN® provides vision that lasts

Guaranteed vision is all well and good – but how long does it last? Glass used in consumer goods is subjected to all sorts of outside influences on a daily basis. As a result its quality is often adversely affected and the coating gets damaged. CONTURAN® can change all that for you: it not only has a high chemical resistance, its abrasion resistance and adhesion properties are permanent.

| What is tested? | Test method | Result |
|-------------------------------------|---|-----------------------------------|
| Corrosion resistance of the coating | Copper Accelerated Acetic Acid-Salt Spray Testing (DIN 50 021 – CASS) | No peeling off of coating visible |
| Adhesion of the coating | In accordance with DIN 58 196-K2 (Part 6) | No peeling off of coating visible |

High chemical resistance

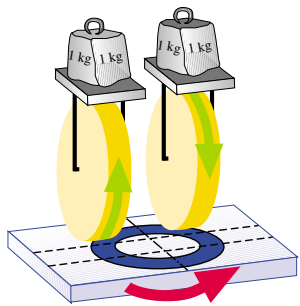
CONTURAN® has proved its chemical resistance in a range of test methods. Its anti-reflective coating has demonstrated that it is resistant to drinks and cockpit sprays. The Copper Accelerated Acetic Acid-Salt Spray Testing has

confirmed its good resistance to corrosion: no peeling off of coating visible.

Abrasion resistance of the layers tested using the Taber-Abraser based on DIN 52347

| Item tested | Taber class |
|--------------------------------|-------------|
| Uncoated float glass | 1 |
| CONTURAN® | 1 – 2 |
| Polymethyl methacrylate (PMMA) | 4 |

CONTURAN® can be cleaned easily with a cloth and conventional glass cleaner or an alcohol-water mixture (1:1 ratio).



Principle of the Taber test

High abrasion resistance

The Taber abrasion test certifies a Taber class from 1 to 2. This means that CONTURAN® is very resistant to abrasion and is therefore highly suitable for use with consumer goods.

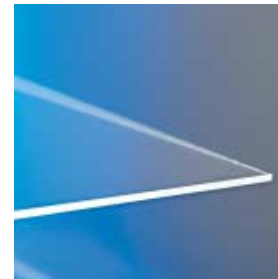
Suitable for a wide range of processing methods

CONTURAN® can be used for a wide range of applications and the range of processing methods that can be used with it is just as wide. From 3 mm thick and above it can be thermally

toughened (for safety glass $d \geq 4$ mm); it can be shaped (e.g. by cylindrical bending or molding), surface treated (screenprinting) and processed in a variety of other ways (cutting, drilling,

edge treatment). Consequently, the areas of application for CONTURAN® are virtually unlimited.

Glass treatment



Cutting



Edge treatment



Drilling

Surface treatment



Screenprinting

Shaping



Molding

CONTURAN® at a glance

The technology:

- A special dipping process is used to coat the glass with layers of metal oxides which produce the anti-reflective effect. These are then fired on.

The basic benefits:

- Reduction of irritating reflections
- Good view of dimly lit items
- High transmission
- Resistance to chemical attack and abrasion

Additional benefits:

- No cleaning problems
- Increased contrast effect (CONTURAN® Grey)

Areas of application:

- Instruments and monitors (e.g. TVs, computers, measuring instruments)
- Indicator boards (e.g. railroad destination indicators)
- Displays and control panels (e.g. film keyboards)
- Freezer cabinets
- Low voltage lamps, projection lamps

Wherever irritating reflections occur.

Advanced Materials
SCHOTT North America, Inc.
555 Taxter Road
Elmsford, NY
Phone: (914) 831-2200
Fax: (914) 831-2201
conturan@us.schott.com
www.us.schott.com/conturan

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glass made of ideas