HEBO

SPEZIALGLAS

COLOR FILTER GLASS

Ultraviolet

Yellow

Orange

Red

Infrared

Blue

Green

Violet

Neutral Density

Heat Absorbing

Rising Color

Wavelength Calibrated

Color Filter Glass Types

ULTRAVIOLET Page 4/5	HEBO	Schott	Hoya
	UV 280	≈ WG 280	≈ UV-28
	UV 360	≈ WG 360	≈ UV-36

ULTRAVIOLET Page 6/7	HEBO	Schott	Hoya
	HU 01	≈ UG 11	≈ U-340
	HU 02	≈ UG 1	≈ U-360
	HU 03	≈ UG 5	≈ U-330

YELLOW Page 8/9	HEBO	Schott	Hoya
	HY 01	≈ GG 19	
	HY 02	≈ GG 10	

YELLOW Page 10/11	HEBO	Schott	Hoya
	Y 380	≈ GG 375	≈ L-38
	Y 400	≈ GG 400	≈ L-40
	Y 420	≈ GG 420	≈ L-42

YELLOW Page 12/13	HEBO	Schott	Hoya
	Y 460	≈ GG 455	≈ Y-46
	Y 500	≈ GG 495	≈ Y-50
	Y 510	≈ OG 515	

ORANGE Page 14/15	HEBO	Schott	Hoya
	O 530	≈ OG 530	
	O 540		≈ O-54
	O 550	≈ OG 550	
	O 565	≈ OG 570	≈ O-56
	O 580	≈ OG 590	≈ O-58

RED Page 16/17	HEBO	Schott	Hoya
	R 600		≈ R-60
	R 610	≈ RG 610	
	R 630	≈ RG 630	≈ R-62
	R 640	≈ RG 645	≈ R-64

RED Page 18/19	HEBO	Schott	Hoya
	R 650		≈ R-66
	R 670	≈ RG 665	
	R 700	≈ RG 695	≈ R-70
	R 720	≈ RG 715	≈ R-72

INFRARED Page 20/21	HEBO	Schott	Hoya
	IR 760		≈ IR-76
	IR 780	≈ RG 780	
	IR 800		≈ IR-80
	IR 830	≈ RG 830	≈ IR-83
	IR 850	≈ RG 850	≈ IR-85

INFRARED Page 22/23	HEBO	Schott	Hoya
	HR 01		≈ RM-86
	HR 02	≈ RG 7	≈ RM-90
	HR 03		

BLUE Page 24/25	HEBO	Schott	Hoya
	B 01		
	B 02		≈ B-410
	B 03		
	B 05		≈ B-440

BLUE Page 26/27	HEBO	Schott	Hoya
	B 09		
	B 10		
	B 11		≈ B-460
	B 13		
	B 14	≈ BG 14	

BLUE Page 28/29	HEBO	Schott	Hoya
	B 15		
	B 38	≈ BG 38	

BLUE Page 30/31	HEBO	Schott	Hoya
	B 07	≈ BG 7	≈ B-480
	B 12	≈ BG 12	
	B 18	≈ BG 18	
	B 25	≈ BG 25	≈ B-380

BLUE Page 32/33	HEBO	Schott	Hoya
	B 39	≈ BG 39	
	B 40	≈ BG 40	

GREEN Page 34/35	HEBO	Schott	Hoya
	G 05	≈ VG 5	
	G 06	≈ VG 6	
	G 13		≈ G-545
	G 16		

GREEN
Page 36/37

HEBO	Schott	Hoya
G 08	≈ VG 8	≈ G-533
G 09	≈ VG 9	
G 10	≈ VG 10	
G 11	≈ VG 11	
G 12		≈ G-550

VIOLET
Page 38/39

HEBO	Schott	Hoya
V 01		≈ B-390
V 02	≈ BG 3	
V 03		≈ B-370

NEUTRAL DENSITY
Page 40/41

HEBO	Schott	Hoya
ND 01	≈ NG 1	≈ ND-0
ND 03	≈ NG 3	
ND 04	≈ NG 4	≈ ND-13
ND 09	≈ NG 9	≈ ND-03

NEUTRAL DENSITY
Page 42/43

HEBO	Schott	Hoya
ND 02		
ND 05	≈ NG 5	≈ ND-25
ND 06		≈ ND-50
ND 11	≈ NG 11	≈ ND-70

HEAT ABSORBING
Page 44/45

HEBO	Schott	Hoya
HA 02	≈ KG 2	≈ HA-50
HA 03	≈ KG 3	≈ HA-30

RISING COLOR
Page 44/45

HEBO	Schott	Hoya
RC 01	(≈ BG 34)	≈ LB-120

WAVELENGTH CALIBRATED
Page 46/47

HEBO	Schott	Hoya
WL 01	≈ BG 20	≈ V-10

The filter glasstypes shown in the charts are available as polished filters manufactured according to your specifications. Raw material is not available.

The polished filters are available in thicknesses from 0.5 up to 10.0 mm and edgelengths from 2.0 up to 200.0 mm (special dimensions upon request).
The designation of each table is as follows:
- 1st column: Filterglass group (Color)
- 2nd column: Designation filter glasstype from HEBO
- 3rd column: Designation of equivalent filter glasstype by Schott
- 4th column: Designation of equivalent filter glasstype by Hoya

The indication of the equivalent filter glasstype of Schott or Hoya is only informative – this does not imply that the filter glasstypes from Hebo is 100% identical with the Schott or Hoya glasses. Please check on the filter datasheets if the material complies with the requirements you have.

Polished samples of the HEBO filters are available from stock in Aalen/Germany of those types where the corresponding Schott designation is shown on the tables. Other samples, delivery terms and prices upon request.

Available sizes of polished samples of HEBO filterglasses:
50 × 50 × 1 mm
50 × 50 × 2 mm

Explantation as to data tables

Y	Tristimulus value
A[2856K]	CIE standard illuminant A, Planckian radiator at 2,855.6 K, light from incandescent bulbs
D65	CIE standard illuminant D65, standard daylight
x, y	Chromaticity coordinates
D_A	Acid durability
D_W	Water durability
N_D	Refractive indice (He 587.6 nm)
α	Mean coefficient of linear thermal expansion
T_g (°C)	Transformation temperature
T_s (°C)	Sag temperature
ρ	Specific gravity (g/cm³)
v	Conversion value
(mired)	Micro reciprocal degree
λ_{ti}	Edge position
λ_p	Limit of the passband
T_p	Filter factor
T_k (nm/°C)	Temperature coefficient

All indications and values in this catalogue are standard values.

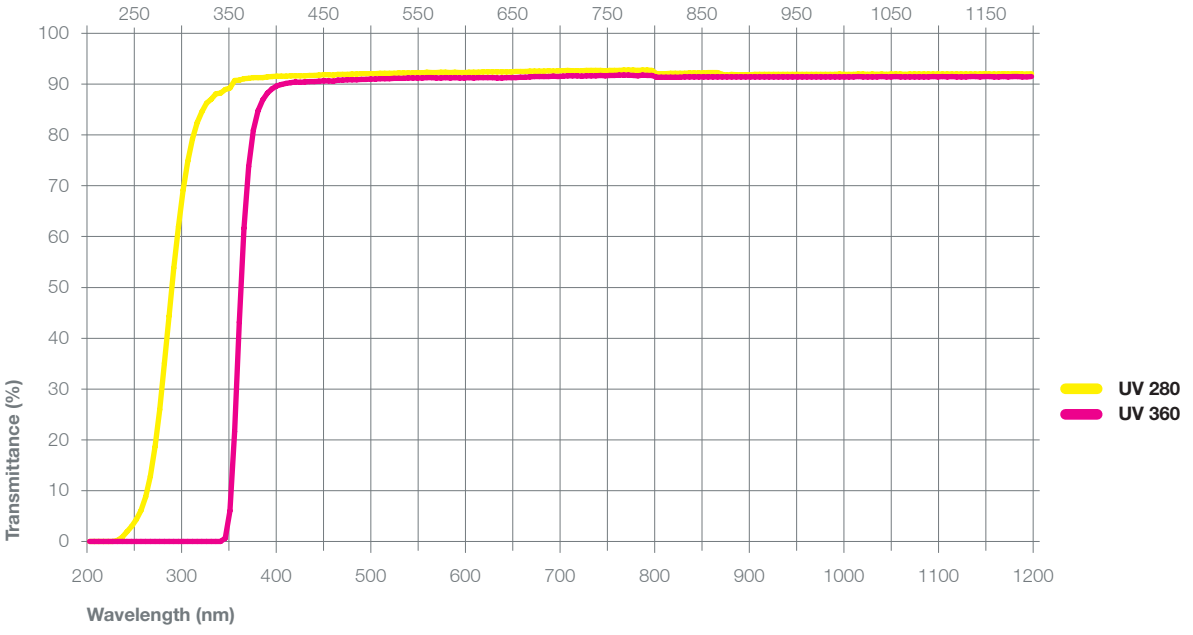
Glass Types

ULTRAVIOLET	HEBO	Schott	Hoya
	UV 280	≈ WG 280	≈ UV-28
	UV 360	≈ WG 360	≈ UV-36

Ultraviolet Glass Characteristics

Type	Thickness (mm)	A[2856K]			D65			Chemical Stability		N_D	α×10-7(°C)	T_g(°C)	T_s(°C)	ρ (g/cm³)
		x	y	Y	x	y	Y	D_A	D_W					
UV 280	2							1	4	1.508	81	586	656	2.47
UV 360	2									1.643	98	487	546	3.72

Type	Thickness (mm)	λ_{ti}(nm)	λ_p(nm)	$T\lambda_p$(%)	T_k(nm/°C)		Bubbles	Striae	Stress
UV 280	2	280± 10	340	≥89.5	≥0.5		B	3C	3
UV 360	2	360± 10	440	≥87.0	≥1.0		C-B	3C	3



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	UV 280	UV 360
Thickness (mm)	2	2
Wavelength (nm)	%T	%T
200	0,004	0,010
210	0,001	0,008
220	0,015	0,012
230	0,884	0,017
240	3,004	0,016
250	6,109	0,017
260	12,824	0,016
270	25,951	0,018
280	44,349	0,016
290	61,930	0,009
300	74,821	0,003
310	82,444	$4 \cdot 10^{-4}$
320	86,277	$2 \cdot 10^{-4}$
330	88,128	$6 \cdot 10^{-5}$
340	88,975	0,633
350	90,699	21,640
360	91,045	61,663
370	91,257	80,901
380	91,307	86,878
390	91,498	89,086
400	91,534	89,952
410	91,625	90,319
420	91,623	90,372
430	91,694	90,509
440	91,762	90,563
450	91,832	90,654
460	91,906	90,760
470	91,927	90,835
480	91,968	90,867
490	92,042	90,956
500	92,095	91,009
510	92,122	91,058
520	92,152	91,128
530	92,196	91,173
540	92,223	91,192
550	92,202	91,186
560	92,281	91,259
570	92,369	91,234
580	92,302	91,230
590	92,264	91,202
600	92,378	91,263
610	92,375	91,253
620	92,393	91,249
630	92,425	91,235
640	92,449	91,252
650	92,470	91,310
660	92,500	91,353
670	92,579	91,460
680	92,563	91,460
690	92,590	91,570

	UV 280	UV 360
Thickness (mm)	2	2
Wavelength (nm)	%T	%T
700	92,661	91,564
710	92,649	91,624
720	92,623	91,585
730	92,715	91,666
740	92,671	91,690
750	92,680	91,687
760	92,733	91,747
770	92,756	91,798
780	92,679	91,650
790	92,774	91,706
800	92,053	91,340
810	92,056	91,358
820	92,104	91,376
830	92,144	91,391
840	92,204	91,429
850	92,199	91,408
900	91,875	91,449
950	91,935	91,437
1000	91,945	91,426
1050	91,974	91,452
1065	91,955	91,437
1100	91,986	91,440
1200	92,029	91,467
1300	92,073	91,483
1400	91,914	91,374
1500	92,086	91,466
1600	92,117	91,422
1700	92,060	91,156
1800	92,011	90,719
1900	91,941	90,240
2000	91,732	89,509
2100	91,312	88,698
2200	90,831	87,207
2300	90,717	86,478
2400	90,200	85,294
2500	89,287	83,853
2600	88,600	82,317
2700	84,891	78,142
2800	53,450	40,665
2900	57,657	37,584
3000	58,741	34,051

OPTICS CONCEPT

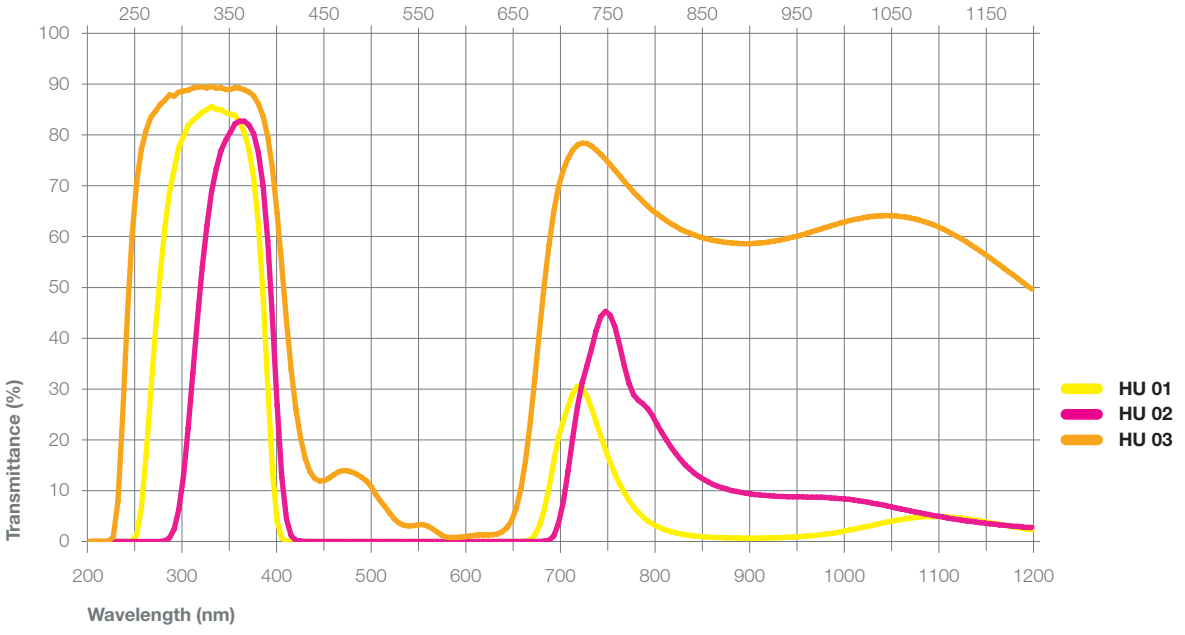
Glass Types

ULTRAVIOLET	HEBO	Schott	Hoya
	HU 01	≈ UG 11	≈ U-340
	HU 02	≈ UG 1	≈ U-360
	HU 03	≈ UG 5	≈ U-330

Ultraviolet Glass Characteristics

Type	Thickness (mm)	A[2856K]			D65			Chemical Stability		N_D	α×10-7(°C)	T_g(°C)	T_s(°C)	ρ (g/cm³)
		x	y	Y	x	y	Y	D_A	D_W					
HU 01	1	0.734	0.266	0.1	0.726	0.262	0.0	4	4	1.557	94	529	588	2.87
HU 02	1	0.532	0.171	0.9	0.231	0.032	0.4	2	2	1.520	97	515	589	2.65
HU 03	1	0.711	0.256	0.3	0.538	0.176	0.1	2	3	1.526	85	527	616	2.63

Type	Bubbles	Striae	Stress
HU 01	C	3C	4
HU 02	D-C	3C	4
HU 03			



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	HU 01	HU 02	HU 03
Thickness (mm)	1	1	1
Wavelength (nm)	%T	%T	%T
200	$5 \cdot 10^{-4}$	$2 \cdot 10^{-4}$	$9 \cdot 10^{-4}$
210	$2 \cdot 10^{-4}$	$2 \cdot 10^{-4}$	$2 \cdot 10^{-4}$
220	0,001	0,001	0,904
230	$5 \cdot 10^{-4}$	$3 \cdot 10^{-4}$	24,641
240	0,091	$6 \cdot 10^{-4}$	60,009
250	6,595	$1 \cdot 10^{-4}$	77,202
260	29,262	$9 \cdot 10^{-5}$	83,498
270	52,219	0,019	85,944
280	68,677	0,721	87,866
290	77,570	6,296	88,471
300	81,857	22,330	88,803
310	83,649	43,984	89,334
320	84,948	62,140	89,206
330	85,031	73,323	89,161
340	84,428	78,926	88,940
350	83,861	82,212	89,277
360	80,415	82,729	88,859
370	71,502	80,208	87,664
380	48,377	69,920	83,689
390	13,862	43,951	73,366
400	0,624	12,582	54,179
410	0,001	1,150	33,744
420	$4 \cdot 10^{-4}$	0,044	20,391
430	$5 \cdot 10^{-5}$	0,001	13,747
440	$2 \cdot 10^{-4}$	$2 \cdot 10^{-4}$	11,872
450	$6 \cdot 10^{-4}$	0,001	12,445
460	$1 \cdot 10^{-4}$	$8 \cdot 10^{-4}$	13,674
470	$2 \cdot 10^{-4}$	$3 \cdot 10^{-4}$	13,890
480	$3 \cdot 10^{-4}$	$5 \cdot 10^{-5}$	13,208
490	$2 \cdot 10^{-4}$	$7 \cdot 10^{-4}$	11,917
500	$2 \cdot 10^{-4}$	$8 \cdot 10^{-5}$	9,247
510	$6 \cdot 10^{-5}$	$2 \cdot 10^{-4}$	6,791
520	$6 \cdot 10^{-4}$	$4 \cdot 10^{-4}$	4,370
530	$3 \cdot 10^{-4}$	$6 \cdot 10^{-4}$	3,174
540	$6 \cdot 10^{-4}$	$6 \cdot 10^{-5}$	3,100
550	$3 \cdot 10^{-4}$	$5 \cdot 10^{-4}$	3,333
560	$6 \cdot 10^{-4}$	$2 \cdot 10^{-4}$	2,552
570	$2 \cdot 10^{-4}$	$6 \cdot 10^{-4}$	1,249
580	$1 \cdot 10^{-4}$	$7 \cdot 10^{-4}$	0,777
590	$2 \cdot 10^{-4}$	$1 \cdot 10^{-4}$	0,827
600	$2 \cdot 10^{-4}$	$4 \cdot 10^{-4}$	1,044
610	$1 \cdot 10^{-4}$	$1 \cdot 10^{-4}$	1,253
620	$8 \cdot 10^{-4}$	$2 \cdot 10^{-4}$	1,262
630	$2 \cdot 10^{-4}$	$3 \cdot 10^{-5}$	1,499
640	$5 \cdot 10^{-4}$	0,001	2,716
650	0,003	$4 \cdot 10^{-4}$	6,536
660	0,092	$4 \cdot 10^{-5}$	15,974
670	1,279	0,001	32,367
680	6,314	0,036	50,592
690	15,619	1,086	64,814

	HU 01	HU 02	HU 03
Thickness (mm)	1	1	1
Wavelength (nm)	%T	%T	%T
700	23,807	7,843	73,122
710	29,133	20,503	77,040
720	30,281	31,162	78,398
730	26,243	37,877	77,786
740	20,677	44,299	76,213
750	15,571	44,520	74,148
760	11,362	38,618	71,973
770	8,095	31,085	69,839
780	5,722	27,794	67,803
790	4,071	26,166	65,983
800	2,941	23,043	64,510
810	2,193	20,012	63,147
820	1,678	17,306	61,984
830	1,345	15,126	61,039
840	1,084	13,427	60,288
850	0,936	12,173	59,709
900	0,652	9,344	58,630
950	0,918	8,789	60,127
1000	2,047	8,383	62,855
1050	3,988	6,821	64,103
1065	4,459	6,214	63,848
1100	4,913	4,953	61,915
1200	2,295	2,731	49,684
1300	0,861	2,647	40,732
1400	0,763	3,324	41,087
1500	0,704	2,372	39,723
1600	0,808	2,971	40,501
1700	1,002	2,356	42,704
1800	0,985	1,805	43,374
1900	1,078	2,227	46,075
2000	1,500	3,000	50,370
2100	2,309	3,995	54,257
2200	3,568	5,573	57,101
2300	5,115	7,770	59,535
2400	6,745	10,068	61,680
2500	8,027	12,011	62,635
2600	8,662	13,668	62,083
2700	9,111	15,121	61,339
2800	5,906	12,238	44,154
2900	2,168	12,933	26,415
3000	1,046	14,560	19,440

OPTICS CONCEPT

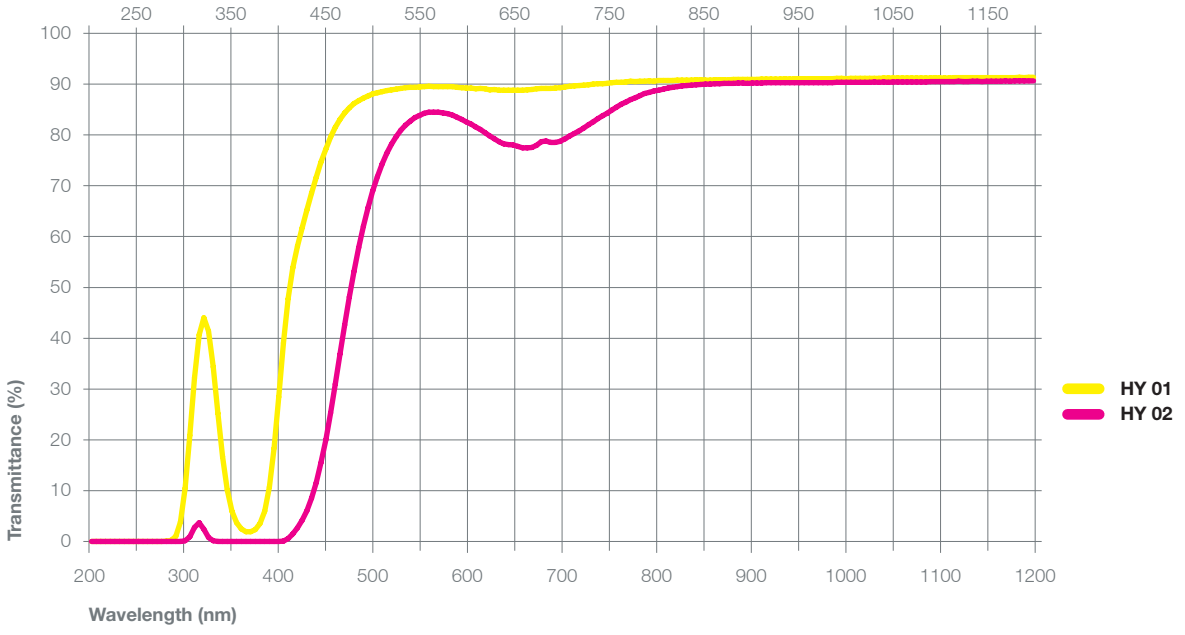
Glass Types

	HEBO	Schott	Hoya
YELLOW	HY 01	≈ GG 19	
	HY 02	≈ GG 10	

Yellow Glass Characteristics

Type	Thickness (mm)	A[2856K]			D65			Chemical Stability		N_D	α×10-7(°C)	T_g(°C)	T_s(°C)	ρ (g/cm³)
		x	y	Y	x	y	Y	D_A	D_W					
HY 01	1	0.459	0.423	89.0	0.331	0.366	89.0	4	3	1.536	107	549	619	2.78
HY 02	1	0.473	0.453	82.0	0.366	0.438	81.0	4	3	1.526	111	594	667	2.76

Type	Bubbles	Striae	Stress
HY 01	D	3C	3
HY 02	C-B	3C	3



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	HY 01	HY 02
Thickness (mm)	1	1
Wavelength (nm)	%T	%T
200	0,001	0,001
210	$4 \cdot 10^{-5}$	$3 \cdot 10^{-5}$
220	0,001	$5 \cdot 10^{-4}$
230	0,001	0,001
240	$2 \cdot 10^{-4}$	$5 \cdot 10^{-4}$
250	0,001	$6 \cdot 10^{-5}$
260	$2 \cdot 10^{-4}$	$4 \cdot 10^{-4}$
270	0,007	$9 \cdot 10^{-5}$
280	0,202	$5 \cdot 10^{-4}$
290	3,800	0,003
300	20,822	0,935
310	40,687	3,665
320	41,410	0,804
330	25,256	0,010
340	10,165	$7 \cdot 10^{-5}$
350	3,657	$4 \cdot 10^{-4}$
360	1,935	0,001
370	2,344	$2 \cdot 10^{-4}$
380	5,986	$2 \cdot 10^{-4}$
390	18,331	$6 \cdot 10^{-4}$
400	39,020	0,105
410	53,850	1,508
420	61,752	4,186
430	68,513	8,473
440	74,612	15,464
450	79,571	25,317
460	83,091	36,828
470	85,343	48,114
480	86,731	57,824
490	87,679	65,716
500	88,309	71,823
510	88,731	76,382
520	89,048	79,686
530	89,280	81,950
540	89,395	83,404
550	89,523	84,271
560	89,529	84,509
570	89,508	84,368
580	89,530	83,934
590	89,300	83,068
600	89,247	82,161
610	89,138	81,069
620	88,889	79,774
630	88,785	78,646
640	88,811	78,132
650	88,814	77,761
660	88,908	77,443
670	89,113	77,979
680	89,167	78,816
690	89,219	78,504

	HY 01	HY 02
Thickness (mm)	1	1
Wavelength (nm)	%T	%T
700	89,443	79,233
710	89,652	80,278
720	89,788	81,358
730	89,972	82,591
740	90,105	83,776
750	90,270	84,922
760	90,386	86,004
770	90,547	86,944
780	90,592	87,739
790	90,637	88,396
800	90,719	88,814
810	90,730	89,214
820	90,754	89,517
830	90,784	89,731
840	90,823	89,862
850	90,817	89,980
900	90,953	90,242
950	91,078	90,321
1000	91,105	90,350
1050	91,179	90,421
1065	91,189	90,397
1100	91,224	90,484
1200	91,356	90,663
1300	91,387	90,762
1400	91,443	90,750
1500	91,470	90,911
1600	91,482	91,009
1700	91,395	91,016
1800	91,280	90,998
1900	91,148	90,977
2000	91,015	90,877
2100	90,779	90,694
2200	90,287	90,212
2300	90,054	90,012
2400	89,775	89,771
2500	89,285	89,252
2600	88,677	88,876
2700	87,121	87,016
2800	60,767	58,274
2900	54,491	53,385
3000	50,370	49,959

OPTICS CONCEPT

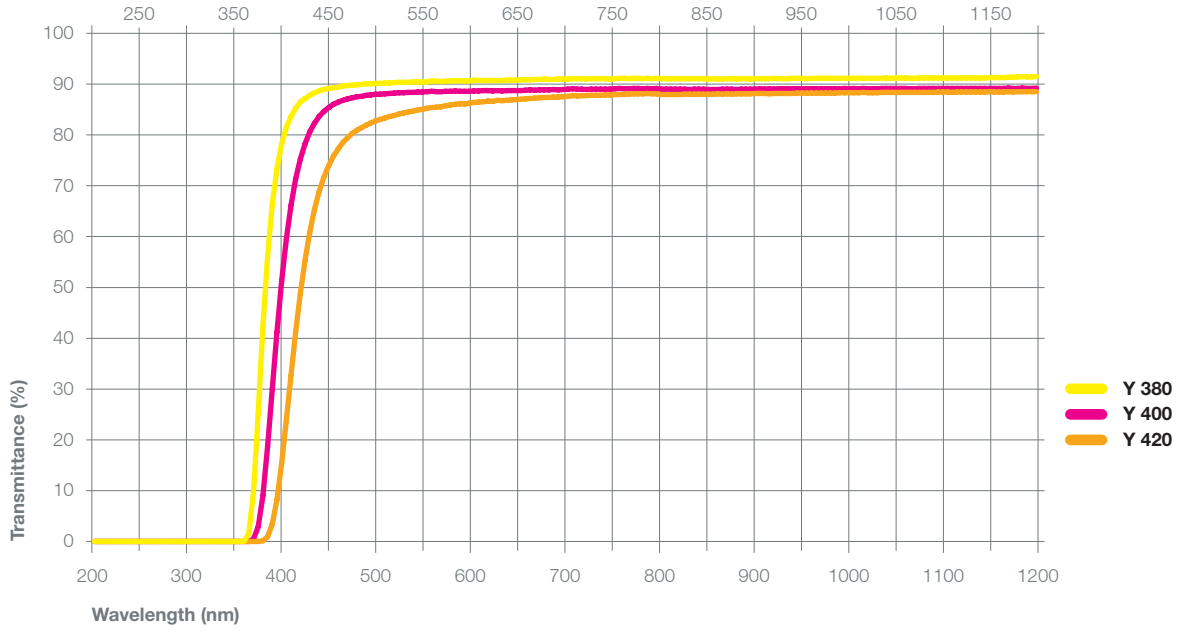
Glass Types

YELLOW	HEBO	Schott	Hoya
	Y 380	≈ GG 375	≈ L-38
	Y 400	≈ GG 400	≈ L-40
	Y 420	≈ GG 420	≈ L-42

Yellow Glass Characteristics

Type	Thickness (mm)	A[2856K]			D65			Chemical Stability		N_D	α×10-7(°C)	T_g(°C)	T_s(°C)	ρ (g/cm³)
		x	y	Y	x	y	Y	D_A	D_W					
Y 380	2							1	2	1.547	98	487	546	2.85
Y 400	2	0.450	0.410	96.3	0.316	0.336	94.2	1	1	1.632	95	497	555	3.65
Y 420	2	0.455	0.414	93.1	0.323	0.346	90.8	2	3	1.632	95	497	555	3.69

Type	Thickness (mm)	λ_{ti}(nm)	λ_p(nm)	$T\lambda_p$(%)	T_k(nm/°C)		Bubbles	Striae	Stress
Y 380	2	380± 10	500	≥86.0	≥0.8		B	3C	3
Y 400	2	400± 10	560	≥86.0	≥0.6		C-B	3C	3
Y 420	2	420± 10	560	≥86.0	≥0.6		C-B	3C	3



OPTICS CONCEPT

HEBO SPEZIALGLAS

HEBO Spezialglas
An der Wette 4 . D-73433 Aalen . Fon +49 7361/71088 . Fax +49 7361/71089 . www.hebo-glass.com . info@hebo-glass.com

	Y 380	Y 400	Y 420
Thickness (mm)	2	2	2
Wavelength (nm)	%T	%T	%T
200	$8 \cdot 10^{-4}$	0,001	$8 \cdot 10^{-4}$
210	$8 \cdot 10^{-4}$	$4 \cdot 10^{-4}$	$6 \cdot 10^{-4}$
220	0,002	0,001	$8 \cdot 10^{-4}$
230	0,002	0,002	$9 \cdot 10^{-4}$
240	0,001	0,001	$8 \cdot 10^{-4}$
250	0,001	0,001	0,001
260	$8 \cdot 10^{-4}$	$4 \cdot 10^{-5}$	$4 \cdot 10^{-4}$
270	0,001	$2 \cdot 10^{-4}$	0,001
280	$5 \cdot 10^{-4}$	$1 \cdot 10^{-4}$	$4 \cdot 10^{-4}$
290	$2 \cdot 10^{-4}$	$5 \cdot 10^{-4}$	$5 \cdot 10^{-4}$
300	$5 \cdot 10^{-4}$	$9 \cdot 10^{-4}$	$5 \cdot 10^{-4}$
310	$9 \cdot 10^{-4}$	$7 \cdot 10^{-5}$	0,001
320	$7 \cdot 10^{-4}$	$6 \cdot 10^{-5}$	$3 \cdot 10^{-4}$
330	$2 \cdot 10^{-4}$	$6 \cdot 10^{-5}$	$4 \cdot 10^{-4}$
340	$4 \cdot 10^{-4}$	$5 \cdot 10^{-4}$	$2 \cdot 10^{-4}$
350	$8 \cdot 10^{-4}$	0,001	$9 \cdot 10^{-4}$
360	1,647	0,025	$8 \cdot 10^{-4}$
370	25,262	2,896	0,008
380	56,164	18,648	0,932
390	73,324	41,157	8,200
400	81,414	59,492	23,786
410	85,293	71,334	41,226
420	87,136	78,266	55,315
430	88,310	82,317	65,241
440	88,945	84,620	71,678
450	89,332	86,006	75,806
460	89,629	86,844	78,505
470	89,799	87,348	80,286
480	89,929	87,630	81,462
490	90,057	87,862	82,367
500	90,175	88,040	83,075
510	90,230	88,168	83,635
520	90,334	88,297	84,121
530	90,395	88,357	84,518
540	90,460	88,419	84,880
550	90,463	88,549	85,247
560	90,554	88,538	85,488
570	90,608	88,556	85,739
580	90,629	88,638	86,017
590	90,631	88,561	86,124
600	90,757	88,675	86,387
610	90,709	88,717	86,562
620	90,719	88,628	86,603
630	90,736	88,668	86,737
640	90,801	88,708	86,896
650	90,846	88,746	87,020
660	90,871	88,839	87,202
670	90,955	88,886	87,302
680	90,933	88,864	87,387
690	90,989	88,897	87,490

	Y 380	Y 400	Y 420
Thickness (mm)	2	2	2
Wavelength (nm)	%T	%T	%T
700	91,018	88,979	87,628
710	91,041	89,000	87,698
720	91,015	88,976	87,732
730	91,080	88,984	87,821
740	91,059	89,020	87,862
750	91,101	89,059	87,923
760	91,107	89,099	88,004
770	91,147	89,133	88,067
780	91,042	89,085	88,074
790	91,079	89,101	88,091
800	91,076	89,034	87,919
810	91,066	89,019	87,947
820	91,068	89,018	87,966
830	91,037	88,974	87,995
840	91,036	88,985	88,030
850	91,027	88,978	88,026
900	91,088	89,031	88,152
950	91,147	89,094	88,253
1000	91,137	89,115	88,297
1050	91,208	89,123	88,359
1065	91,163	89,101	88,375
1100	91,198	89,147	88,413
1200	91,482	89,195	88,522
1300	91,512	89,228	88,603
1400	91,392	89,179	88,614
1500	91,514	89,200	88,662
1600	91,456	89,186	88,669
1700	91,238	88,991	88,475
1800	90,874	88,656	88,150
1900	90,513	88,290	87,852
2000	89,970	87,815	87,370
2100	89,127	87,310	86,790
2200	87,799	86,087	85,426
2300	87,316	85,247	84,548
2400	86,113	84,624	83,816
2500	84,346	83,182	81,906
2600	81,768	81,309	78,874
2700	74,549	76,248	71,279
2800	36,690	44,229	35,297
2900	34,079	37,809	28,686
3000	31,213	34,116	25,421

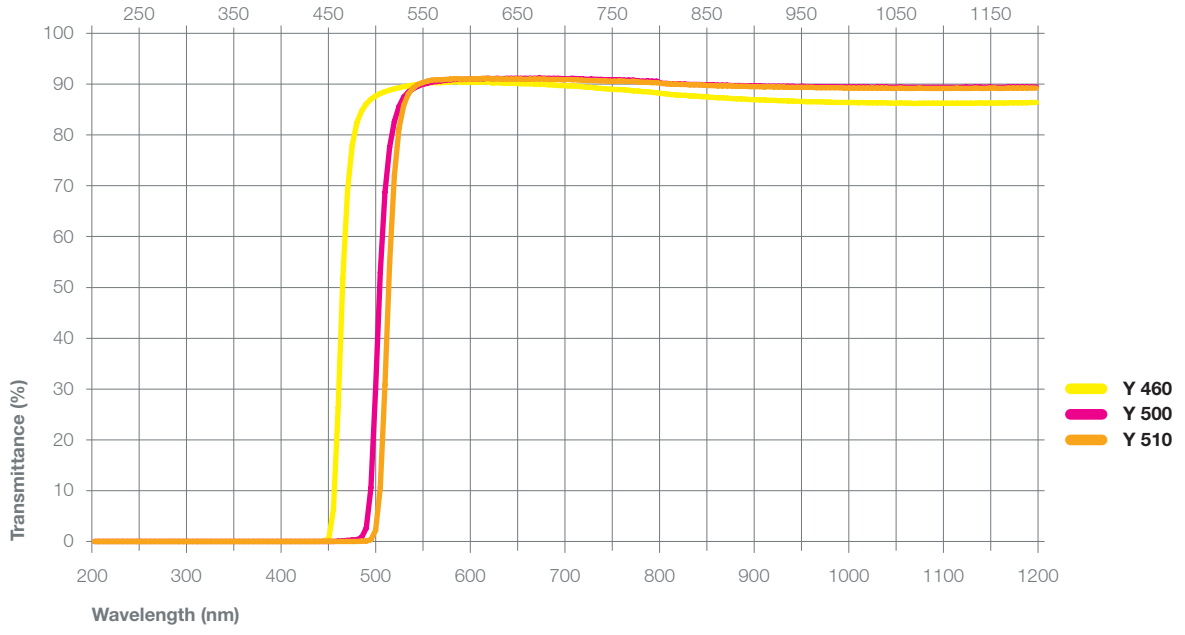
Glass Types

YELLOW	HEBO	Schott	Hoya
	Y 460	≈ GG 455	≈ Y-46
	Y 500	≈ GG 495	≈ Y-50
	Y 510	≈ OG 515	

Yellow Glass Characteristics

Type	Thickness (mm)	A[2856K]			D65			Chemical Stability		N_D	α×10-7(°C)	T_g(°C)	T_s(°C)	ρ (g/cm³)
		x	y	Y	x	y	Y	D_A	D_W					
Y 460	2	0.492	0.462	96.0	0.401	0.490	92.0	1	3	1.523	103	527	605	2.64
Y 500	2	0.502	0.468	94.5	0.422	0.514	89.6	1	3	1.523	103	527	605	2.64
Y 510	2	0.519	0.471	91.5	0.456	0.526	84.0	1	2	1.523	103	527	605	2.64

Type	Thickness (mm)	λ_{ti}(nm)	λ_p(nm)	$T\lambda_p$(%)	T_k(nm/°C)		Bubbles	Striae	Stress
Y 460	2	460± 10	560	≥89.5	≥0.8		C-B	3C	3
Y 500	2	500± 10	580	≥89.5	≥1.2		C-B	3C	3
Y 510	2	510± 10	600	≥89.5	≥1.2		C-B	3C	3



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	Y 460	Y 500	Y 510
Thickness (mm)	2	2	2
Wavelength (nm)	%T	%T	%T
200	0,009	0,004	0,004
210	0,007	0,004	0,004
220	0,009	0,005	0,005
230	0,010	0,005	0,006
240	0,010	0,005	0,005
250	0,011	0,004	0,005
260	0,011	0,004	0,005
270	0,012	0,004	0,005
280	0,012	0,004	0,006
290	0,012	0,005	0,005
300	0,014	0,006	0,007
310	0,014	0,006	0,005
320	0,014	0,006	0,007
330	0,016	0,005	0,007
340	0,016	0,005	0,006
350	0,014	0,005	0,007
360	0,014	0,005	0,007
370	0,014	0,006	0,007
380	0,013	0,004	0,006
390	0,013	0,005	0,006
400	0,013	0,004	0,006
410	0,013	0,004	0,006
420	0,014	0,005	0,006
430	0,014	0,006	0,006
440	0,037	0,006	0,006
450	6,413	0,023	0,007
460	51,834	0,119	0,017
470	77,961	0,259	0,027
480	84,698	0,761	0,038
490	87,025	10,585	0,357
500	88,144	52,921	10,661
510	88,835	77,591	54,845
520	89,314	85,635	81,261
530	89,686	88,459	88,099
540	89,908	89,555	89,921
550	90,175	90,124	90,606
560	90,258	90,529	90,825
570	90,363	90,763	90,928
580	90,471	90,899	91,061
590	90,362	90,952	90,982
600	90,441	91,105	91,087
610	90,443	91,076	91,112
620	90,234	91,085	90,982
630	90,208	91,096	90,967
640	90,164	91,116	90,981
650	90,106	91,123	90,978
660	90,087	91,130	91,018
670	89,988	91,180	90,996
680	89,843	91,121	90,922
690	89,747	91,117	90,917

	Y 460	Y 500	Y 510
Thickness (mm)	2	2	2
Wavelength (nm)	%T	%T	%T
700	89,656	91,083	90,907
710	89,587	91,047	90,878
720	89,358	90,962	90,721
730	89,261	90,941	90,724
740	89,092	90,868	90,648
750	88,966	90,825	90,596
760	88,872	90,809	90,556
770	88,689	90,770	90,539
780	88,549	90,597	90,394
790	88,407	90,600	90,322
800	88,132	90,149	90,136
810	87,956	90,079	90,037
820	87,835	90,037	89,968
830	87,682	89,950	89,879
840	87,571	89,927	89,838
850	87,433	89,838	89,715
900	86,969	89,679	89,532
950	86,629	89,550	89,397
1000	86,397	89,438	89,254
1050	86,273	89,372	89,178
1065	86,251	89,381	89,177
1100	86,237	89,377	89,172
1200	86,383	89,471	89,251
1300	86,726	89,635	89,408
1400	87,044	89,632	89,447
1500	87,860	90,106	89,914
1600	88,518	90,352	90,204
1700	88,783	90,358	90,232
1800	88,663	90,113	90,031
1900	88,343	89,775	89,696
2000	87,831	89,254	89,182
2100	87,201	88,583	88,545
2200	86,031	87,259	87,261
2300	85,742	86,871	86,869
2400	85,242	86,234	86,319
2500	84,027	84,910	85,059
2600	83,165	83,901	84,174
2700	78,842	79,295	79,721
2800	35,098	34,869	35,733
2900	33,240	33,253	34,092
3000	31,061	31,050	32,009

OPTICS CONCEPT

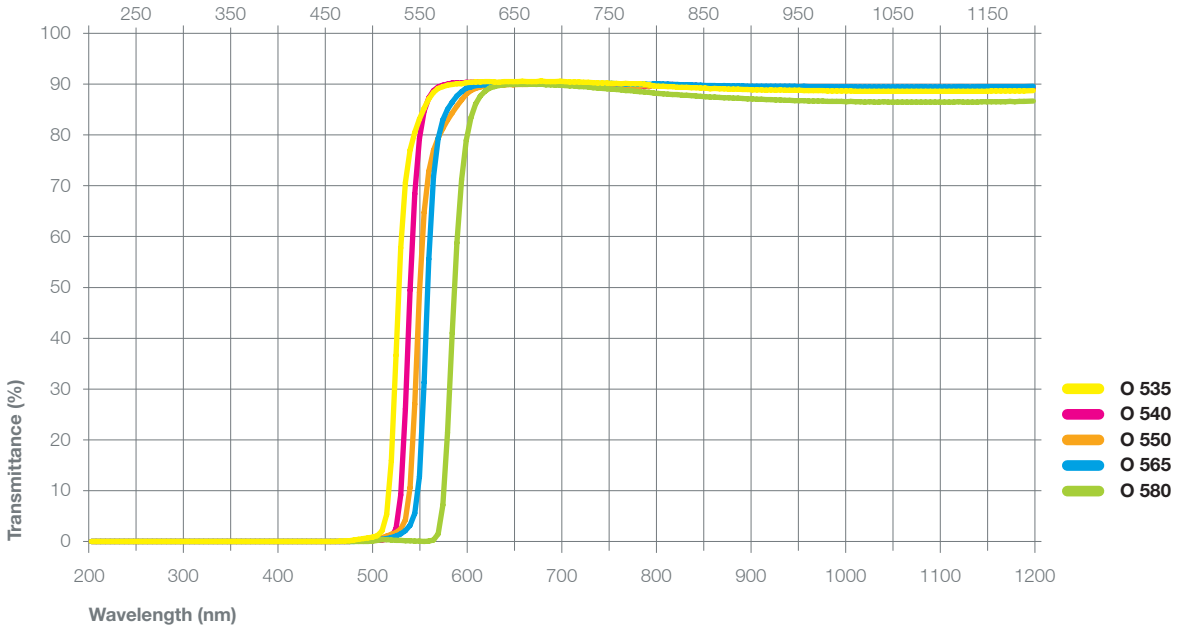
Glass Types

ORANGE	HEBO	Schott	Hoya
	O 530	≈ OG 530	
	O 540		≈ O-54
	O 550	≈ OG 550	
	O 565	≈ OG 570	≈ O-56
	O 580	≈ OG 590	≈ O-58

Orange Glass Characteristics

Type	Thickness (mm)	A[2856K]			D65			Chemical Stability		N_D	α×10-7(°C)	T_g(°C)	T_s(°C)	ρ (g/cm³)
		x	y	Y	x	y	Y	D_A	D_W					
O 530	2	0.549	0.448	82.2	0.504	0.492	70.2	3	2	1.523	103	527	605	2.64
O 540	2	0.572	0.427	72.9	0.537	0.461	59.3	3	2	1.523	103	527	605	2.64
O 550	2	0.594	0.405	63.6	0.569	0.430	48.4	3	2	1.523	103	527	605	2.64
O 565	2	0.622	0.377	51.6	0.605	0.395	36.7	3	2	1.523	103	527	605	2.64
O 580	2	0.658	0.342	35.9	0.649	0.351	23.3	1	2	1.523	103	527	605	2.64

Type	Thickness (mm)	λ_{ti}(nm)	λ_p(nm)	$T\lambda_p$(%)	T_K(nm/°C)		Bubbles	Striae	Stress
O 530	2	530± 10	650	≥88.7	≥1.2		C-B	3C	3
O 540	2	540± 10	650	≥88.7	≥1.2		C-B	3C	3
O 550	2	550± 10	650	≥88.7	≥1.2		C-B	3C	3
O 565	2	565± 10	650	≥88.7	≥1.2		C-B	3C	3
O 580	2	580± 10	680	≥88.7	≥1.2		C-B	3C	3



	O 530	O 540	O 550	O 565	O 580
Thickness (mm)	2	2	2	2	2
Wavelength (nm)	%T	%T	%T	%T	%T
200	0,003	0,004	0,002	0,001	0,001
210	0,003	0,003	0,002	0,002	0,001
220	0,002	0,002	0,001	0,002	0,001
230	0,003	0,003	0,001	0,002	0,002
240	0,003	0,003	$9 \cdot 10^{-4}$	0,001	0,001
250	0,002	0,004	0,001	0,001	0,001
260	0,003	0,003	0,001	0,001	0,001
270	0,002	0,002	$1 \cdot 10^{-4}$	$1 \cdot 10^{-4}$	$1 \cdot 10^{-4}$
280	0,002	0,003	$6 \cdot 10^{-4}$	0,001	$6 \cdot 10^{-4}$
290	0,001	0,003	$2 \cdot 10^{-4}$	$2 \cdot 10^{-4}$	0,001
300	0,002	0,003	0,001	$< 10^{-5}$	0,001
310	0,003	0,004	0,001	$4 \cdot 10^{-4}$	0,001
320	0,002	0,005	0,001	$1 \cdot 10^{-4}$	$2 \cdot 10^{-4}$
330	0,004	0,005	0,002	0,001	0,003
340	0,004	0,003	0,001	0,001	0,002
350	0,003	0,003	$1 \cdot 10^{-4}$	0,001	0,001
360	0,003	0,003	$7 \cdot 10^{-4}$	$5 \cdot 10^{-4}$	0,001
370	0,002	0,003	$8 \cdot 10^{-4}$	0,001	0,001
380	0,003	0,004	0,001	$9 \cdot 10^{-4}$	0,001
390	0,002	0,003	$3 \cdot 10^{-4}$	$7 \cdot 10^{-4}$	$9 \cdot 10^{-4}$
400	0,002	0,003	$3 \cdot 10^{-4}$	$1 \cdot 10^{-4}$	0,001
410	0,003	0,003	$4 \cdot 10^{-4}$	0,001	0,001
420	0,004	0,004	0,002	0,002	0,002
430	0,003	0,003	0,001	$3 \cdot 10^{-4}$	0,001
440	0,004	0,004	0,002	0,002	0,001
450	0,006	0,003	0,002	0,001	0,001
460	0,019	0,004	0,004	0,002	0,001
470	0,077	0,013	0,013	0,008	0,001
480	0,264	0,057	0,058	0,031	0,001
490	0,559	0,182	0,161	0,096	0,007
500	0,856	0,227	0,344	0,220	0,077
510	2,034	0,273	0,768	0,408	0,324
520	15,971	0,808	1,416	0,771	0,316
530	57,739	9,165	2,426	1,509	0,184
540	77,057	49,486	10,598	3,168	0,106
550	83,125	79,305	49,076	12,774	0,035
560	87,127	87,319	72,870	55,541	0,060
570	89,176	89,426	79,384	79,327	1,511
580	89,815	90,041	82,891	85,060	21,406
590	90,079	90,271	85,661	87,664	58,755
600	90,296	90,392	88,041	89,199	78,940
610	90,411	90,402	89,178	89,711	86,118
620	90,506	90,411	89,555	89,856	88,565
630	90,415	90,286	89,752	89,957	89,485
640	90,513	90,382	89,821	90,051	89,840
650	90,520	90,358	89,891	90,086	90,000
660	90,556	90,364	89,962	90,144	90,032
670	90,499	90,305	90,018	90,199	89,989
680	90,618	90,302	90,011	90,272	90,007
690	90,509	90,225	90,009	90,218	89,861

	O 530	O 540	O 550	O 565	O 580
Thickness (mm)	2	2	2	2	2
Wavelength (nm)	%T	%T	%T	%T	%T
700	90,564	90,247	90,028	90,254	89,826
710	90,461	90,149	89,976	90,200	89,650
720	90,414	90,066	89,988	90,221	89,544
730	90,335	90,007	89,945	90,175	89,421
740	90,246	89,904	89,844	90,143	89,233
750	90,225	89,870	89,898	90,140	89,059
760	90,151	89,814	89,768	90,068	88,912
770	90,114	89,742	89,703	90,007	88,730
780	90,058	89,639	89,602	89,937	88,561
790	89,993	89,613	89,707	90,055	88,459
800	89,627	90,036	89,708	90,104	88,230
810	89,575	89,936	89,680	90,026	88,113
820	89,481	89,925	89,608	89,958	87,967
830	89,398	89,850	89,500	89,861	87,829
840	89,283	89,733	89,454	89,836	87,713
850	89,197	89,662	89,340	89,775	87,577
900	88,942	89,423	89,124	89,611	87,090
950	88,772	89,266	88,999	89,553	86,776
1000	88,677	89,164	88,896	89,492	86,597
1050	88,586	89,071	88,854	89,454	86,469
1065	88,593	89,065	88,878	89,445	86,471
1100	88,584	89,046	88,836	89,448	86,456
1200	88,704	89,127	88,937	89,560	86,642
1300	88,847	89,309	89,115	89,698	86,982
1400	88,932	89,372	89,166	89,697	87,351
1500	89,450	89,882	89,667	90,144	88,158
1600	89,781	90,182	89,936	90,345	88,783
1700	89,833	90,225	89,939	90,320	89,033
1800	89,592	89,973	89,666	90,006	88,915
1900	89,197	89,609	89,275	89,597	88,634
2000	88,684	89,109	88,711	89,069	88,242
2100	88,025	88,317	88,037	88,397	87,772
2200	86,699	87,144	86,630	87,004	86,676
2300	86,201	86,766	86,095	86,464	86,485
2400	85,726	86,124	85,597	85,963	86,078
2500	84,401	84,811	84,229	84,573	84,874
2600	83,433	83,792	83,177	83,551	84,105
2700	78,985	79,300	78,743	78,999	79,881
2800	35,457	34,387	35,770	35,392	35,235
2900	33,726	32,578	34,039	33,638	33,490
3000	31,419	30,360	31,620	31,274	31,780

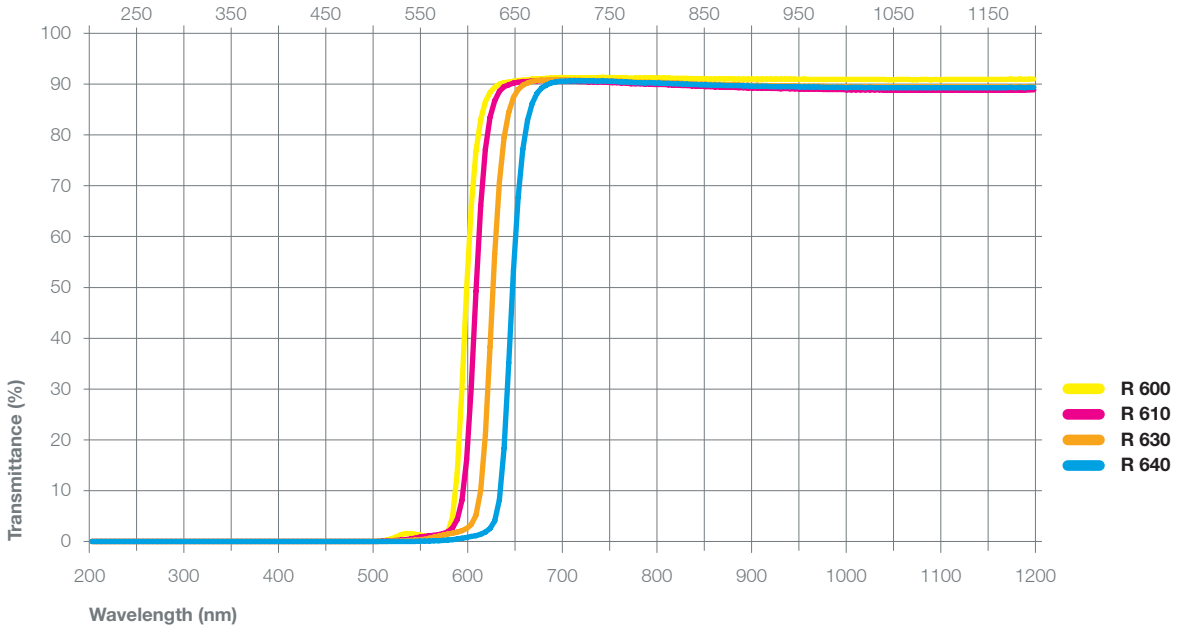
Glass Types

RED	HEBO	Schott	Hoya
	R 600		≈ R-60
	R 610	≈ RG 610	
	R 630	≈ RG 630	≈ R-62
	R 640	≈ RG 645	≈ R-64

Red Glass Characteristics

Type	Thickness (mm)	A[2856K]			D65			Chemical Stability		N_D	α×10-7(°C)	T_g(°C)	T_s(°C)	ρ (g/cm³)
		x	y	Y	x	y	Y	D_A	D_W					
R 600	2	0.680	0.319	27.0	0.675	0.325	16.5	1	2	1.523	103	527	605	2.64
R 610	2	0.695	0.305	18.4	0.690	0.310	10.7	1	2	1.523	103	527	605	2.64
R 630	2	0.713	0.287	10.4	0.711	0.289	5.5	1	2	1.523	103	527	605	2.64
R 640	2	0.724	0.276	5.0	0.723	0.277	2.4	1	2	1.523	103	527	605	2.64

Type	Thickness (mm)	λ_{ti}(nm)	λ_p(nm)	$T\lambda_p$(%)	T_k(nm/°C)		Bubbles	Striae	Stress
R 600	2	600± 10	680	≥88.7	≥1.2		C-B	3C	3
R 610	2	610± 10	680	≥88.7	≥1.2		C-B	3C	3
R 630	2	630± 10	700	≥88.7	≥1.2		C-B	3C	3
R 640	2	640± 10	720	≥88.7	≥1.2		C-B	3C	3



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	R 600	R 610	R 630	R 640
Thickness (mm)	2	2	2	2
Wavelength (nm)	%T	%T	%T	%T
200	0,001	0,001	$3 \cdot 10^{-4}$	$1 \cdot 10^{-4}$
210	0,002	$8 \cdot 10^{-4}$	$5 \cdot 10^{-5}$	$4 \cdot 10^{-4}$
220	$1 \cdot 10^{-4}$	$6 \cdot 10^{-4}$	$5 \cdot 10^{-4}$	0,001
230	0,002	0,001	0,001	$1 \cdot 10^{-4}$
240	$6 \cdot 10^{-4}$	$7 \cdot 10^{-4}$	$1 \cdot 10^{-4}$	$8 \cdot 10^{-4}$
250	$1 \cdot 10^{-3}$	$1 \cdot 10^{-4}$	0,001	$5 \cdot 10^{-5}$
260	$5 \cdot 10^{-4}$	0,001	$7 \cdot 10^{-4}$	$4 \cdot 10^{-4}$
270	0,001	0,001	$5 \cdot 10^{-4}$	$8 \cdot 10^{-5}$
280	0,001	$4 \cdot 10^{-4}$	$8 \cdot 10^{-4}$	0,001
290	$8 \cdot 10^{-4}$	$4 \cdot 10^{-4}$	0,001	$3 \cdot 10^{-4}$
300	0,001	0,001	0,001	$7 \cdot 10^{-4}$
310	$3 \cdot 10^{-4}$	$4 \cdot 10^{-4}$	$5 \cdot 10^{-5}$	$8 \cdot 10^{-4}$
320	$8 \cdot 10^{-4}$	0,001	$8 \cdot 10^{-4}$	$6 \cdot 10^{-4}$
330	$4 \cdot 10^{-4}$	$3 \cdot 10^{-5}$	$6 \cdot 10^{-5}$	0,001
340	$6 \cdot 10^{-4}$	$4 \cdot 10^{-5}$	0,001	$4 \cdot 10^{-4}$
350	0,001	0,001	0,001	$5 \cdot 10^{-4}$
360	0,001	0,001	$3 \cdot 10^{-4}$	$1 \cdot 10^{-4}$
370	0,001	0,001	$9 \cdot 10^{-4}$	$1 \cdot 10^{-4}$
380	0,001	$6 \cdot 10^{-4}$	$7 \cdot 10^{-5}$	$5 \cdot 10^{-4}$
390	0,001	0,001	$8 \cdot 10^{-4}$	$6 \cdot 10^{-4}$
400	$2 \cdot 10^{-4}$	$3 \cdot 10^{-4}$	$3 \cdot 10^{-4}$	$3 \cdot 10^{-4}$
410	0,001	$1 \cdot 10^{-4}$	$3 \cdot 10^{-4}$	$2 \cdot 10^{-4}$
420	$8 \cdot 10^{-4}$	$8 \cdot 10^{-4}$	$3 \cdot 10^{-4}$	$8 \cdot 10^{-4}$
430	$9 \cdot 10^{-4}$	$7 \cdot 10^{-4}$	$6 \cdot 10^{-4}$	$2 \cdot 10^{-4}$
440	0,002	0,001	$7 \cdot 10^{-4}$	$3 \cdot 10^{-4}$
450	0,003	$4 \cdot 10^{-4}$	$2 \cdot 10^{-4}$	0,001
460	0,006	0,001	$2 \cdot 10^{-4}$	$1 \cdot 10^{-4}$
470	0,007	0,003	$3 \cdot 10^{-4}$	$2 \cdot 10^{-4}$
480	0,008	0,005	0,001	$8 \cdot 10^{-5}$
490	0,016	0,010	0,005	$6 \cdot 10^{-5}$
500	0,064	0,030	0,008	$7 \cdot 10^{-5}$
510	0,283	0,084	0,022	0,001
520	0,944	0,192	0,058	0,003
530	1,582	0,379	0,137	0,011
540	1,424	0,673	0,258	0,031
550	1,077	0,984	0,459	0,066
560	0,772	1,196	0,819	0,119
570	0,904	1,534	1,287	0,211
580	4,870	2,708	1,624	0,383
590	30,102	8,050	2,102	0,653
600	66,067	30,550	3,300	0,961
610	83,069	66,009	10,019	1,451
620	88,353	83,455	38,281	2,533
630	90,006	88,599	70,696	8,231
640	90,429	89,888	84,467	35,141
650	90,691	90,366	88,910	67,656
660	90,841	90,534	90,247	82,851
670	91,046	90,665	90,721	88,150
680	91,107	90,652	90,799	89,828
690	91,219	90,651	90,851	90,411

	R 600	R 610	R 630	R 640
Thickness (mm)	2	2	2	2
Wavelength (nm)	%T	%T	%T	%T
700	91,256	90,612	90,825	90,594
710	91,282	90,550	90,786	90,623
720	91,277	90,474	90,712	90,626
730	91,290	90,432	90,701	90,612
740	91,361	90,430	90,711	90,611
750	91,304	90,321	90,661	90,568
760	91,283	90,230	90,573	90,398
770	91,164	90,088	90,457	90,333
780	91,204	90,044	90,377	90,257
790	91,250	89,981	90,361	90,261
800	91,211	89,961	90,348	90,207
810	91,180	89,869	90,250	90,130
820	91,131	89,761	90,194	90,057
830	91,123	89,692	90,107	89,985
840	91,067	89,590	90,038	89,912
850	91,064	89,529	89,987	89,849
900	91,000	89,222	89,736	89,597
950	90,961	89,017	89,611	89,455
1000	90,897	88,864	89,479	89,333
1050	90,890	88,790	89,440	89,287
1065	90,901	88,811	89,454	89,301
1100	90,892	88,794	89,446	89,284
1200	90,990	88,849	89,504	89,377
1300	91,099	89,008	89,652	89,535
1400	91,013	89,101	89,717	89,631
1500	91,239	89,608	90,156	90,060
1600	91,310	89,942	90,412	90,363
1700	91,186	89,988	90,411	90,384
1800	90,872	89,721	90,142	90,136
1900	90,570	89,339	89,794	89,799
2000	90,186	88,786	89,292	89,314
2100	89,614	88,056	88,603	88,694
2200	88,434	86,648	87,281	87,450
2300	88,115	86,198	86,867	87,090
2400	87,534	85,522	86,217	86,464
2500	86,325	84,169	84,897	85,196
2600	85,490	83,117	83,913	84,234
2700	81,383	78,460	79,440	80,104
2800	37,039	34,059	34,837	37,728
2900	34,917	32,368	33,053	35,880
3000	32,723	30,042	30,791	33,473

OPTICS CONCEPT

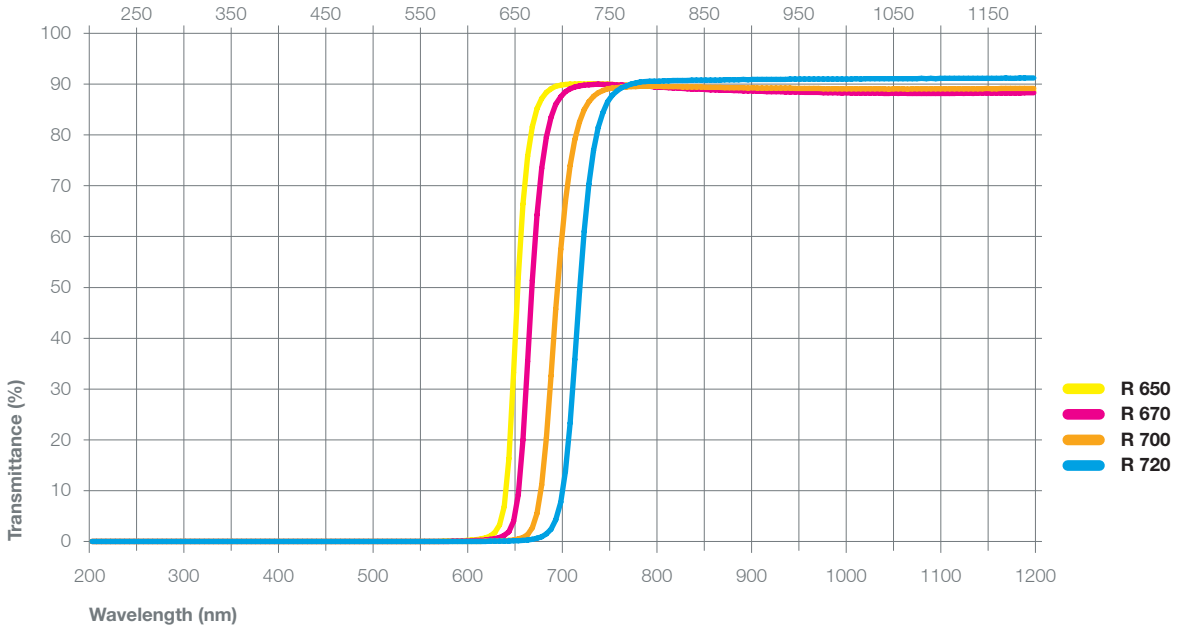
Glass Types

RED	HEBO	Schott	Hoya
	R 650		≈ R-66
	R 670	≈ RG 665	
	R 700	≈ RG 695	≈ R-70
	R 720	≈ RG 715	≈ R-72

Red Glass Characteristics

Type	Thickness (mm)	A[2856K]			D65			Chemical Stability		N_D	α×10-7(°C)	T_g(°C)	T_s(°C)	ρ (g/cm³)
		x	y	Y	x	y	Y	D_A	D_W					
R 650	2	0.728	0.272	3.2	0.728	0.272	1.5	1	2	1.523	103	527	605	2.64
R 670	2	0.731	0.269	1.1	0.730	0.270	0.5	1	2	1.523	103	527	605	2.64
R 700	2	0.735	0.265	0.0	0.735	0.265	0.0	1	2	1.523	111	534	592	2.64
R 720	2							5	4	1.523	111	534	592	2.77

Type	Thickness (mm)	λ_{ti}(nm)	λ_p(nm)	$T\lambda_p$(%)	T_k(nm/°C)		Bubbles	Striae	Stress
R 650	2	650± 10	720	≥88.5	≥1.0		C-B	3C	3
R 670	2	670± 10	750	≥87.5	≥1.0		C-B	3C	3
R 700	2	700± 10	800	≥79.8	≥0.8		C-B	3C	3
R 720	2	720± 10	800	≥80.0	≥0.8		C-B	4	3



OPTICS CONCEPT

HEBO SPEZIALGLAS
HEBO Spezialglas
An der Wette 4 . D-73433 Aalen . Fon +49 7361/71088 . Fax +49 7361/71089 . www.hebo-glass.com . info@hebo-glass.com

	R 650	R 670	R 700	R 720
Thickness (mm)	2	2	2	2
Wavelength (nm)	%T	%T	%T	%T
200	$6 \cdot 10^{-4}$	$3 \cdot 10^{-4}$	$8 \cdot 10^{-4}$	$1 \cdot 10^{-4}$
210	$3 \cdot 10^{-4}$	$4 \cdot 10^{-4}$	$4 \cdot 10^{-4}$	$7 \cdot 10^{-4}$
220	0,001	0,001	0,001	0,001
230	$2 \cdot 10^{-4}$	$8 \cdot 10^{-4}$	$1 \cdot 10^{-4}$	$3 \cdot 10^{-4}$
240	0,001	0,001	0,001	0,001
250	$1 \cdot 10^{-4}$	$9 \cdot 10^{-4}$	$5 \cdot 10^{-4}$	$<1 \cdot 10^{-5}$
260	$1 \cdot 10^{-4}$	$1 \cdot 10^{-4}$	$<1 \cdot 10^{-5}$	$4 \cdot 10^{-4}$
270	$3 \cdot 10^{-4}$	$8 \cdot 10^{-4}$	$5 \cdot 10^{-4}$	$1 \cdot 10^{-4}$
280	$4 \cdot 10^{-4}$	$6 \cdot 10^{-5}$	$7 \cdot 10^{-5}$	$4 \cdot 10^{-4}$
290	$5 \cdot 10^{-4}$	$5 \cdot 10^{-4}$	$6 \cdot 10^{-5}$	$2 \cdot 10^{-4}$
300	$4 \cdot 10^{-4}$	$2 \cdot 10^{-4}$	$7 \cdot 10^{-5}$	$8 \cdot 10^{-4}$
310	$3 \cdot 10^{-4}$	$2 \cdot 10^{-4}$	$2 \cdot 10^{-4}$	$8 \cdot 10^{-4}$
320	$2 \cdot 10^{-4}$	$4 \cdot 10^{-4}$	$7 \cdot 10^{-5}$	$9 \cdot 10^{-5}$
330	$7 \cdot 10^{-4}$	$5 \cdot 10^{-4}$	$4 \cdot 10^{-4}$	$2 \cdot 10^{-4}$
340	$2 \cdot 10^{-4}$	$2 \cdot 10^{-4}$	$6 \cdot 10^{-4}$	$9 \cdot 10^{-4}$
350	$5 \cdot 10^{-5}$	$2 \cdot 10^{-4}$	0,001	$2 \cdot 10^{-4}$
360	$7 \cdot 10^{-4}$	$4 \cdot 10^{-4}$	$1 \cdot 10^{-4}$	$3 \cdot 10^{-4}$
370	$1 \cdot 10^{-4}$	$7 \cdot 10^{-4}$	$1 \cdot 10^{-4}$	$1 \cdot 10^{-4}$
380	$2 \cdot 10^{-4}$	$7 \cdot 10^{-4}$	$2 \cdot 10^{-4}$	$6 \cdot 10^{-4}$
390	$1 \cdot 10^{-4}$	0,001	$<1 \cdot 10^{-5}$	$7 \cdot 10^{-4}$
400	$7 \cdot 10^{-4}$	$7 \cdot 10^{-4}$	$8 \cdot 10^{-4}$	$4 \cdot 10^{-4}$
410	$7 \cdot 10^{-4}$	$8 \cdot 10^{-4}$	$5 \cdot 10^{-4}$	$3 \cdot 10^{-4}$
420	$4 \cdot 10^{-4}$	$6 \cdot 10^{-4}$	$1 \cdot 10^{-4}$	$4 \cdot 10^{-4}$
430	$7 \cdot 10^{-4}$	$5 \cdot 10^{-4}$	$6 \cdot 10^{-4}$	$2 \cdot 10^{-4}$
440	$2 \cdot 10^{-4}$	$3 \cdot 10^{-4}$	$2 \cdot 10^{-4}$	$5 \cdot 10^{-5}$
450	$7 \cdot 10^{-4}$	$6 \cdot 10^{-4}$	$5 \cdot 10^{-4}$	0,001
460	$6 \cdot 10^{-4}$	$2 \cdot 10^{-5}$	$4 \cdot 10^{-4}$	$4 \cdot 10^{-4}$
470	$4 \cdot 10^{-4}$	$4 \cdot 10^{-5}$	$2 \cdot 10^{-4}$	$4 \cdot 10^{-5}$
480	$6 \cdot 10^{-5}$	$3 \cdot 10^{-4}$	$5 \cdot 10^{-5}$	$5 \cdot 10^{-4}$
490	$6 \cdot 10^{-4}$	$6 \cdot 10^{-5}$	$3 \cdot 10^{-4}$	0,001
500	$7 \cdot 10^{-5}$	$3 \cdot 10^{-4}$	$7 \cdot 10^{-4}$	$5 \cdot 10^{-5}$
510	$7 \cdot 10^{-5}$	$6 \cdot 10^{-5}$	$6 \cdot 10^{-5}$	$8 \cdot 10^{-4}$
520	$8 \cdot 10^{-4}$	$6 \cdot 10^{-4}$	0,001	$9 \cdot 10^{-4}$
530	$8 \cdot 10^{-4}$	$3 \cdot 10^{-4}$	$4 \cdot 10^{-4}$	$4 \cdot 10^{-4}$
540	0,003	$2 \cdot 10^{-4}$	$6 \cdot 10^{-5}$	$7 \cdot 10^{-5}$
550	0,009	0,002	$7 \cdot 10^{-5}$	$2 \cdot 10^{-4}$
560	0,019	0,005	$4 \cdot 10^{-5}$	$5 \cdot 10^{-4}$
570	0,034	0,014	0,001	$9 \cdot 10^{-4}$
580	0,058	0,026	0,003	0,001
590	0,102	0,050	0,008	0,005
600	0,188	0,094	0,014	0,009
610	0,359	0,177	0,025	0,018
620	0,700	0,314	0,045	0,028
630	1,802	0,576	0,082	0,046
640	6,863	1,178	0,155	0,078
650	33,246	3,940	0,315	0,129
660	66,373	19,971	0,771	0,230
670	81,673	51,390	2,685	0,435
680	87,168	73,424	11,092	0,930
690	89,096	83,502	32,603	2,442

	R 650	R 670	R 700	R 720
Thickness (mm)	2	2	2	2
Wavelength (nm)	%T	%T	%T	%T
700	89,768	87,541	57,495	7,731
710	89,993	89,082	74,016	23,312
720	90,050	89,677	82,580	49,125
730	90,073	89,873	86,515	70,290
740	90,088	89,991	88,305	81,498
750	90,009	89,955	89,061	86,522
760	89,868	89,824	89,332	88,655
770	89,798	89,751	89,462	89,664
780	89,756	89,662	89,536	90,184
790	89,790	89,638	89,606	90,513
800	89,618	89,450	89,575	90,585
810	89,542	89,341	89,546	90,648
820	89,448	89,230	89,481	90,694
830	89,398	89,152	89,472	90,736
840	89,299	89,049	89,422	90,757
850	89,239	88,984	89,410	90,799
900	88,953	88,638	89,237	90,866
950	88,764	88,442	89,158	90,977
1000	88,604	88,254	89,078	90,995
1050	88,565	88,181	89,035	91,067
1065	88,544	88,202	89,082	91,089
1100	88,543	88,187	89,070	91,102
1200	88,634	88,284	89,181	91,209
1300	88,814	88,515	89,355	91,252
1400	88,933	88,684	89,438	91,250
1500	89,486	89,266	89,907	91,405
1600	89,858	89,673	90,173	91,451
1700	89,916	89,785	90,189	91,376
1800	89,696	89,568	89,927	91,221
1900	89,357	89,217	89,585	91,075
2000	88,847	88,713	89,088	90,896
2100	88,192	88,034	88,426	90,568
2200	86,940	86,744	87,053	89,878
2300	86,536	86,372	86,684	89,682
2400	85,908	85,758	86,063	89,280
2500	84,645	84,476	84,705	88,532
2600	83,691	83,544	83,747	88,014
2700	79,398	79,204	79,133	85,370
2800	36,225	35,137	33,189	49,652
2900	34,068	33,113	31,421	47,144
3000	31,616	30,692	29,322	44,934

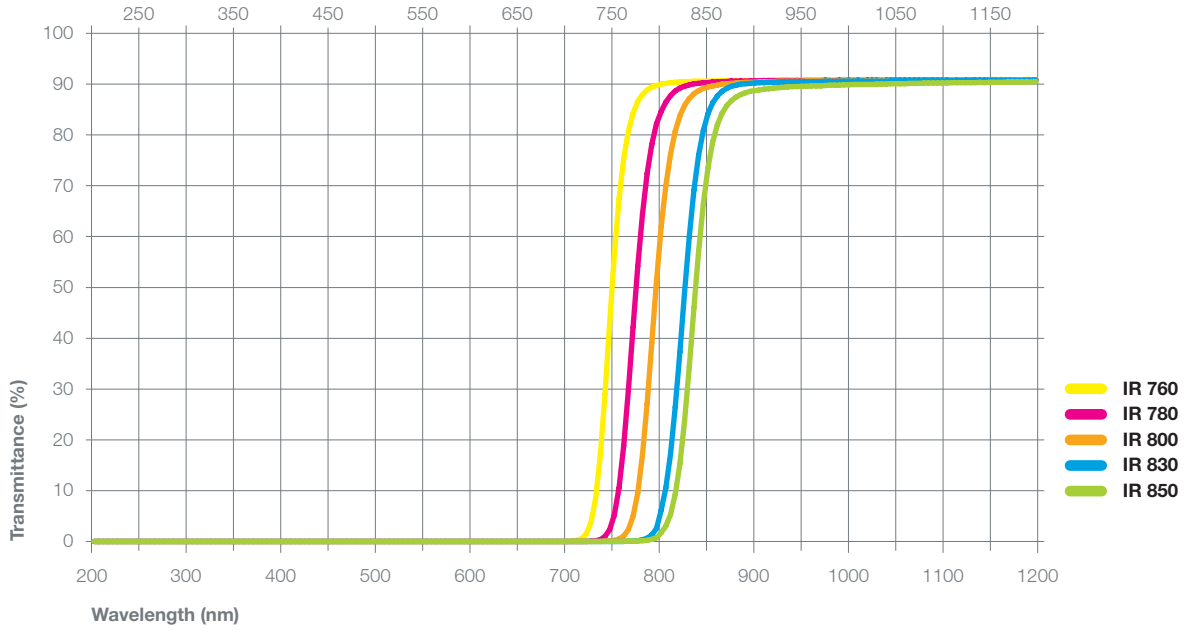
Glass Types

	HEBO	Schott	Hoya
INFRARED	IR 760		≈ IR-76
	IR 780	≈ RG 780	
	IR 800		≈ IR-80
	IR 830	≈ RG 830	≈ IR-83
	IR 850	≈ RG 850	≈ IR-85

Infrared Glass Characteristics

Type	Thickness (mm)	A[2856K]			D65			Chemical Stability		N_D	α×10-7(°C)	T_g(°C)	T_s(°C)	ρ (g/cm³)
		x	y	Y	x	y	Y	D_A	D_W					
IR 760	2							5	4	1.532	111	534	592	2.77
IR 780	2							5	4	1.532	111	534	592	2.77
IR 800	2							5	4	1.520	98	559	615	3.05
IR 830	2							5	4	1.520	98	559	615	3.05
IR 850	2							5	4	1.520	98	559	615	3.05

Type	Thickness (mm)	λ_{ti}(nm)	λ_p(nm)	$T\lambda_p$(%)	T_k(nm/°C)		Bubbles	Striae	Stress
IR 760	2	760± 10	850	≥83.6	≥0.6		C-B	3C	3
IR 780	2	780± 10	900	≥83.6	≥0.5		C-B	3C	3
IR 800	2	800± 10	900	≥83.6	≥0.5		C-B	3C	3
IR 830	2	830± 10	930	≥83.6	≥0.5		C-B	3C	3
IR 850	2	850± 10	950	≥80.0	≥0.5		C-B	3C	3



	IR 760	IR 780	IR 800	IR 830	IR 850
Thickness (mm)	2	2	2	2	2
Wavelength (nm)	%T	%T	%T	%T	%T
200	$5 \cdot 10^{-4}$	$8 \cdot 10^{-4}$	$8 \cdot 10^{-4}$	$3 \cdot 10^{-5}$	$3 \cdot 10^{-4}$
210	$5 \cdot 10^{-4}$	0,001	$6 \cdot 10^{-4}$	$5 \cdot 10^{-4}$	0,001
220	$6 \cdot 10^{-4}$	$6 \cdot 10^{-4}$	0,001	0,001	$4 \cdot 10^{-4}$
230	$1 \cdot 10^{-4}$	$3 \cdot 10^{-4}$	$1 \cdot 10^{-4}$	$1 \cdot 10^{-5}$	$5 \cdot 10^{-4}$
240	$<1 \cdot 10^{-5}$	$7 \cdot 10^{-4}$	$5 \cdot 10^{-4}$	$5 \cdot 10^{-4}$	$3 \cdot 10^{-4}$
250	0,001	$7 \cdot 10^{-4}$	$3 \cdot 10^{-5}$	$3 \cdot 10^{-4}$	$6 \cdot 10^{-4}$
260	$3 \cdot 10^{-4}$	0,001	$4 \cdot 10^{-4}$	$7 \cdot 10^{-4}$	$2 \cdot 10^{-4}$
270	$7 \cdot 10^{-4}$	0,001	$4 \cdot 10^{-4}$	$5 \cdot 10^{-4}$	0,001
280	$8 \cdot 10^{-4}$	$6 \cdot 10^{-4}$	$4 \cdot 10^{-4}$	$5 \cdot 10^{-4}$	$1 \cdot 10^{-4}$
290	$1 \cdot 10^{-5}$	$1 \cdot 10^{-4}$	$4 \cdot 10^{-4}$	$3 \cdot 10^{-4}$	$4 \cdot 10^{-4}$
300	$1 \cdot 10^{-4}$	$1 \cdot 10^{-4}$	$1 \cdot 10^{-4}$	$6 \cdot 10^{-4}$	$3 \cdot 10^{-4}$
310	0,001	$4 \cdot 10^{-4}$	0,001	0,001	0,001
320	$6 \cdot 10^{-4}$	$3 \cdot 10^{-4}$	$2 \cdot 10^{-5}$	$2 \cdot 10^{-4}$	$4 \cdot 10^{-4}$
330	$7 \cdot 10^{-4}$	0,001	0,001	0,001	0,001
340	0,001	$7 \cdot 10^{-4}$	0,001	0,001	$6 \cdot 10^{-4}$
350	$4 \cdot 10^{-4}$	$1 \cdot 10^{-4}$	$3 \cdot 10^{-4}$	$3 \cdot 10^{-4}$	$6 \cdot 10^{-4}$
360	$2 \cdot 10^{-4}$	$9 \cdot 10^{-4}$	$3 \cdot 10^{-4}$	$2 \cdot 10^{-4}$	$3 \cdot 10^{-4}$
370	$8 \cdot 10^{-5}$	$6 \cdot 10^{-4}$	$3 \cdot 10^{-4}$	$4 \cdot 10^{-4}$	$3 \cdot 10^{-4}$
380	$5 \cdot 10^{-4}$	$3 \cdot 10^{-4}$	$4 \cdot 10^{-4}$	0,001	$7 \cdot 10^{-4}$
390	$5 \cdot 10^{-5}$	0,001	$9 \cdot 10^{-4}$	$6 \cdot 10^{-4}$	$3 \cdot 10^{-4}$
400	$6 \cdot 10^{-4}$	$1 \cdot 10^{-4}$	$4 \cdot 10^{-4}$	$4 \cdot 10^{-4}$	$5 \cdot 10^{-4}$
410	$4 \cdot 10^{-4}$	$<1 \cdot 10^{-5}$	$8 \cdot 10^{-4}$	$7 \cdot 10^{-5}$	$1 \cdot 10^{-4}$
420	0,001	0,001	0,001	0,001	0,001
430	$7 \cdot 10^{-5}$	$<1 \cdot 10^{-5}$	$3 \cdot 10^{-4}$	$3 \cdot 10^{-4}$	$1 \cdot 10^{-4}$
440	$4 \cdot 10^{-4}$	$7 \cdot 10^{-4}$	$<1 \cdot 10^{-5}$	$8 \cdot 10^{-4}$	$1 \cdot 10^{-5}$
450	$5 \cdot 10^{-4}$	$4 \cdot 10^{-4}$	$3 \cdot 10^{-4}$	$2 \cdot 10^{-4}$	$4 \cdot 10^{-4}$
460	$7 \cdot 10^{-4}$	$4 \cdot 10^{-4}$	$3 \cdot 10^{-4}$	$6 \cdot 10^{-4}$	$8 \cdot 10^{-4}$
470	$8 \cdot 10^{-5}$	$1 \cdot 10^{-4}$	$<1 \cdot 10^{-5}$	$4 \cdot 10^{-4}$	$5 \cdot 10^{-4}$
480	$3 \cdot 10^{-4}$	$4 \cdot 10^{-4}$	$1 \cdot 10^{-4}$	0,001	$1 \cdot 10^{-4}$
490	$2 \cdot 10^{-4}$	$1 \cdot 10^{-4}$	$1 \cdot 10^{-4}$	$1 \cdot 10^{-4}$	$1 \cdot 10^{-4}$
500	$6 \cdot 10^{-4}$	$5 \cdot 10^{-4}$	$4 \cdot 10^{-4}$	$9 \cdot 10^{-4}$	$5 \cdot 10^{-4}$
510	$3 \cdot 10^{-4}$	$9 \cdot 10^{-4}$	$1 \cdot 10^{-4}$	$5 \cdot 10^{-4}$	$9 \cdot 10^{-4}$
520	$6 \cdot 10^{-4}$	$1 \cdot 10^{-4}$	$3 \cdot 10^{-4}$	$2 \cdot 10^{-4}$	$5 \cdot 10^{-4}$
530	$6 \cdot 10^{-5}$	$5 \cdot 10^{-4}$	$5 \cdot 10^{-4}$	0,001	$<1 \cdot 10^{-5}$
540	$8 \cdot 10^{-5}$	$5 \cdot 10^{-4}$	$3 \cdot 10^{-4}$	$4 \cdot 10^{-4}$	$6 \cdot 10^{-4}$
550	$3 \cdot 10^{-4}$	$1 \cdot 10^{-4}$	$1 \cdot 10^{-5}$	$7 \cdot 10^{-4}$	$4 \cdot 10^{-4}$
560	0,001	$3 \cdot 10^{-4}$	$2 \cdot 10^{-4}$	$<1 \cdot 10^{-5}$	$4 \cdot 10^{-4}$
570	$5 \cdot 10^{-5}$	$1 \cdot 10^{-4}$	$1 \cdot 10^{-4}$	$2 \cdot 10^{-4}$	$7 \cdot 10^{-4}$
580	$4 \cdot 10^{-4}$	$3 \cdot 10^{-4}$	$3 \cdot 10^{-4}$	$2 \cdot 10^{-4}$	$3 \cdot 10^{-4}$
590	$2 \cdot 10^{-4}$	$2 \cdot 10^{-5}$	$4 \cdot 10^{-4}$	$3 \cdot 10^{-4}$	$3 \cdot 10^{-4}$
600	$3 \cdot 10^{-4}$	$4 \cdot 10^{-4}$	$4 \cdot 10^{-4}$	$4 \cdot 10^{-4}$	$5 \cdot 10^{-4}$
610	$5 \cdot 10^{-4}$	$1 \cdot 10^{-4}$	$3 \cdot 10^{-4}$	0,001	$6 \cdot 10^{-4}$
620	$4 \cdot 10^{-4}$	$8 \cdot 10^{-4}$	$8 \cdot 10^{-4}$	$3 \cdot 10^{-4}$	0,001
630	0,001	$1 \cdot 10^{-4}$	$6 \cdot 10^{-4}$	$1 \cdot 10^{-4}$	$6 \cdot 10^{-4}$
640	$5 \cdot 10^{-4}$	$4 \cdot 10^{-4}$	$1 \cdot 10^{-4}$	$7 \cdot 10^{-4}$	$5 \cdot 10^{-4}$
650	$8 \cdot 10^{-5}$	$6 \cdot 10^{-4}$	0,001	$5 \cdot 10^{-4}$	$2 \cdot 10^{-4}$
660	$8 \cdot 10^{-4}$	$2 \cdot 10^{-4}$	$2 \cdot 10^{-5}$	$<1 \cdot 10^{-5}$	$5 \cdot 10^{-4}$
670	$6 \cdot 10^{-4}$	$3 \cdot 10^{-4}$	$3 \cdot 10^{-4}$	$3 \cdot 10^{-4}$	$5 \cdot 10^{-4}$
680	0,001	$5 \cdot 10^{-4}$	$4 \cdot 10^{-4}$	$5 \cdot 10^{-4}$	$3 \cdot 10^{-4}$
690	0,004	$5 \cdot 10^{-4}$	$1 \cdot 10^{-4}$	$5 \cdot 10^{-4}$	$5 \cdot 10^{-4}$

	IR 760	IR 780	IR 800	IR 830	IR 850
Thickness (mm)	2	2	2	2	2
Wavelength (nm)	%T	%T	%T	%T	%T
700	0,028	$1 \cdot 10^{-4}$	$3 \cdot 10^{-4}$	$4 \cdot 10^{-4}$	$1 \cdot 10^{-4}$
710	0,197	0,003	$8 \cdot 10^{-4}$	$2 \cdot 10^{-5}$	0,001
720	1,466	0,021	0,002	$5 \cdot 10^{-4}$	0,001
730	8,483	0,143	0,011	0,003	0,004
740	29,005	0,971	0,043	0,005	0,007
750	56,472	5,251	0,207	0,012	0,015
760	75,417	18,829	1,072	0,031	0,028
770	84,290	42,153	4,936	0,094	0,060
780	87,933	64,376	16,976	0,328	0,143
790	89,416	78,188	39,133	1,272	0,401
800	89,977	84,595	61,926	6,138	1,699
810	90,285	87,735	76,286	17,243	5,347
820	90,455	89,192	83,790	37,256	15,224
830	90,494	89,870	87,173	59,946	34,290
840	90,577	90,163	88,697	76,048	57,022
850	90,581	90,317	89,435	84,174	73,553
900	90,666	90,625	90,382	90,228	88,765
950	90,735	90,738	90,588	90,488	89,559
1000	90,831	90,774	90,681	90,570	89,893
1050	90,828	90,782	90,727	90,630	90,092
1065	90,849	90,802	90,725	90,626	90,135
1100	90,854	90,792	90,731	90,656	90,247
1200	90,930	90,854	90,818	90,742	90,470
1300	90,937	90,873	90,842	90,754	90,602
1400	90,914	90,847	90,808	90,744	90,642
1500	90,984	90,907	90,844	90,800	90,729
1600	90,971	90,891	90,860	90,792	90,738
1700	90,885	90,811	90,736	90,695	90,640
1800	90,773	90,684	90,611	90,585	90,520
1900	90,701	90,570	90,492	90,488	90,453
2000	90,601	90,487	90,384	90,402	90,341
2100	90,480	90,377	90,010	90,298	90,230
2200	90,051	89,861	89,708	89,826	89,726
2300	89,665	89,486	89,297	89,448	89,360
2400	88,958	88,763	88,574	88,712	88,644
2500	88,488	88,301	88,048	88,252	88,131
2600	87,651	87,333	87,065	87,329	87,212
2700	85,570	85,139	84,692	85,134	84,926
2800	56,378	53,517	49,319	54,935	50,534
2900	48,180	44,289	40,442	45,792	42,440
3000	43,409	39,142	35,691	40,706	38,048

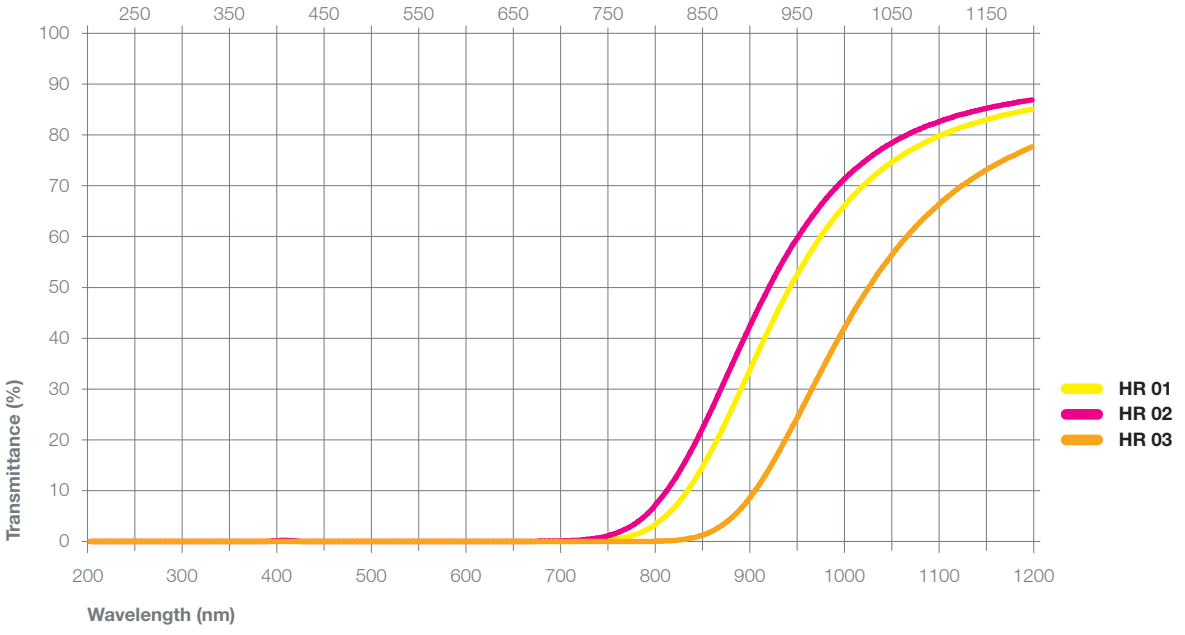
Glass Types

	HEBO	Schott	Hoya
INFRARED	HR 01		≈ RM-86
	HR 02	≈ RG 7	≈ RM-90
	HR 03		

Infrared Glass Characteristics

Type	Thickness (mm)	A[2856K]			D65			Chemical Stability		N_D	α×10-7(°C)	T_g(°C)	T_s(°C)	ρ (g/cm³)
		x	y	Y	x	y	Y	D_A	D_W					
HR 01	2	0.612	0.260	0.2	0.325	0.111	0.1	1	3	1.525				2.53
HR 02	1							1	3	1.525				2.53
HR 03	2							1	3	1.525				2.53

Type	Bubbles	Striae	Stress
HR 01	C	3C	4
HR 02	D-C	3C	4
HR 03			



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HEBO Spezialglas
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	HR 01	HR 02	HR 03
Thickness (mm)	2	1	2
Wavelength (nm)	%T	%T	%T
200	$3 \cdot 10^{-4}$	$3 \cdot 10^{-5}$	$1 \cdot 10^{-4}$
210	$<1 \cdot 10^{-5}$	$6 \cdot 10^{-4}$	$6 \cdot 10^{-4}$
220	$7 \cdot 10^{-4}$	$4 \cdot 10^{-4}$	0,001
230	$4 \cdot 10^{-4}$	$1 \cdot 10^{-4}$	$3 \cdot 10^{-4}$
240	$1 \cdot 10^{-5}$	$1 \cdot 10^{-4}$	$4 \cdot 10^{-4}$
250	$2 \cdot 10^{-5}$	0,001	$1 \cdot 10^{-4}$
260	$8 \cdot 10^{-4}$	$1 \cdot 10^{-4}$	$4 \cdot 10^{-4}$
270	$7 \cdot 10^{-4}$	$8 \cdot 10^{-4}$	$8 \cdot 10^{-4}$
280	$1 \cdot 10^{-4}$	$1 \cdot 10^{-5}$	$4 \cdot 10^{-4}$
290	$3 \cdot 10^{-4}$	$1 \cdot 10^{-4}$	$8 \cdot 10^{-4}$
300	$5 \cdot 10^{-4}$	$6 \cdot 10^{-4}$	$1 \cdot 10^{-4}$
310	$3 \cdot 10^{-4}$	$2 \cdot 10^{-4}$	$3 \cdot 10^{-4}$
320	$1 \cdot 10^{-4}$	0,001	$6 \cdot 10^{-4}$
330	0,004	0,006	0,001
340	0,016	0,006	0,001
350	0,005	$6 \cdot 10^{-4}$	0,001
360	0,001	$8 \cdot 10^{-5}$	$7 \cdot 10^{-5}$
370	0,002	$5 \cdot 10^{-5}$	$2 \cdot 10^{-4}$
380	0,014	0,003	$2 \cdot 10^{-4}$
390	0,108	0,047	0,001
400	0,224	0,187	$4 \cdot 10^{-4}$
410	0,069	0,116	0,001
420	0,006	0,017	0,001
430	$2 \cdot 10^{-4}$	0,001	$2 \cdot 10^{-4}$
440	$5 \cdot 10^{-4}$	$3 \cdot 10^{-5}$	$3 \cdot 10^{-4}$
450	$4 \cdot 10^{-4}$	$4 \cdot 10^{-4}$	$7 \cdot 10^{-4}$
460	$5 \cdot 10^{-4}$	$2 \cdot 10^{-4}$	$5 \cdot 10^{-4}$
470	$2 \cdot 10^{-4}$	$2 \cdot 10^{-4}$	$3 \cdot 10^{-4}$
480	$5 \cdot 10^{-4}$	$1 \cdot 10^{-4}$	$7 \cdot 10^{-5}$
490	$6 \cdot 10^{-4}$	$2 \cdot 10^{-4}$	$4 \cdot 10^{-4}$
500	$4 \cdot 10^{-4}$	$6 \cdot 10^{-4}$	0,001
510	$4 \cdot 10^{-4}$	$7 \cdot 10^{-4}$	$8 \cdot 10^{-4}$
520	$2 \cdot 10^{-4}$	$3 \cdot 10^{-5}$	$3 \cdot 10^{-4}$
530	$2 \cdot 10^{-5}$	$2 \cdot 10^{-4}$	$5 \cdot 10^{-5}$
540	$1 \cdot 10^{-5}$	$2 \cdot 10^{-4}$	0,001
550	$3 \cdot 10^{-4}$	$7 \cdot 10^{-4}$	$3 \cdot 10^{-4}$
560	0,001	$3 \cdot 10^{-5}$	$3 \cdot 10^{-4}$
570	$3 \cdot 10^{-4}$	$2 \cdot 10^{-4}$	$2 \cdot 10^{-4}$
580	$4 \cdot 10^{-4}$	0,001	$2 \cdot 10^{-4}$
590	$2 \cdot 10^{-4}$	$4 \cdot 10^{-4}$	0,001
600	$6 \cdot 10^{-4}$	$8 \cdot 10^{-4}$	$2 \cdot 10^{-4}$
610	$4 \cdot 10^{-4}$	0,001	$5 \cdot 10^{-5}$
620	$8 \cdot 10^{-4}$	0,001	$5 \cdot 10^{-5}$
630	$4 \cdot 10^{-4}$	0,005	$7 \cdot 10^{-4}$
640	$6 \cdot 10^{-4}$	0,007	$3 \cdot 10^{-4}$
650	0,001	0,011	0,001
660	0,001	0,016	$4 \cdot 10^{-4}$
670	0,002	0,027	$3 \cdot 10^{-5}$
680	0,004	0,044	$9 \cdot 10^{-5}$
690	0,007	0,067	$9 \cdot 10^{-4}$

	HR 01	HR 02	HR 03
Thickness (mm)	2	1	2
Wavelength (nm)	%T	%T	%T
700	0,015	0,110	$8 \cdot 10^{-5}$
710	0,029	0,184	$2 \cdot 10^{-4}$
720	0,057	0,306	0,001
730	0,109	0,503	$4 \cdot 10^{-5}$
740	0,199	0,803	$3 \cdot 10^{-4}$
750	0,351	1,251	0,001
760	0,600	1,894	$7 \cdot 10^{-4}$
770	0,990	2,784	0,002
780	1,569	3,980	0,007
790	2,394	5,519	0,018
800	3,662	7,629	0,053
810	5,154	9,932	0,122
820	7,026	12,628	0,239
830	9,354	15,726	0,455
840	12,078	19,167	0,788
850	15,173	22,873	1,353
900	34,154	42,776	8,865
950	52,781	59,907	24,606
1000	66,191	71,421	42,203
1050	74,626	78,409	56,375
1065	76,438	79,902	59,768
1100	79,739	82,589	66,287
1200	85,080	86,895	77,647
1300	87,630	88,886	83,316
1400	88,972	89,965	86,434
1500	89,862	90,594	88,262
1600	90,336	90,988	89,385
1700	90,440	91,105	89,896
1800	90,311	91,120	90,065
1900	90,100	91,077	90,064
2000	89,723	90,940	89,895
2100	89,429	90,824	89,756
2200	88,031	90,184	88,636
2300	87,553	89,994	88,339
2400	87,174	89,758	87,915
2500	85,918	89,136	86,856
2600	84,948	88,666	86,041
2700	81,705	86,942	83,135
2800	43,602	62,271	44,292
2900	37,649	57,974	38,157
3000	37,674	58,160	38,021

OPTICS CONCEPT

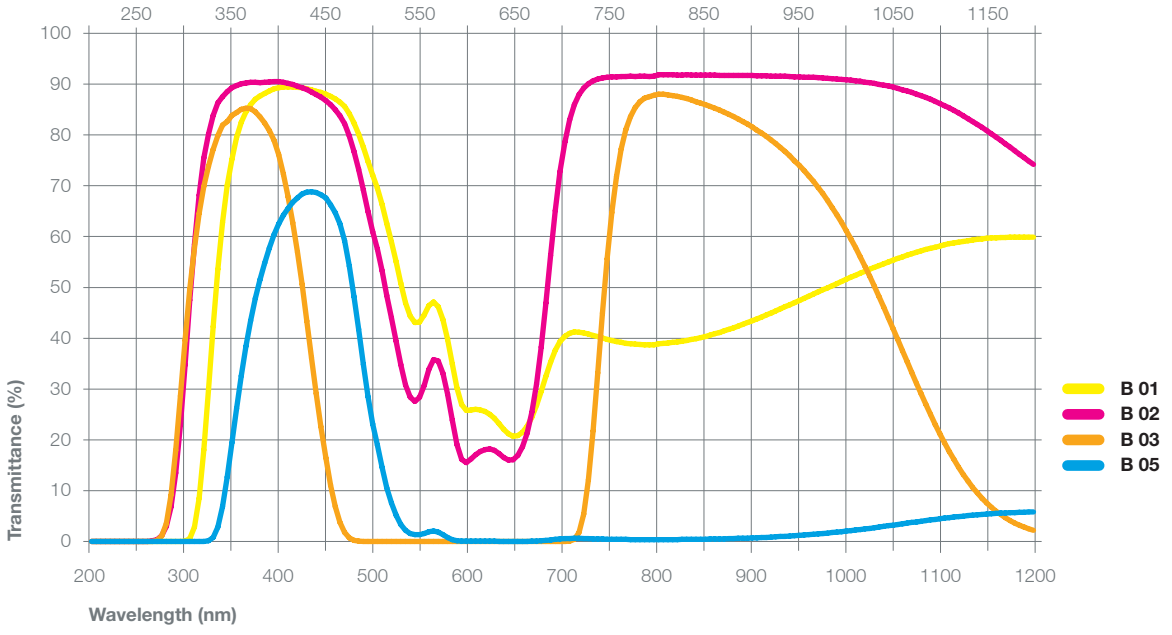
Glass Types

	HEBO	Schott	Hoya
BLUE	B 01		
	B 02		≈ B-410
	B 03		
	B 05		≈ B-440

Blue Glass Characteristics

Type	Thickness (mm)	A[2856K]			D65			Chemical Stability		N_D	α×10-7(°C)	T_g(°C)	T_s(°C)	ρ (g/cm³)
		x	y	Y	x	y	Y	D_A	D_W					
B 01	2	0.354	0.379	44.8	0.235	0.258	49.0	1	3	1.520	93	477	550	2.51
B 02	2	0.322	0.334	28.8	0.210	0.206	32.6	1	3	1.520	93	477	550	2.51
B 03	2	0.159	0.042	0.8	0.156	0.028	1.8	1	3	1.520	91	525	577	2.51
B 05	2	0.143	0.106	2.8	0.146	0.146	5.2	1	2	1.520	93	477	550	2.52

Type	Bubbles	Striae	Stress
B 01	C-B	3C	3
B 02	C-B	3C	3
B 03	C-B	4	3
B 05	C-B	4	3



	B 01	B 02	B 03	B 05
Thickness (mm)	2	2	2	2
Wavelength (nm)	%T	%T	%T	%T
200	0,012	$3 \cdot 10^{-4}$	$8 \cdot 10^{-4}$	$5 \cdot 10^{-4}$
210	0,012	$6 \cdot 10^{-4}$	$3 \cdot 10^{-4}$	$3 \cdot 10^{-4}$
220	0,010	$3 \cdot 10^{-4}$	$5 \cdot 10^{-4}$	$6 \cdot 10^{-4}$
230	0,009	0,001	$7 \cdot 10^{-4}$	$1 \cdot 10^{-4}$
240	0,008	0,001	$4 \cdot 10^{-4}$	$1 \cdot 10^{-4}$
250	0,006	0,009	$4 \cdot 10^{-4}$	$7 \cdot 10^{-4}$
260	0,005	0,112	0,034	$4 \cdot 10^{-4}$
270	0,004	1,127	1,084	$1 \cdot 10^{-5}$
280	0,004	6,787	9,111	$7 \cdot 10^{-4}$
290	0,004	22,953	28,648	$6 \cdot 10^{-4}$
300	0,559	47,459	49,675	$6 \cdot 10^{-4}$
310	8,487	68,164	64,545	$7 \cdot 10^{-4}$
320	29,854	80,190	73,874	0,120
330	53,562	86,339	79,905	2,828
340	70,100	88,503	82,616	12,673
350	79,527	89,734	84,375	26,139
360	84,538	90,225	85,279	38,444
370	87,024	90,337	84,561	47,820
380	88,176	90,332	82,371	54,779
390	89,051	90,506	78,964	60,356
400	89,430	90,345	72,259	64,237
410	89,430	89,911	62,740	66,777
420	89,284	89,322	50,587	68,356
430	88,874	88,481	36,171	68,804
440	88,353	87,423	22,617	68,265
450	87,629	85,951	11,029	66,264
460	86,487	83,800	3,779	62,540
470	84,162	79,774	0,694	54,204
480	80,189	73,231	0,069	41,753
490	74,794	64,937	0,004	28,458
500	69,560	57,519	$6 \cdot 10^{-4}$	18,984
510	62,580	48,402	$5 \cdot 10^{-4}$	10,576
520	55,038	39,417	$4 \cdot 10^{-4}$	5,182
530	47,018	30,848	$4 \cdot 10^{-4}$	2,164
540	43,099	27,598	$3 \cdot 10^{-4}$	1,320
550	44,547	30,713	$4 \cdot 10^{-4}$	1,556
560	47,124	35,755	$5 \cdot 10^{-4}$	2,082
570	43,680	33,131	$4 \cdot 10^{-4}$	1,348
580	34,942	23,864	$3 \cdot 10^{-4}$	0,387
590	26,914	16,154	$2 \cdot 10^{-4}$	0,088
600	25,861	16,221	$6 \cdot 10^{-4}$	0,068
610	25,863	17,693	$1 \cdot 10^{-4}$	0,067
620	25,038	18,183	$3 \cdot 10^{-4}$	0,053
630	23,185	17,306	$<1 \cdot 10^{-5}$	0,032
640	21,157	16,020	$5 \cdot 10^{-4}$	0,019
650	20,815	16,929	$9 \cdot 10^{-4}$	0,017
660	22,692	21,367	$2 \cdot 10^{-4}$	0,027
670	26,812	31,003	0,001	0,064
680	32,509	46,912	$1 \cdot 10^{-4}$	0,179
690	37,615	65,151	$5 \cdot 10^{-4}$	0,390

	B 01	B 02	B 03	B 05
Thickness (mm)	2	2	2	2
Wavelength (nm)	%T	%T	%T	%T
700	40,410	78,666	0,005	0,561
710	41,214	85,946	0,410	0,612
720	41,053	89,234	5,411	0,584
730	40,568	90,671	21,770	0,531
740	40,016	91,210	44,908	0,481
750	39,519	91,398	64,725	0,441
760	39,179	91,483	77,219	0,412
770	38,914	91,536	83,635	0,389
780	38,784	91,548	86,532	0,377
790	38,707	91,493	87,554	0,369
800	38,912	91,822	88,036	0,387
810	39,034	91,817	87,897	0,372
820	39,253	91,811	87,588	0,377
830	39,572	91,839	87,157	0,410
840	39,914	91,759	86,544	0,436
850	40,356	91,761	85,963	0,458
900	43,429	91,686	81,560	0,705
950	47,421	91,442	74,003	1,191
1000	51,572	90,836	61,182	2,043
1050	55,351	89,405	41,887	3,199
1065	56,321	88,657	35,406	3,594
1100	58,142	86,189	21,193	4,461
1200	59,895	74,213	2,197	5,809
1300	61,394	67,089	0,438	7,237
1400	66,283	69,095	0,414	11,760
1500	66,602	64,670	0,266	12,751
1600	70,239	67,512	0,419	17,909
1700	72,019	67,879	0,523	21,323
1800	73,415	68,482	0,506	24,773
1900	77,675	74,327	1,233	35,190
2000	81,108	79,029	3,447	46,397
2100	83,059	81,926	6,725	54,604
2200	83,627	82,983	11,000	60,772
2300	84,340	83,995	17,593	66,091
2400	84,506	84,323	25,118	69,503
2500	83,914	83,561	30,676	70,702
2600	83,183	82,526	33,800	70,841
2700	80,659	79,860	30,521	69,263
2800	56,353	55,113	4,256	48,288
2900	52,991	50,265	5,407	45,327
3000	49,620	46,481	8,001	42,663

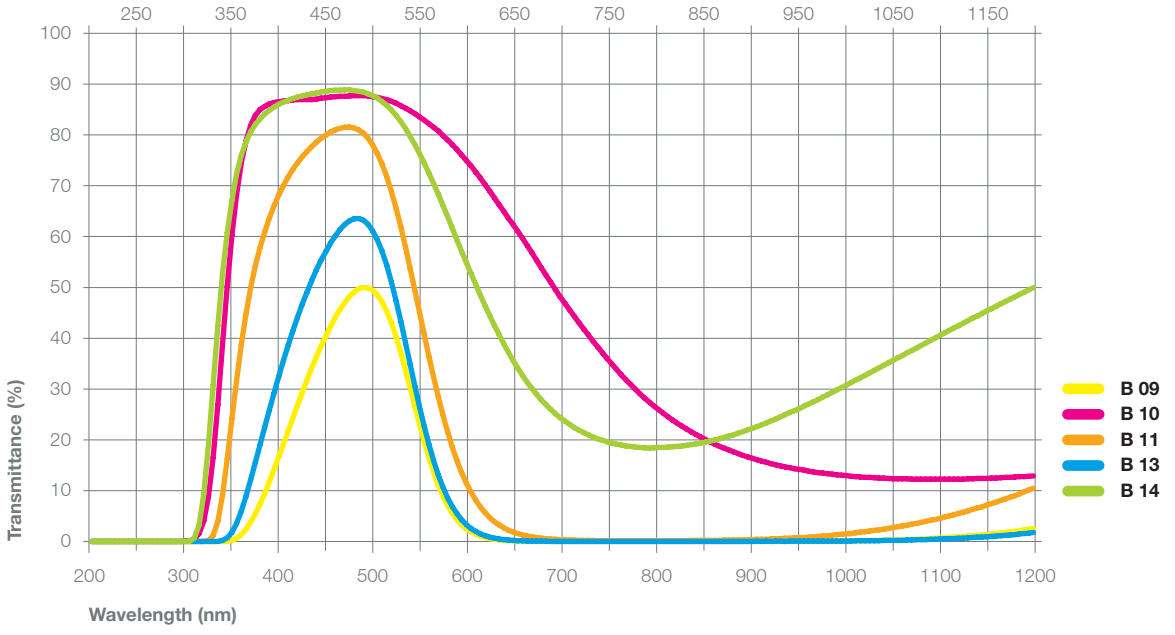
Glass Types

BLUE	HEBO	Schott	Hoya
	B 09		
	B 10		
	B 11		≈ B-460
	B 13		
	B 14	≈ BG 14	

Blue Glass Characteristics

Type	Thickness (mm)	A[2856K]			D65			Chemical Stability		N_D	α×10-7(°C)	T_g(°C)	T_s(°C)	ρ (g/cm³)
		x	y	Y	x	y	Y	D_A	D_W					
B 09	2	0.187	0.391	14.8	0.156	0.256	20.3	1	2	1.524	89	460	532	2.56
B 10	1	0.409	0.417	74.4	0.283	0.324	76.6	1	2	1.529	84	540	606	2.63
B 11	1	0.269	0.406	36.2	0.194	0.271	44.2	1	2	1.517	91	506	572	2.59
B 13	2	0.189	0.377	17.3	0.157	0.242	23.7	1	2	1.522	90	490	555	2.61
B 14	1	0.328	0.412	52.0	0.226	0.290	59.1	1	2	1.514	93	477	550	2.57

Type	Bubbles	Striae	Stress
B 09	C-B	4	3
B 10	D	3C	3
B 11	C-B	3C	3
B 13	C-B	3C	3
B 14	C-B	3C	3



	B 09	B 10	B 11	B 13	B 14
Thickness (mm)	2	1	2	2	1
Wavelength (nm)	%T	%T	%T	%T	%T
200	$2 \cdot 10^{-4}$	$3 \cdot 10^{-4}$	0,001	$1 \cdot 10^{-4}$	0,007
210	$3 \cdot 10^{-4}$	0,002	0,001	$6 \cdot 10^{-4}$	0,008
220	$3 \cdot 10^{-4}$	0,002	$6 \cdot 10^{-4}$	$2 \cdot 10^{-4}$	0,004
230	$6 \cdot 10^{-4}$	0,002	$6 \cdot 10^{-4}$	$8 \cdot 10^{-4}$	0,003
240	$4 \cdot 10^{-4}$	0,002	$8 \cdot 10^{-4}$	$3 \cdot 10^{-4}$	0,002
250	$<1 \cdot 10^{-5}$	$4 \cdot 10^{-4}$	$4 \cdot 10^{-4}$	$6 \cdot 10^{-4}$	0,001
260	$<1 \cdot 10^{-5}$	$4 \cdot 10^{-4}$	$5 \cdot 10^{-4}$	$4 \cdot 10^{-4}$	0,002
270	$3 \cdot 10^{-4}$	$8 \cdot 10^{-4}$	$4 \cdot 10^{-4}$	$7 \cdot 10^{-4}$	0,001
280	$6 \cdot 10^{-4}$	0,001	$3 \cdot 10^{-4}$	$1 \cdot 10^{-4}$	$4 \cdot 10^{-4}$
290	$1 \cdot 10^{-5}$	0,010	$1 \cdot 10^{-4}$	$7 \cdot 10^{-4}$	$9 \cdot 10^{-4}$
300	$4 \cdot 10^{-4}$	0,154	$1 \cdot 10^{-4}$	$<1 \cdot 10^{-5}$	0,071
310	$4 \cdot 10^{-4}$	1,557	0,001	$4 \cdot 10^{-4}$	3,280
320	$<1 \cdot 10^{-5}$	8,873	0,189	$6 \cdot 10^{-4}$	19,188
330	0,001	26,951	3,987	0,027	42,438
340	0,065	50,244	16,200	0,693	60,705
350	0,642	68,269	31,690	3,538	72,344
360	2,419	78,765	44,754	8,890	78,576
370	5,490	83,822	54,184	15,545	82,070
380	9,449	85,623	60,905	22,452	84,116
390	14,146	86,360	66,058	29,227	85,441
400	19,164	86,699	70,051	35,570	86,449
410	24,268	86,871	73,199	41,377	87,159
420	29,271	86,971	75,681	46,626	87,691
430	34,008	86,975	77,661	51,265	88,090
440	38,355	87,210	79,282	55,299	88,432
450	42,315	87,486	80,578	58,723	88,697
460	45,621	87,604	81,294	61,352	88,824
470	48,173	87,672	81,560	63,079	88,854
480	49,741	87,770	81,007	63,549	88,621
490	49,900	87,691	79,346	62,423	88,121
500	48,523	87,381	76,357	59,296	87,213
510	45,306	86,954	71,800	54,340	85,806
520	40,253	86,248	65,579	47,358	83,837
530	33,785	85,226	57,968	39,141	81,282
540	26,640	84,186	49,444	30,628	78,121
550	19,719	82,931	40,724	22,671	74,496
560	13,694	81,510	32,371	15,925	70,481
570	8,952	79,894	24,894	10,678	66,129
580	5,552	78,099	18,597	6,863	61,680
590	3,288	76,074	13,527	4,253	57,082
600	1,882	73,886	9,678	2,568	52,761
610	1,045	71,495	6,795	1,509	48,508
620	0,566	68,925	4,704	0,869	44,452
630	0,303	66,262	3,235	0,495	40,649
640	0,162	63,600	2,226	0,283	37,174
650	0,088	61,017	1,545	0,163	34,102
660	0,050	58,272	1,085	0,096	31,359
670	0,027	55,355	0,777	0,058	28,953
680	0,017	52,441	0,570	0,036	26,896
690	0,011	49,582	0,430	0,023	25,124

	B 09	B 10	B 11	B 13	B 14
Thickness (mm)	2	1	2	2	1
Wavelength (nm)	%T	%T	%T	%T	%T
700	0,007	46,869	0,334	0,016	23,658
710	0,005	44,283	0,269	0,012	22,415
720	0,004	41,795	0,222	0,008	21,390
730	0,003	39,414	0,190	0,006	20,565
740	0,001	37,115	0,166	0,004	19,891
750	0,001	34,911	0,150	0,003	19,365
760	0,001	32,829	0,140	0,004	18,965
770	0,001	30,877	0,133	0,004	18,675
780	0,001	29,071	0,130	0,003	18,510
790	0,001	27,404	0,129	0,002	18,386
800	0,013	25,926	0,151	0,013	18,488
810	0,012	24,542	0,140	0,011	18,534
820	0,002	23,277	0,153	0,007	18,681
830	0,015	22,110	0,167	0,020	18,917
840	0,020	21,031	0,197	0,021	19,200
850	0,031	20,051	0,200	0,027	19,562
900	0,022	16,363	0,378	0,030	22,279
950	0,041	14,158	0,752	0,039	26,182
1000	0,122	12,940	1,505	0,101	30,758
1050	0,292	12,362	2,732	0,213	35,635
1065	0,379	12,298	3,214	0,279	37,113
1100	0,668	12,228	4,560	0,461	40,511
1200	2,580	12,912	10,458	1,758	49,995
1300	6,747	14,845	19,156	4,797	58,484
1400	13,337	18,590	29,449	10,047	65,575
1500	21,758	24,482	39,956	17,251	71,260
1600	30,890	30,992	49,534	25,577	75,725
1700	39,789	35,347	57,666	34,137	79,142
1800	47,826	36,577	64,198	42,211	81,696
1900	54,796	36,340	69,322	49,397	83,653
2000	60,560	36,499	73,164	55,442	85,080
2100	65,349	37,745	76,163	60,559	86,184
2200	68,065	39,738	77,579	64,102	86,669
2300	71,113	42,239	79,215	67,274	87,223
2400	73,735	44,156	80,240	69,777	87,605
2500	74,521	45,266	80,349	71,294	87,620
2600	75,372	46,020	80,340	72,366	87,554
2700	72,639	45,327	78,159	71,537	86,648
2800	28,995	25,360	48,361	47,775	72,154
2900	26,136	26,154	44,717	42,539	69,730
3000	27,887	27,350	43,901	38,891	67,742

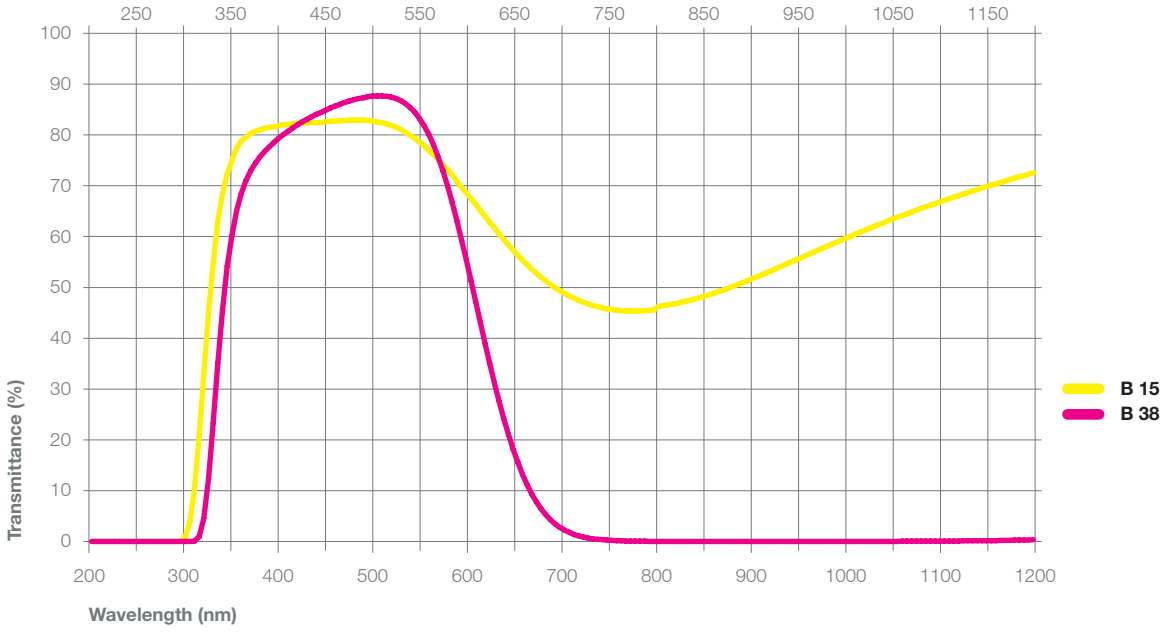
Glass Types

	HEBO	Schott	Hoya
BLUE	B 15		
	B 38	≈ BG 38	

Blue Glass Characteristics

Type	Thickness (mm)	A[2856K]			D65			Chemical Stability		N_D	α×10-7(°C)	T_g(°C)	T_s(°C)	ρ (g/cm³)
		x	y	Y	x	y	Y	D_A	D_W					
B 15	1	0.400	0.413	75.20	0.274	0.315	78.3	1	3	1.518	90	490	555	2.50
B 38	2	0.345	0.439	62.1	0.244	0.326	68.8	1	3	1.535	100	421	463	2.86

Type	Bubbles	Striae	Stress
B 15	D	3C	3
B 38	C	3C	4



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	B 15	B 38
Thickness (mm)	1	2
Wavelength (nm)	%T	%T
200	0,019	$5 \cdot 10^{-4}$
210	0,020	$2 \cdot 10^{-4}$
220	0,014	$5 \cdot 10^{-4}$
230	0,012	$<1 \cdot 10^{-5}$
240	0,010	$7 \cdot 10^{-4}$
250	0,008	$<1 \cdot 10^{-5}$
260	0,006	$8 \cdot 10^{-4}$
270	0,006	$4 \cdot 10^{-4}$
280	0,004	$3 \cdot 10^{-4}$
290	0,106	$7 \cdot 10^{-4}$
300	3,736	0,002
310	20,613	0,955
320	44,954	12,256
330	62,973	35,120
340	72,384	54,234
350	77,403	65,033
360	79,588	71,004
370	80,710	74,410
380	81,281	76,751
390	81,671	78,538
400	82,020	80,067
410	82,227	81,391
420	82,317	82,564
430	82,399	83,585
440	82,426	84,425
450	82,684	85,357
460	82,797	86,038
470	82,916	86,684
480	82,945	87,188
490	82,853	87,515
500	82,589	87,686
510	82,171	87,621
520	81,496	87,139
530	80,507	86,158
540	79,307	84,449
550	77,867	81,806
560	76,116	78,012
570	74,147	72,925
580	72,051	66,645
590	69,682	59,255
600	67,478	51,335
610	65,163	43,086
620	62,790	34,982
630	60,543	27,570
640	58,306	21,022
650	56,279	15,562
660	54,456	11,137
670	52,717	7,731
680	51,212	5,211
690	49,908	3,420

	B 15	B 38
Thickness (mm)	1	2
Wavelength (nm)	%T	%T
700	48,765	2,191
710	47,804	1,379
720	47,049	0,854
730	46,435	0,527
740	45,942	0,323
750	45,637	0,198
760	45,434	0,123
770	45,328	0,078
780	45,349	0,051
790	45,452	0,032
800	46,280	0,031
810	46,536	0,019
820	46,881	0,016
830	47,324	0,013
840	47,779	0,009
850	48,310	0,007
900	51,707	0,018
950	55,705	0,011
1000	59,708	0,022
1050	63,467	0,024
1065	64,520	0,043
1100	66,818	0,057
1200	72,558	0,346
1300	77,027	1,452
1400	80,304	4,787
1500	82,711	11,590
1600	84,439	21,718
1700	85,622	32,668
1800	86,415	42,032
1900	86,919	49,080
2000	87,282	53,492
2100	87,555	55,840
2200	87,246	53,221
2300	87,322	51,275
2400	87,286	50,996
2500	86,910	46,501
2600	86,562	36,350
2700	85,039	28,289
2800	65,127	1,078
2900	62,415	0,012
3000	61,215	0,013

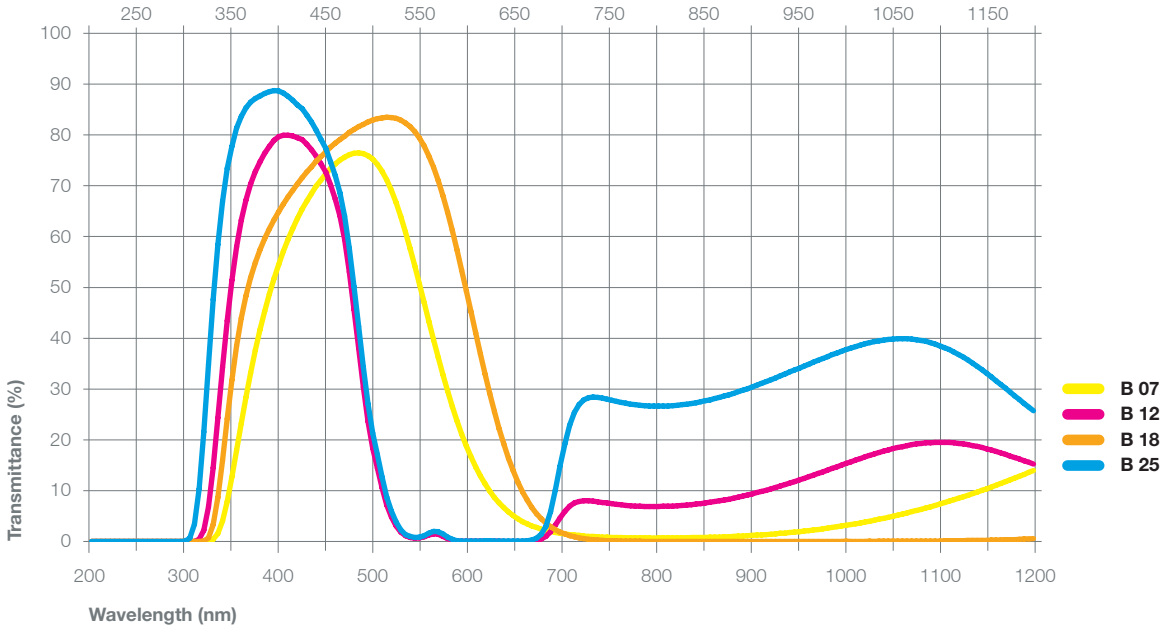
Glass Types

	HEBO	Schott	Hoya
BLUE	B 07	≈ BG7	≈ B-480
	B 12	≈ BG12	
	B 18	≈ BG18	
	B 25	≈ BG25	≈ B-380

Blue Glass Characteristics

Type	Thickness (mm)	A[2856K]			D65			Chemical Stability		N_D	α×10-7(°C)	T_g(°C)	T_s(°C)	ρ (g/cm³)
		x	y	Y	x	y	Y	D_A	D_W					
B 07	1	0.306	0.440	10.0	0.207	0.229	51.2	1	2	1.517	93	477	550	2.56
B 12	1	0.148	0.084	1.4	0.148	0.053	4.75	4	3	1.513	93	477	550	2.56
B 18	1	0.375	0.452	57.2	0.266	0.356	61.8	6	5	1.536	74	549	624	2.82
B 25	1	0.158	0.093	2.1	0.151	0.070	4.5	1	2	1.517	93	477	550	2.56

Type	Bubbles	Striae	Stress
B 07	C-B	3C	3
B 12	C-B	3C	3
B 18	D-C	3C	4
B 25	C-B	3C	3



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	B 07	B 12	B 18	B 25
Thickness (mm)	1	1	1	1
Wavelength (nm)	%T	%T	%T	%T
200	$6 \cdot 10^{-4}$	$1 \cdot 10^{-4}$	$4 \cdot 10^{-4}$	$4 \cdot 10^{-5}$
210	0,001	$2 \cdot 10^{-5}$	$4 \cdot 10^{-4}$	$3 \cdot 10^{-4}$
220	$2 \cdot 10^{-4}$	$5 \cdot 10^{-4}$	$2 \cdot 10^{-4}$	$2 \cdot 10^{-4}$
230	$3 \cdot 10^{-4}$	$4 \cdot 10^{-4}$	$4 \cdot 10^{-4}$	$3 \cdot 10^{-4}$
240	$4 \cdot 10^{-4}$	$1 \cdot 10^{-4}$	$3 \cdot 10^{-4}$	$4 \cdot 10^{-4}$
250	$3 \cdot 10^{-4}$	$<1 \cdot 10^{-5}$	$<1 \cdot 10^{-5}$	$4 \cdot 10^{-4}$
260	$1 \cdot 10^{-5}$	$7 \cdot 10^{-4}$	$7 \cdot 10^{-4}$	$5 \cdot 10^{-4}$
270	$1 \cdot 10^{-5}$	$<1 \cdot 10^{-5}$	$1 \cdot 10^{-4}$	$4 \cdot 10^{-4}$
280	$4 \cdot 10^{-4}$	0,001	$4 \cdot 10^{-4}$	$8 \cdot 10^{-4}$
290	0,001	$<1 \cdot 10^{-5}$	$4 \cdot 10^{-4}$	0,001
300	$<1 \cdot 10^{-5}$	0,001	0,001	0,650
310	$2 \cdot 10^{-4}$	0,404	$6 \cdot 10^{-4}$	10,346
320	0,057	6,793	0,703	34,794
330	1,577	24,336	8,621	58,396
340	7,834	43,444	24,150	73,403
350	17,917	57,966	38,448	81,348
360	28,376	67,197	48,352	85,312
370	37,615	72,766	54,879	87,139
380	45,301	76,413	59,590	88,156
390	51,730	78,919	63,304	88,716
400	57,103	79,960	66,400	88,225
410	61,595	79,808	69,134	86,847
420	65,382	79,067	71,600	85,182
430	68,486	77,076	73,728	82,534
440	71,113	74,332	75,707	79,164
450	73,404	70,130	77,578	74,702
460	75,048	64,060	79,110	68,625
470	76,135	53,083	80,492	57,658
480	76,497	38,056	81,628	42,301
490	75,925	23,617	82,537	27,062
500	74,202	14,443	83,174	17,084
510	71,176	7,153	83,471	8,707
520	66,687	3,067	83,251	3,819
530	60,904	1,098	82,381	1,379
540	54,186	0,647	80,647	0,810
550	46,972	0,895	77,796	1,132
560	39,684	1,497	73,608	1,990
570	32,809	1,019	68,055	1,471
580	26,564	0,255	61,247	0,400
590	21,128	0,048	53,375	0,081
600	16,620	0,042	45,185	0,078
610	12,895	0,053	36,930	0,102
620	9,906	0,050	29,098	0,106
630	7,589	0,035	22,213	0,081
640	5,804	0,022	16,399	0,055
650	4,466	0,024	11,722	0,064
660	3,471	0,054	8,131	0,151
670	2,730	0,214	5,474	0,628
680	2,186	0,980	3,593	3,005
690	1,783	3,180	2,305	10,048

	B 07	B 12	B 18	B 25
Thickness (mm)	1	1	1	1
Wavelength (nm)	%T	%T	%T	%T
700	1,484	5,937	1,453	19,308
710	1,261	7,556	0,906	25,380
720	1,093	8,026	0,560	27,853
730	0,968	7,941	0,346	28,397
740	0,873	7,685	0,216	28,184
750	0,803	7,421	0,134	27,767
760	0,750	7,194	0,087	27,357
770	0,712	7,025	0,057	27,026
780	0,686	6,910	0,037	26,787
790	0,673	6,853	0,026	26,661
800	0,690	6,897	0,034	26,632
810	0,683	6,928	0,010	26,674
820	0,695	7,023	0,010	26,807
830	0,729	7,176	0,018	27,036
840	0,764	7,348	0,022	27,318
850	0,805	7,579	0,015	27,689
900	1,195	9,368	0,022	30,404
950	1,930	12,098	0,013	34,106
1000	3,174	15,347	0,040	37,748
1050	4,964	18,258	0,057	39,849
1065	5,617	18,867	0,067	39,899
1100	7,352	19,497	0,102	38,517
1200	13,978	15,259	0,534	25,712
1300	22,613	13,148	2,062	19,330
1400	32,050	17,714	6,099	23,860
1500	41,561	15,633	13,585	19,611
1600	50,129	20,519	23,960	24,219
1700	57,516	22,409	35,137	25,617
1800	63,597	24,836	45,310	27,447
1900	68,528	36,355	53,692	39,250
2000	72,389	48,887	59,956	52,117
2100	75,476	57,704	64,434	60,730
2200	77,538	64,479	65,424	67,080
2300	79,308	70,055	66,816	72,176
2400	80,727	73,317	68,667	75,036
2500	81,558	74,203	67,532	75,604
2600	82,044	73,876	62,123	74,919
2700	81,507	72,595	57,069	73,405
2800	66,110	59,427	12,350	62,086
2900	62,497	57,008	1,592	60,727
3000	59,774	55,418	1,072	59,288

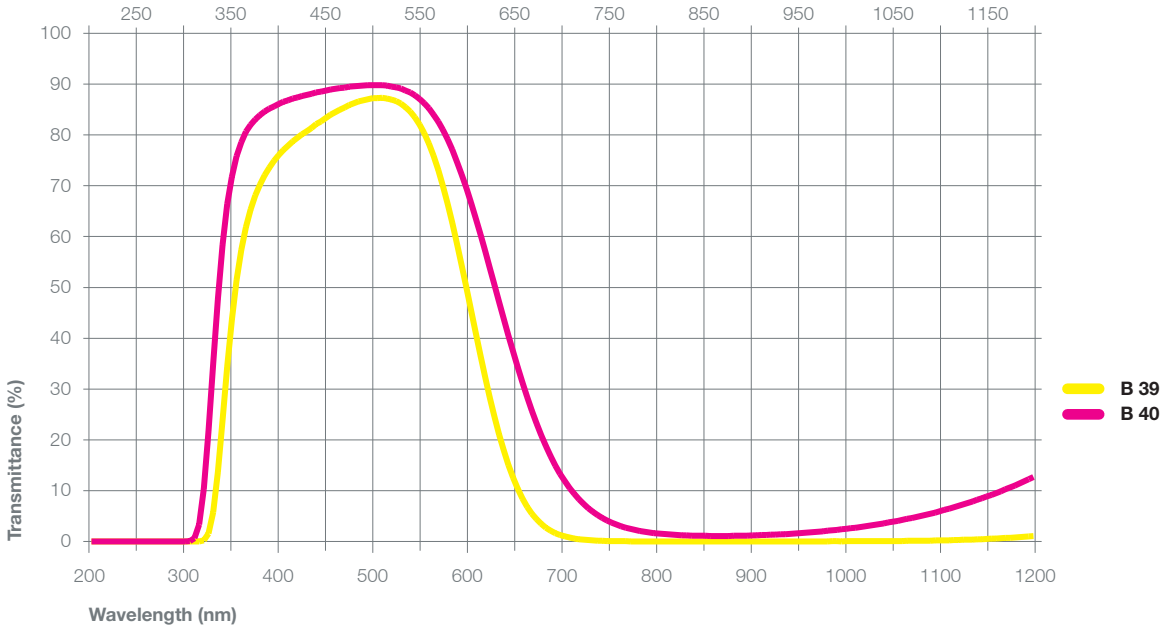
Glass Types

	HEBO	Schott	Hoya
BLUE	B 39	≈ BG 39	
	B 40	≈ BG 40	

Blue Glass Characteristics

Type	Thickness (mm)	A[2856K]			D65			Chemical Stability		N_D	α×10-7(°C)	T_g(°C)	T_s(°C)	ρ (g/cm³)
		x	y	Y	x	y	Y	D_A	D_W					
B 39	1	0.364	0.431	66	0.255	0.321	73	1	3	1.55	94	417	489	2.75
B 40	1	0.404	0.422	77	0.282	0.327	82	1	3	1.54	95	419	492	2.75

Type	Bubbles	Striae	Stress
B 39	C	3C	4
B 40	C	3C	4



	B 39	B 40
Thickness (mm)	1	1
Wavelength (nm)	%T	%T
200	$4 \cdot 10^{-5}$	$1 \cdot 10^{-4}$
210	$2 \cdot 10^{-4}$	$2 \cdot 10^{-4}$
220	$6 \cdot 10^{-4}$	$2 \cdot 10^{-4}$
230	$3 \cdot 10^{-4}$	$4 \cdot 10^{-4}$
240	0,001	$<1 \cdot 10^{-5}$
250	0,001	$6 \cdot 10^{-4}$
260	$5 \cdot 10^{-4}$	$3 \cdot 10^{-4}$
270	$1 \cdot 10^{-4}$	$4 \cdot 10^{-4}$
280	$4 \cdot 10^{-4}$	$6 \cdot 10^{-4}$
290	$6 \cdot 10^{-4}$	$3 \cdot 10^{-4}$
300	$7 \cdot 10^{-4}$	0,048
310	0,011	3,359
320	1,567	21,707
330	13,615	47,615
340	34,411	66,407
350	51,487	75,823
360	61,846	80,616
370	68,086	83,083
380	72,068	84,633
390	74,881	85,637
400	77,056	86,500
410	78,705	87,159
420	80,144	87,696
430	81,393	88,071
440	82,649	88,496
450	83,959	88,949
460	84,996	89,242
470	85,887	89,484
480	86,597	89,670
490	87,046	89,778
500	87,276	89,792
510	87,193	89,703
520	86,664	89,399
530	85,474	88,760
540	83,499	87,798
550	80,350	86,266
560	75,882	84,012
570	69,964	81,021
580	62,701	77,077
590	54,333	72,191
600	45,556	66,693
610	36,706	60,510
620	28,361	53,860
630	21,078	47,157
640	15,041	40,494
650	10,323	34,210
660	6,831	28,433
670	4,360	23,243
680	2,703	18,770
690	1,634	14,977

	B 39	B 40
Thickness (mm)	1	1
Wavelength (nm)	%T	%T
700	0,968	11,842
710	0,569	9,334
720	0,334	7,335
730	0,196	5,784
740	0,116	4,584
750	0,071	3,676
760	0,045	2,983
770	0,029	2,465
780	0,019	2,066
790	0,014	1,772
800	0,023	1,562
810	0,016	1,395
820	0,014	1,269
830	0,017	1,194
840	0,018	1,138
850	0,015	1,109
900	0,021	1,184
950	0,020	1,620
1000	0,053	2,497
1050	0,094	3,894
1065	0,114	4,436
1100	0,206	5,951
1200	1,080	12,675
1300	4,182	23,368
1400	11,518	36,784
1500	23,205	50,079
1600	37,098	61,570
1700	49,935	69,765
1800	60,055	74,986
1900	67,461	78,287
2000	72,300	79,961
2100	75,349	80,750
2200	74,497	77,816
2300	74,561	76,666
2400	75,703	77,134
2500	73,418	74,035
2600	66,990	66,606
2700	61,308	60,210
2800	14,468	11,627
2900	1,308	0,900
3000	0,603	0,404

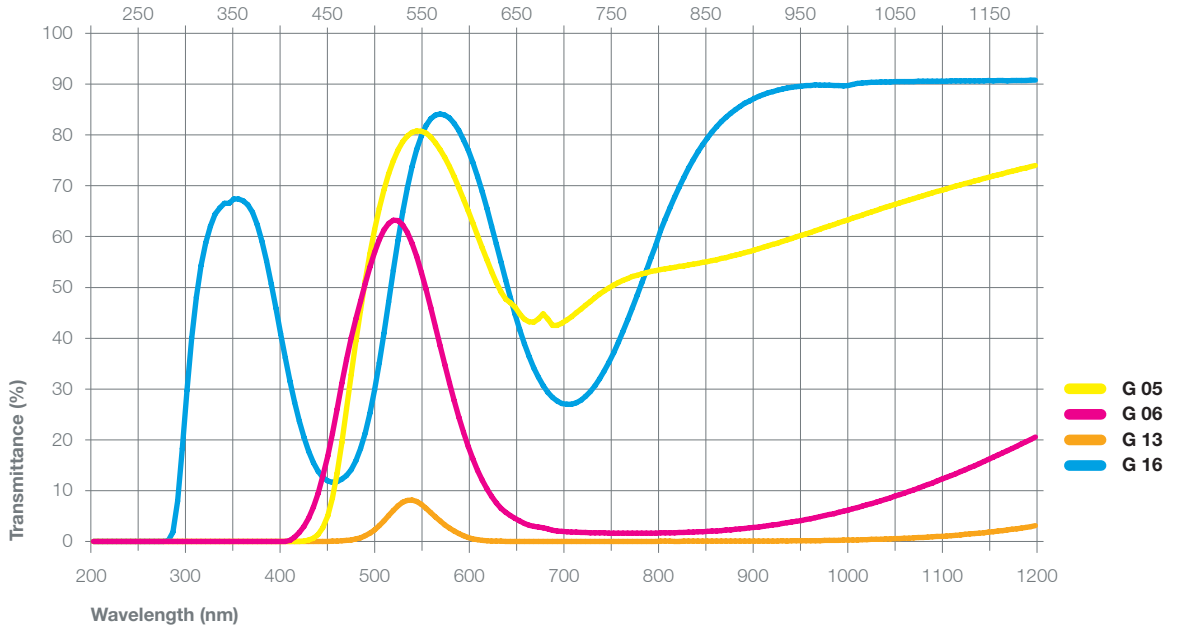
Glass Types

GREEN	HEBO	Schott	Hoya
	G 05	≈ VG 5	
	G 06	≈ VG 6	
	G 13		≈ G-545
	G 16		

Green Glass Characteristics

Type	Thickness (mm)	A[2856K]			D65			Chemical Stability		N_D	α×10-7(°C)	T_g(°C)	T_s(°C)	ρ (g/cm³)
		x	y	Y	x	y	Y	D_A	D_W					
G 05	1	0.455	0.477	73.4	0.362	0.476	73.5	1	2	1.547	104	458	526	2.85
G 06	2	0.377	0.543	40.9	0.299	0.536	44.8	1	2	1.547	104	458	526	2.85
G 13	2	0.352	0.568	15.2	0.284	0.554	16.9	1	3	1.527	98	597	663	2.53
G 16	2	0.484	0.476	74.0	0.405	0.483	70.2	6	5	1.535	100	421	463	2.84

Type	Bubbles	Striae	Stress
G 05	C-B	4	3
G 06	C-B	4	3
G 13	C-B	4	3
G 16	C-B	4	3



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	G 05	G 06	G 13	G 16
Thickness (mm)	1	2	2	2
Wavelength (nm)	%T	%T	%T	%T
200	$5 \cdot 10^{-4}$	$4 \cdot 10^{-4}$	$1 \cdot 10^{-4}$	0,002
210	$1 \cdot 10^{-4}$	$5 \cdot 10^{-4}$	$1 \cdot 10^{-4}$	0,002
220	0,001	0,001	$8 \cdot 10^{-4}$	$6 \cdot 10^{-4}$
230	$4 \cdot 10^{-4}$	$7 \cdot 10^{-4}$	$1 \cdot 10^{-4}$	$1 \cdot 10^{-4}$
240	$7 \cdot 10^{-4}$	$2 \cdot 10^{-4}$	$8 \cdot 10^{-4}$	$7 \cdot 10^{-4}$
250	$5 \cdot 10^{-4}$	$3 \cdot 10^{-4}$	$2 \cdot 10^{-4}$	$1 \cdot 10^{-4}$
260	$1 \cdot 10^{-4}$	0,001	$2 \cdot 10^{-4}$	$2 \cdot 10^{-5}$
270	$5 \cdot 10^{-4}$	$3 \cdot 10^{-4}$	$5 \cdot 10^{-4}$	0,002
280	$1 \cdot 10^{-4}$	$4 \cdot 10^{-4}$	$1 \cdot 10^{-4}$	1,816
290	$4 \cdot 10^{-4}$	$2 \cdot 10^{-5}$	$4 \cdot 10^{-4}$	18,271
300	$5 \cdot 10^{-4}$	$8 \cdot 10^{-4}$	0,001	39,962
310	$3 \cdot 10^{-5}$	$4 \cdot 10^{-4}$	$2 \cdot 10^{-4}$	54,292
320	$7 \cdot 10^{-4}$	$3 \cdot 10^{-4}$	$1 \cdot 10^{-4}$	61,980
330	0,001	$4 \cdot 10^{-4}$	$3 \cdot 10^{-4}$	65,607
340	$4 \cdot 10^{-4}$	0,001	$4 \cdot 10^{-4}$	66,573
350	0,001	$2 \cdot 10^{-4}$	$8 \cdot 10^{-5}$	67,388
360	$3 \cdot 10^{-4}$	$2 \cdot 10^{-4}$	$2 \cdot 10^{-4}$	66,232
370	$2 \cdot 10^{-4}$	$3 \cdot 10^{-4}$	$2 \cdot 10^{-4}$	62,360
380	$3 \cdot 10^{-4}$	$6 \cdot 10^{-4}$	$3 \cdot 10^{-4}$	55,199
390	$1 \cdot 10^{-4}$	$<1 \cdot 10^{-5}$	0,001	45,892
400	$8 \cdot 10^{-4}$	0,035	$2 \cdot 10^{-4}$	36,136
410	0,004	0,830	$4 \cdot 10^{-5}$	27,367
420	0,097	3,011	0,003	20,447
430	0,609	6,738	0,007	15,530
440	2,689	12,816	0,015	12,644
450	8,567	21,286	0,039	11,629
460	19,440	31,126	0,115	12,227
470	32,813	40,027	0,312	14,117
480	45,501	47,277	0,736	18,269
490	56,639	54,010	1,608	25,220
500	65,557	59,395	3,088	35,158
510	72,342	62,594	5,069	47,143
520	77,060	63,114	7,011	59,267
530	79,806	60,796	8,088	69,627
540	80,812	56,030	7,847	77,158
550	80,349	49,579	6,523	81,861
560	78,446	42,228	4,811	83,880
570	75,575	34,773	3,275	83,920
580	71,781	27,708	2,044	82,307
590	67,358	21,452	1,110	79,029
600	62,641	16,234	0,521	74,554
610	57,767	12,029	0,222	68,790
620	53,057	8,847	0,093	62,029
630	49,105	6,551	0,043	54,986
640	46,957	5,112	0,027	47,995
650	44,757	4,010	0,017	41,703
660	43,221	3,214	0,012	36,407
670	43,779	2,800	0,012	32,282
680	43,764	2,460	0,013	29,362
690	42,505	2,054	0,010	27,615

	G 05	G 06	G 13	G 16
Thickness (mm)	1	2	2	2
Wavelength (nm)	%T	%T	%T	%T
700	43,589	1,907	0,011	26,971
710	44,992	1,813	0,011	27,290
720	46,494	1,752	0,013	28,538
730	47,976	1,708	0,014	30,645
740	49,331	1,676	0,016	33,567
750	50,443	1,654	0,017	37,156
760	51,392	1,637	0,018	41,365
770	52,128	1,628	0,017	45,986
780	52,640	1,622	0,020	50,864
790	53,154	1,633	0,020	55,888
800	53,512	1,680	0,045	61,148
810	53,815	1,701	0,042	65,604
820	54,122	1,745	0,034	69,763
830	54,412	1,807	0,042	73,473
840	54,727	1,889	0,036	76,690
850	55,082	1,985	0,050	79,399
900	57,329	2,755	0,062	87,171
950	60,220	4,138	0,123	89,595
1000	63,310	6,182	0,274	89,741
1050	66,330	8,895	0,555	90,480
1065	67,211	9,833	0,659	90,538
1100	69,132	12,246	1,027	90,584
1200	73,973	20,557	3,089	90,758
1300	77,805	30,199	7,154	90,837
1400	80,720	39,902	12,629	90,787
1500	83,019	48,763	18,870	90,118
1600	84,713	56,365	24,971	89,618
1700	85,899	62,567	29,933	88,132
1800	86,716	67,409	33,423	86,002
1900	87,211	71,133	36,106	84,155
2000	87,546	73,857	38,798	82,060
2100	87,644	76,012	41,946	80,282
2200	87,239	76,861	44,944	76,197
2300	87,139	77,643	48,569	72,110
2400	86,930	78,190	51,837	70,919
2500	86,352	78,133	54,282	66,895
2600	85,832	77,845	56,493	59,616
2700	83,836	76,017	56,687	52,758
2800	58,693	51,538	31,372	17,939
2900	56,141	43,140	30,218	1,182
3000	53,223	38,141	32,177	0,198

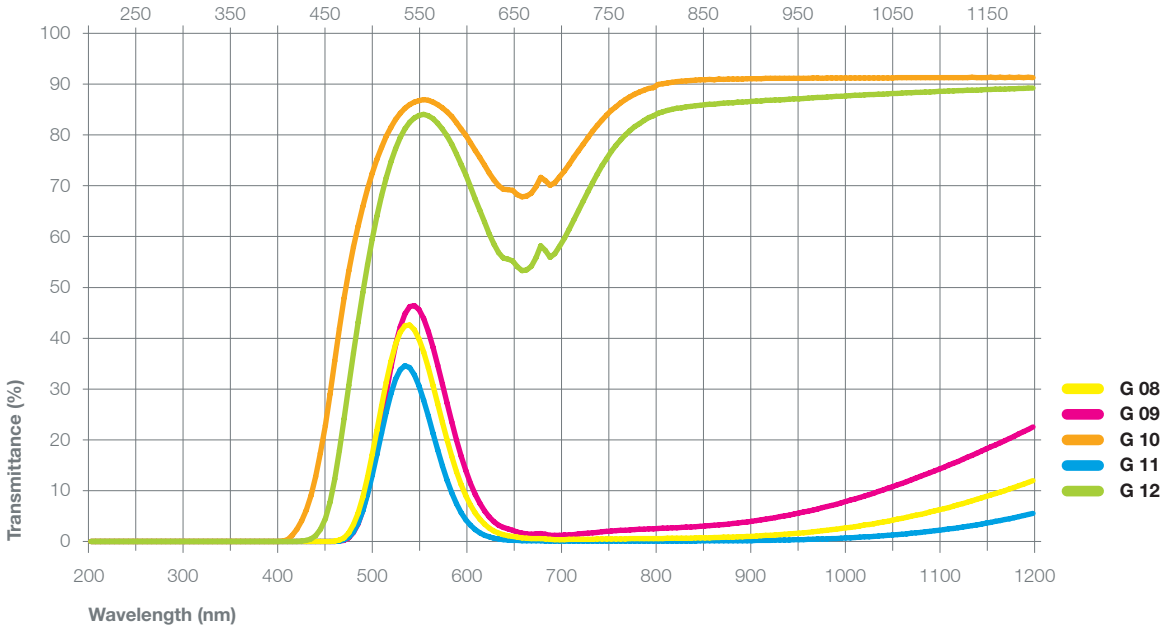
Glass Types

GREEN	HEBO	Schott	Hoya
	G 08	≈ VG 8	≈ G-533
	G 09	≈ VG 9	
	G 10	≈ VG 10	
	G 11	≈ VG 11	
	G 12		≈ G-550

Green Glass Characteristics

Type	Thickness (mm)	A[2856K]			D65			Chemical Stability		N_D	α×10-7(°C)	T_g(°C)	T_s(°C)	ρ (g/cm³)
		x	y	Y	x	y	Y	D_A	D_W					
G 08	2	0.360	0.603	25.6	0.308	0.629	28.4	1	2	1.547	104	458	526	2.85
G 09	2	0.328	0.593	24.6	0.268	0.586	28.2	1	3	1.524	96	535	599	2.52
G 10	2	0.462	0.452	86.7	0.353	0.429	85.2	1	2	1.547	104	458	526	2.85
G 11	2	0.250	0.669	9.7	0.216	0.658	11.9	1	2	1.524	96	535	599	2.52
G 12	2	0.472	0.477	79.2	0.383	0.495	77.6	1	3	1.547	104	458	526	2.85

Type	Bubbles	Striae	Stress
G 08	C-B	4	3
G 09	C-B	4	3
G 10	C-B	4	3
G 11	C-B	4	3
G 12	C-B	4	3



	G 08	G 09	G 10	G 11	G 12
Thickness (mm)	2	2	2	2	2
Wavelength (nm)	%T	%T	%T	%T	%T
200	$6 \cdot 10^{-5}$	$4 \cdot 10^{-4}$	0,001	$9 \cdot 10^{-5}$	0,001
210	$3 \cdot 10^{-4}$	$2 \cdot 10^{-4}$	0,001	$1 \cdot 10^{-4}$	0,001
220	0,002	$6 \cdot 10^{-4}$	0,001	0,001	$3 \cdot 10^{-4}$
230	$4 \cdot 10^{-4}$	$4 \cdot 10^{-4}$	0,003	$<1 \cdot 10^{-5}$	0,001
240	0,001	$3 \cdot 10^{-4}$	0,002	$4 \cdot 10^{-4}$	$6 \cdot 10^{-4}$
250	$6 \cdot 10^{-4}$	$1 \cdot 10^{-4}$	0,003	$2 \cdot 10^{-4}$	0,001
260	$3 \cdot 10^{-4}$	$4 \cdot 10^{-4}$	0,002	$3 \cdot 10^{-4}$	0,001
270	$1 \cdot 10^{-4}$	$4 \cdot 10^{-4}$	0,001	$1 \cdot 10^{-4}$	0,001
280	$1 \cdot 10^{-4}$	$1 \cdot 10^{-4}$	0,001	$5 \cdot 10^{-4}$	$1 \cdot 10^{-4}$
290	$7 \cdot 10^{-4}$	$6 \cdot 10^{-4}$	$3 \cdot 10^{-4}$	$3 \cdot 10^{-4}$	$3 \cdot 10^{-4}$
300	$2 \cdot 10^{-5}$	0,001	$8 \cdot 10^{-4}$	$5 \cdot 10^{-4}$	$8 \cdot 10^{-4}$
310	$2 \cdot 10^{-5}$	$4 \cdot 10^{-4}$	$7 \cdot 10^{-4}$	$7 \cdot 10^{-4}$	$7 \cdot 10^{-4}$
320	$7 \cdot 10^{-4}$	$2 \cdot 10^{-4}$	0,006	$7 \cdot 10^{-4}$	$1 \cdot 10^{-4}$
330	$3 \cdot 10^{-4}$	$6 \cdot 10^{-4}$	0,004	0,001	$5 \cdot 10^{-4}$
340	$2 \cdot 10^{-4}$	$6 \cdot 10^{-5}$	$1 \cdot 10^{-4}$	$3 \cdot 10^{-4}$	$6 \cdot 10^{-4}$
350	$7 \cdot 10^{-5}$	$<1 \cdot 10^{-5}$	0,001	$2 \cdot 10^{-4}$	$4 \cdot 10^{-4}$
360	$4 \cdot 10^{-4}$	$3 \cdot 10^{-4}$	$2 \cdot 10^{-4}$	$4 \cdot 10^{-4}$	$5 \cdot 10^{-4}$
370	$5 \cdot 10^{-5}$	$3 \cdot 10^{-4}$	$9 \cdot 10^{-4}$	$6 \cdot 10^{-4}$	$3 \cdot 10^{-5}$
380	$6 \cdot 10^{-4}$	$8 \cdot 10^{-4}$	$6 \cdot 10^{-4}$	$5 \cdot 10^{-4}$	$5 \cdot 10^{-5}$
390	$2 \cdot 10^{-4}$	$5 \cdot 10^{-4}$	$9 \cdot 10^{-4}$	$3 \cdot 10^{-4}$	$3 \cdot 10^{-5}$
400	$6 \cdot 10^{-4}$	$<1 \cdot 10^{-5}$	0,057	$2 \cdot 10^{-4}$	$4 \cdot 10^{-4}$
410	$3 \cdot 10^{-4}$	$<1 \cdot 10^{-5}$	1,179	$2 \cdot 10^{-4}$	0,003
420	$3 \cdot 10^{-4}$	$3 \cdot 10^{-4}$	4,055	$6 \cdot 10^{-4}$	0,081
430	$2 \cdot 10^{-4}$	0,001	9,024	$2 \cdot 10^{-4}$	0,516
440	$3 \cdot 10^{-4}$	0,001	17,338	$1 \cdot 10^{-4}$	2,354
450	0,013	0,001	28,994	0,002	7,707
460	0,254	0,058	41,930	0,089	17,897
470	1,704	0,735	53,231	0,881	30,699
480	5,621	3,466	62,076	3,602	43,127
490	12,643	9,567	69,387	9,186	54,456
500	21,849	18,718	75,186	17,074	63,987
510	31,326	29,205	79,703	25,450	71,614
520	38,808	38,663	83,035	31,958	77,343
530	42,423	44,804	85,258	34,573	81,235
540	41,647	46,442	86,496	32,831	83,342
550	37,272	43,861	86,955	27,815	84,026
560	30,682	38,187	86,467	21,290	83,170
570	23,441	30,993	85,330	14,895	81,181
580	16,722	23,506	83,625	9,562	78,188
590	11,180	16,799	81,164	5,685	74,209
600	7,126	11,415	78,481	3,182	69,796
610	4,373	7,496	75,519	1,701	65,121
620	2,639	4,853	72,478	0,891	60,558
630	1,629	3,211	70,019	0,479	56,842
640	1,156	2,466	69,214	0,303	55,576
650	0,815	1,871	68,270	0,189	54,058
660	0,608	1,501	67,931	0,128	53,408
670	0,553	1,483	69,834	0,107	55,814
680	0,494	1,408	71,004	0,090	57,271
690	0,387	1,175	70,620	0,064	56,596

	G 08	G 09	G 10	G 11	G 12
Thickness (mm)	2	2	2	2	2
Wavelength (nm)	%T	%T	%T	%T	%T
700	0,385	1,249	72,924	0,062	59,684
710	0,401	1,381	75,594	0,062	63,262
720	0,424	1,536	78,189	0,064	66,983
730	0,452	1,711	80,695	0,067	70,594
740	0,478	1,880	82,953	0,070	73,932
750	0,500	2,036	84,811	0,071	76,726
760	0,518	2,170	86,317	0,074	79,027
770	0,534	2,285	87,524	0,074	80,872
780	0,549	2,386	88,425	0,078	82,225
790	0,563	2,463	89,133	0,079	83,381
800	0,595	2,570	89,907	0,090	84,277
810	0,605	2,648	90,231	0,089	84,815
820	0,612	2,724	90,479	0,098	85,231
830	0,653	2,800	90,638	0,100	85,532
840	0,677	2,905	90,778	0,100	85,758
850	0,729	3,049	90,833	0,124	85,944
900	1,013	3,972	91,061	0,170	86,586
950	1,651	5,573	91,143	0,347	87,124
1000	2,665	7,850	91,181	0,683	87,649
1050	4,186	10,775	91,243	1,270	88,143
1065	4,729	11,751	91,250	1,505	88,286
1100	6,233	14,256	91,266	2,219	88,565
1200	11,966	22,506	91,316	5,502	89,219
1300	19,505	31,639	91,344	10,843	89,725
1400	27,895	40,567	91,248	17,856	89,976
1500	36,409	48,817	91,351	25,818	90,314
1600	44,363	55,928	91,309	33,935	90,488
1700	51,367	61,824	91,114	41,635	90,413
1800	57,312	66,549	90,763	48,491	90,120
1900	62,214	70,285	90,378	54,418	89,766
2000	66,082	73,082	89,861	59,320	89,260
2100	69,035	75,146	89,231	63,241	88,592
2200	70,798	76,091	88,027	66,047	87,245
2300	72,622	77,195	87,360	68,668	86,543
2400	73,837	77,866	86,610	70,600	85,737
2500	74,207	77,789	85,431	71,699	84,412
2600	74,514	77,698	84,450	72,638	83,339
2700	71,774	75,022	81,246	70,903	79,835
2800	32,187	39,219	48,317	34,620	43,695
2900	29,680	35,626	45,028	32,142	40,385
3000	26,888	32,141	41,196	29,304	36,741

OPTICS CONCEPT

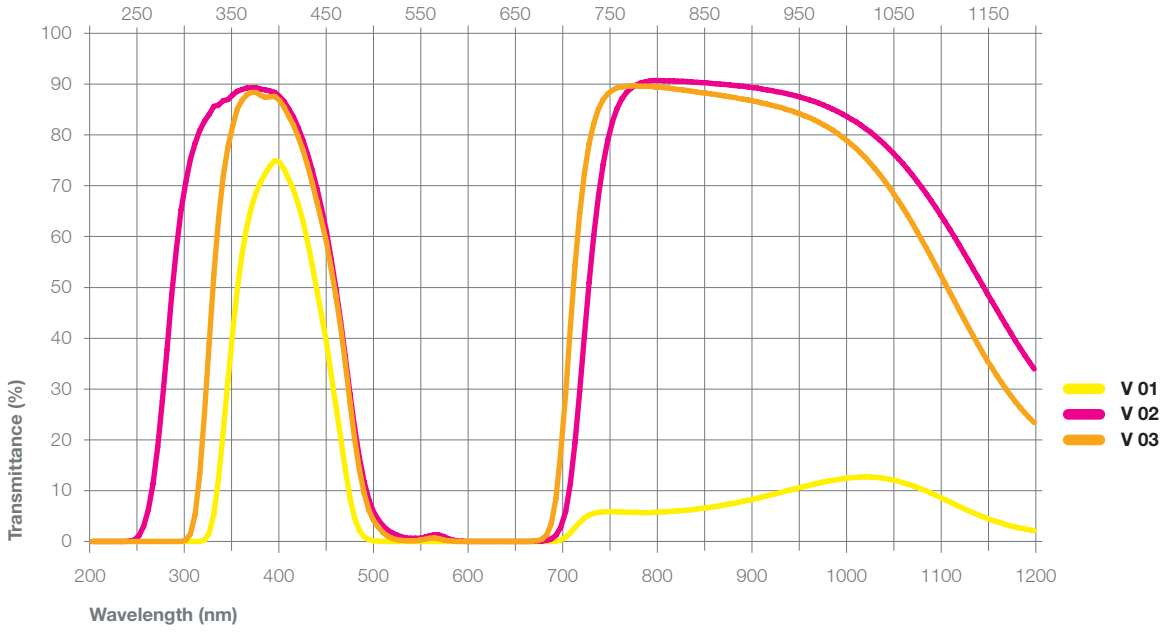
Glass Types

VIOLET	HEBO	Schott	Hoya
	V 01		≈ B-390
	V 02	≈ BG 3	
	V 03		≈ B-370

Violet Glass Characteristics

Type	Thickness (mm)	A[2856K]			D65			Chemical Stability		N_D	α×10-7(°C)	T_g(°C)	T_s(°C)	ρ (g/cm³)
		x	y	Y	x	y	Y	D_A	D_W					
V 01	2	0.519	0.018	0.2	0.160	0.016	0.6	1	3	1.524	89	519	589	2.53
V 02	1	0.152	0.034	1.0	0.154	0.027	1.4	1	2	1.495	58	551	655	2.40
V 03	2	0.165	0.011	0.1	0.166	0.010	0.2	1	2	1.495	57	538	636	2.40

Type	Bubbles	Striae	Stress
V 01	C-B	4	3
V 02	C-B	4	3
V 03	C-B	4	3



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	V 01	V 02	V 03
Thickness (mm)	2	1	2
Wavelength (nm)	%T	%T	%T
200	$3 \cdot 10^{-4}$	$9 \cdot 10^{-5}$	$9 \cdot 10^{-4}$
210	$5 \cdot 10^{-4}$	$2 \cdot 10^{-4}$	$6 \cdot 10^{-5}$
220	0,001	$4 \cdot 10^{-4}$	0,001
230	$8 \cdot 10^{-4}$	0,003	$7 \cdot 10^{-4}$
240	$6 \cdot 10^{-4}$	0,294	$9 \cdot 10^{-4}$
250	$2 \cdot 10^{-4}$	3,008	$5 \cdot 10^{-4}$
260	$1 \cdot 10^{-4}$	11,353	$9 \cdot 10^{-5}$
270	0,001	27,735	$4 \cdot 10^{-4}$
280	$3 \cdot 10^{-4}$	48,600	$7 \cdot 10^{-4}$
290	$4 \cdot 10^{-4}$	65,270	0,027
300	0,001	75,251	1,487
310	0,022	80,908	13,305
320	1,655	84,059	39,036
330	12,339	85,922	63,554
340	31,542	86,984	77,626
350	49,576	88,614	85,092
360	61,722	89,224	87,853
370	68,663	89,329	88,384
380	72,422	88,878	87,362
390	74,933	88,375	87,614
400	73,308	86,607	85,456
410	69,229	83,541	81,939
420	63,243	79,053	77,135
430	54,408	73,052	70,620
440	44,539	65,554	63,075
450	32,698	55,497	53,605
460	20,492	43,365	42,165
470	8,574	29,061	27,388
480	2,187	16,517	14,209
490	0,378	8,320	6,261
500	0,068	4,287	2,880
510	0,006	2,258	1,036
520	$4 \cdot 10^{-4}$	1,266	0,380
530	$7 \cdot 10^{-5}$	0,742	0,162
540	$7 \cdot 10^{-5}$	0,602	0,169
550	$8 \cdot 10^{-4}$	0,820	0,413
560	$8 \cdot 10^{-4}$	1,321	0,679
570	$6 \cdot 10^{-4}$	1,001	0,306
580	$9 \cdot 10^{-4}$	0,273	0,045
590	$8 \cdot 10^{-4}$	0,043	0,007
600	$9 \cdot 10^{-4}$	0,017	0,006
610	$3 \cdot 10^{-4}$	0,016	0,011
620	0,001	0,021	0,014
630	$6 \cdot 10^{-4}$	0,020	0,012
640	$3 \cdot 10^{-4}$	0,016	0,009
650	$5 \cdot 10^{-4}$	0,012	0,010
660	$4 \cdot 10^{-4}$	0,017	0,028
670	0,001	0,042	0,150
680	$6 \cdot 10^{-4}$	0,195	1,251
690	0,073	1,172	8,518

	V 01	V 02	V 03
Thickness (mm)	2	1	2
Wavelength (nm)	%T	%T	%T
700	0,848	5,887	29,130
710	2,773	19,487	54,365
720	4,585	40,494	72,514
730	5,532	60,250	82,311
740	5,843	74,233	86,949
750	5,859	82,652	88,824
760	5,789	87,101	89,469
770	5,717	89,262	89,652
780	5,688	90,232	89,611
790	5,704	90,665	89,595
800	5,792	90,686	89,425
810	5,886	90,658	89,215
820	6,009	90,592	88,963
830	6,166	90,502	88,715
840	6,370	90,376	88,471
850	6,621	90,295	88,228
900	8,304	89,286	86,650
950	10,605	87,420	84,143
1000	12,467	83,621	78,897
1050	12,065	76,341	68,410
1065	11,292	73,232	64,105
1100	8,641	64,290	52,483
1200	2,114	33,981	23,414
1300	1,437	19,243	17,880
1400	1,945	19,229	18,893
1500	1,164	16,306	14,235
1600	2,107	17,743	17,953
1700	2,288	19,478	18,318
1800	2,721	19,875	19,252
1900	6,403	27,083	27,530
2000	13,454	37,797	37,968
2100	21,481	46,203	46,697
2200	30,379	52,747	54,106
2300	39,821	60,006	61,220
2400	46,401	65,875	65,534
2500	48,638	68,837	66,389
2600	48,619	70,111	66,007
2700	46,606	65,190	63,002
2800	24,052	22,061	30,391
2900	22,111	24,906	27,798
3000	23,351	30,432	29,424

OPTICS CONCEPT

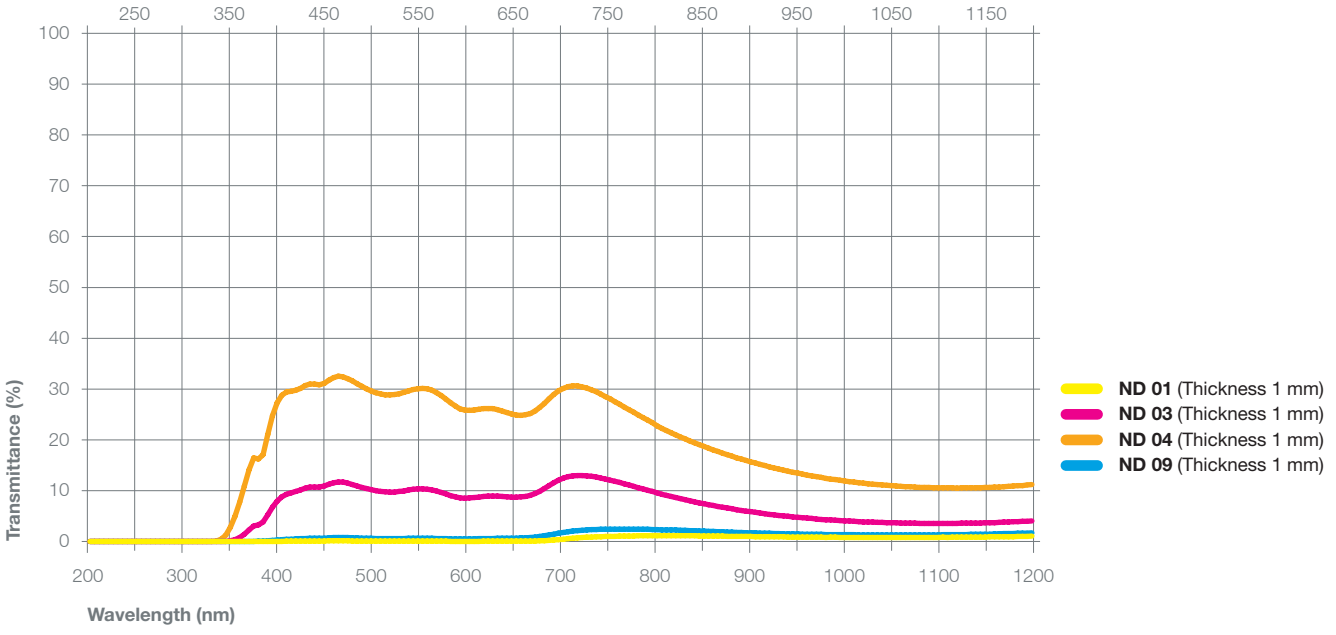
Glass Types

NEUTRAL DENSITY	HEBO	Schott	Hoya
	ND 01	≈ NG 1	≈ ND-0
	ND 03	≈ NG 3	
	ND 04	≈ NG 4	≈ ND-13
	ND 09	≈ NG 9	≈ ND-03

Neutral Density Glass Characteristics

Type	Thickness (mm)	A[2856K]			D65			Chemical Stability		N_D	α×10-7(°C)	T_g(°C)	T_s(°C)	ρ (g/cm³)
		x	y	Y	x	y	Y	D_A	D_W					
ND 01	0.5							5	3	1.527	65	469	582	2.46
ND 03	2	0.447	0.396	1.1	0.306	0.315	1.0	5	3	1.509	65	469	582	2.43
ND 04	2	0.434	0.402	9.0	0.297	0.314	8.9	1	3	1.526	65	469	582	2.52
ND 09	1							5	3	1.514	65	469	582	2.41

Type	Thickness (mm)	T_p(%)		Qz (%)		Bubbles	Striae	Stress
		Standard	Range					
ND 01	0.5	2.0	1.0~4.0	≤4.0		C-B	4	3
ND 03	2	2.0	1.0~3.0	≤3.0		C-B	3C	3
ND 04	2	10.0	6.0~15.0	≤5.0		C-B	3C	3
ND 09	1	1.5	0.5~3.0	≤3.0		C-B	4	3



OPTICS CONCEPT

HEBO SPEZIALGLAS

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	ND 01	ND 03	ND 04	ND 09
Thickness (mm)	1	1	1	1
Wavelength (nm)	%T	%T	%T	%T
200	$7 \cdot 10^{-4}$	$5 \cdot 10^{-4}$	$8 \cdot 10^{-4}$	$3 \cdot 10^{-4}$
210	$1 \cdot 10^{-4}$	$1 \cdot 10^{-5}$	$9 \cdot 10^{-4}$	$1 \cdot 10^{-4}$
220	$6 \cdot 10^{-4}$	0,001	$8 \cdot 10^{-5}$	$9 \cdot 10^{-4}$
230	$9 \cdot 10^{-4}$	$8 \cdot 10^{-4}$	$8 \cdot 10^{-4}$	$6 \cdot 10^{-4}$
240	$6 \cdot 10^{-5}$	$2 \cdot 10^{-4}$	$9 \cdot 10^{-5}$	$3 \cdot 10^{-4}$
250	$6 \cdot 10^{-4}$	$6 \cdot 10^{-4}$	$2 \cdot 10^{-4}$	$3 \cdot 10^{-4}$
260	$8 \cdot 10^{-4}$	$5 \cdot 10^{-4}$	$4 \cdot 10^{-4}$	$6 \cdot 10^{-4}$
270	$2 \cdot 10^{-4}$	$9 \cdot 10^{-5}$	$4 \cdot 10^{-5}$	$4 \cdot 10^{-4}$
280	$6 \cdot 10^{-4}$	$2 \cdot 10^{-4}$	$3 \cdot 10^{-4}$	$2 \cdot 10^{-4}$
290	$7 \cdot 10^{-5}$	$2 \cdot 10^{-4}$	$8 \cdot 10^{-4}$	$6 \cdot 10^{-4}$
300	$6 \cdot 10^{-5}$	$7 \cdot 10^{-4}$	$2 \cdot 10^{-4}$	$6 \cdot 10^{-4}$
310	$3 \cdot 10^{-4}$	$5 \cdot 10^{-4}$	$4 \cdot 10^{-4}$	$6 \cdot 10^{-4}$
320	$8 \cdot 10^{-5}$	$3 \cdot 10^{-4}$	$6 \cdot 10^{-4}$	0,001
330	$5 \cdot 10^{-5}$	$7 \cdot 10^{-5}$	0,096	$8 \cdot 10^{-5}$
340	$2 \cdot 10^{-4}$	0,033	1,236	$8 \cdot 10^{-4}$
350	$2 \cdot 10^{-4}$	0,343	4,936	$8 \cdot 10^{-5}$
360	$6 \cdot 10^{-4}$	1,406	10,925	0,004
370	0,001	3,072	16,442	0,028
380	0,002	3,793	17,057	0,055
390	0,013	6,714	24,733	0,181
400	0,034	8,788	28,752	0,342
410	0,054	9,560	29,537	0,448
420	0,073	10,158	30,151	0,539
430	0,093	10,699	30,967	0,621
440	0,097	10,701	30,826	0,637
450	0,110	11,271	31,751	0,712
460	0,118	11,720	32,517	0,785
470	0,108	11,466	32,048	0,768
480	0,088	10,929	31,046	0,706
490	0,070	10,386	30,045	0,642
500	0,058	9,986	29,302	0,596
510	0,051	9,747	28,871	0,571
520	0,050	9,742	28,888	0,571
530	0,056	9,947	29,309	0,597
540	0,063	10,250	29,895	0,634
550	0,067	10,353	30,140	0,649
560	0,057	10,142	29,776	0,621
570	0,045	9,637	28,722	0,568
580	0,034	9,019	27,276	0,513
590	0,030	8,584	26,087	0,487
600	0,030	8,565	25,825	0,501
610	0,035	8,742	26,002	0,539
620	0,041	8,916	26,154	0,581
630	0,045	8,933	25,947	0,609
640	0,046	8,791	25,379	0,623
650	0,049	8,713	24,910	0,652
660	0,061	8,883	24,939	0,720
670	0,088	9,425	25,676	0,858
680	0,155	10,392	27,171	1,101
690	0,281	11,546	28,911	1,433

	ND 01	ND 03	ND 04	ND 09
Thickness (mm)	1	1	1	1
Wavelength (nm)	%T	%T	%T	%T
700	0,454	12,441	30,146	1,761
710	0,625	12,907	30,615	2,020
720	0,767	12,984	30,438	2,196
730	0,872	12,825	29,863	2,316
740	0,948	12,489	29,017	2,385
750	1,003	12,070	28,032	2,424
760	1,046	11,593	27,002	2,438
770	1,080	11,095	25,934	2,430
780	1,101	10,566	24,886	2,407
790	1,110	10,072	23,882	2,379
800	1,117	9,546	22,740	2,326
810	1,132	9,081	21,842	2,290
820	1,128	8,632	20,990	2,232
830	1,113	8,206	20,173	2,167
840	1,111	7,811	19,419	2,106
850	1,074	7,414	18,684	2,036
900	0,970	5,851	15,683	1,710
950	0,858	4,729	13,437	1,470
1000	0,801	4,055	11,901	1,318
1050	0,776	3,668	10,974	1,267
1065	0,785	3,616	10,797	1,277
1100	0,813	3,562	10,562	1,309
1200	1,039	4,046	11,173	1,682
1300	1,796	5,874	14,120	2,845
1400	3,315	9,357	19,357	5,067
1500	5,138	13,385	25,009	7,665
1600	6,310	15,750	28,403	9,119
1700	6,403	16,279	29,563	9,253
1800	6,565	16,762	30,546	9,430
1900	7,379	18,087	32,366	10,335
2000	8,823	20,108	34,681	11,923
2100	10,708	22,485	37,102	13,988
2200	12,779	24,673	39,028	16,190
2300	15,246	27,239	41,370	18,718
2400	17,485	29,288	43,033	20,938
2500	19,586	31,190	44,533	23,026
2600	21,543	33,041	46,032	25,018
2700	21,912	32,508	44,705	25,391
2800	5,655	8,000	12,298	7,486
2900	6,122	8,542	12,450	7,910
3000	7,852	10,995	15,491	9,913

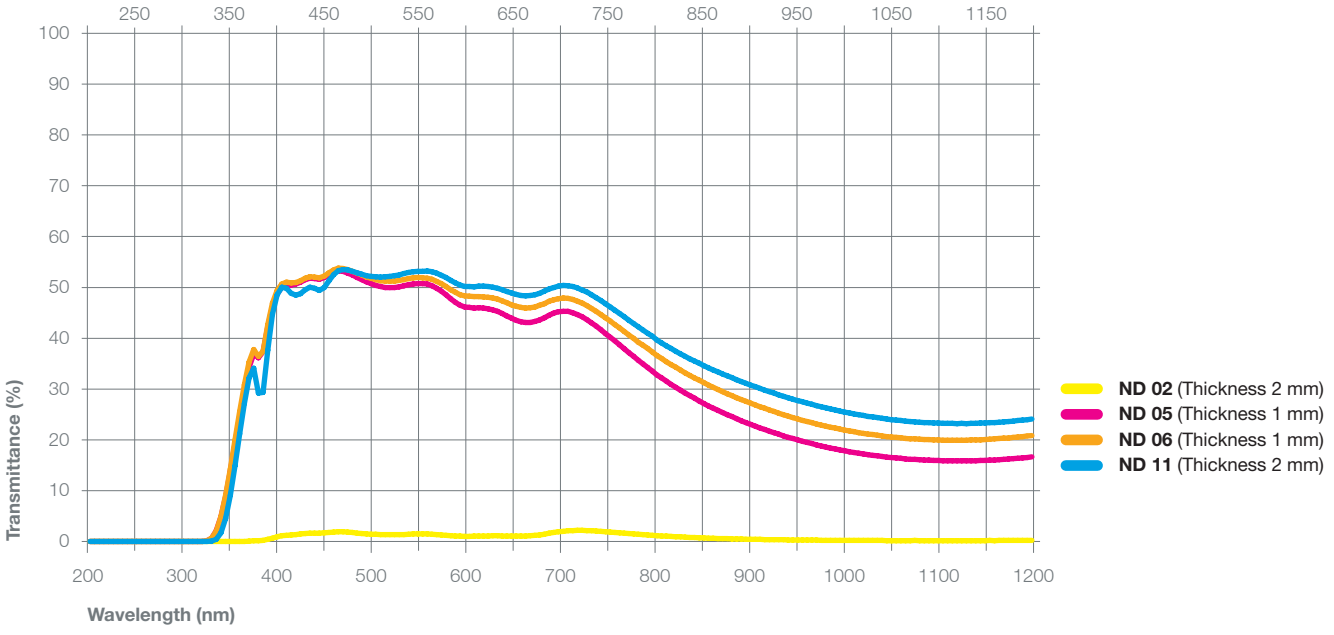
Glass Types

NEUTRAL DENSITY	HEBO	Schott	Hoya
	ND 02		
	ND 05	≈ NG 5	≈ ND-25
	ND 06		≈ ND-50
	ND 11	≈ NG 11	≈ ND-70

Neutral Density Glass Characteristics

Type	Thickness (mm)	A[2856K]			D65			Chemical Stability		N_D	α×10-7(°C)	T_g(°C)	T_s(°C)	ρ (g/cm³)
		x	y	Y	x	y	Y	D_A	D_W					
ND 02	2							1	3	1.523	65	469	582	2.52
ND 05	2	0.442	0.408	25.7	0.308	0.327	25.4	5	3	1.502	65	469	582	2.41
ND 06	2	0.444	0.408	45.7	0.310	0.329	45.0	5	3	1.502	65	469	582	2.41
ND 11	2	0.499	0.410	70.2	0.316	0.385	68.7	5	3	1.502	65	469	582	2.41

Type	Thickness (mm)	T_p(%)		Qz (%)		Bubbles	Striae	Stress
		Standard	Range					
ND 02	2	30	23.0~37.0	≤10.0		C-B	4	3
ND 05	2	25	18.0~32.0	≤6.0		C-B	4	3
ND 06	2	50	41.0~59.0	≤8.0		C-B	3C	3
ND 11	2	70	63.0~77.0	≤7.0		C-B	3C	3



	ND 02	ND 05	ND 06	ND 11
Thickness (mm)	2	1	1	2
Wavelength (nm)	%T	%T	%T	%T
200	$6 \cdot 10^{-4}$	$5 \cdot 10^{-4}$	0,001	$6 \cdot 10^{-4}$
210	$9 \cdot 10^{-4}$	0,001	$2 \cdot 10^{-4}$	$<1 \cdot 10^{-5}$
220	$6 \cdot 10^{-4}$	0,001	$9 \cdot 10^{-4}$	0,001
230	0,001	$9 \cdot 10^{-4}$	0,001	0,001
240	$2 \cdot 10^{-4}$	$6 \cdot 10^{-4}$	$1 \cdot 10^{-4}$	$4 \cdot 10^{-5}$
250	$9 \cdot 10^{-5}$	$6 \cdot 10^{-4}$	$4 \cdot 10^{-4}$	$2 \cdot 10^{-4}$
260	$7 \cdot 10^{-4}$	$8 \cdot 10^{-4}$	$2 \cdot 10^{-4}$	$4 \cdot 10^{-4}$
270	0,001	$9 \cdot 10^{-5}$	$8 \cdot 10^{-4}$	$4 \cdot 10^{-4}$
280	$3 \cdot 10^{-4}$	$3 \cdot 10^{-4}$	$8 \cdot 10^{-4}$	$5 \cdot 10^{-4}$
290	$5 \cdot 10^{-4}$	$2 \cdot 10^{-4}$	$4 \cdot 10^{-5}$	$5 \cdot 10^{-4}$
300	$5 \cdot 10^{-5}$	$5 \cdot 10^{-4}$	$3 \cdot 10^{-4}$	$9 \cdot 10^{-5}$
310	$4 \cdot 10^{-4}$	$5 \cdot 10^{-5}$	$1 \cdot 10^{-4}$	$2 \cdot 10^{-4}$
320	$7 \cdot 10^{-4}$	0,129	0,107	0,003
330	$6 \cdot 10^{-5}$	2,097	2,053	0,414
340	$4 \cdot 10^{-4}$	8,870	9,134	4,557
350	0,001	19,280	19,978	14,899
360	0,034	29,821	30,845	27,166
370	0,151	36,951	37,808	34,084
380	0,227	37,316	37,427	29,347
390	0,667	46,227	46,887	44,696
400	1,109	50,007	50,676	50,024
410	1,302	50,482	50,914	48,850
420	1,462	51,020	51,314	48,756
430	1,607	51,775	52,094	50,014
440	1,609	51,582	51,857	49,417
450	1,771	52,537	52,895	51,287
460	1,901	53,251	53,805	53,316
470	1,823	52,820	53,513	53,441
480	1,664	51,948	52,770	52,838
490	1,509	51,070	52,036	52,321
500	1,396	50,376	51,503	52,057
510	1,330	49,992	51,208	52,073
520	1,326	49,977	51,238	52,313
530	1,380	50,286	51,532	52,702
540	1,459	50,702	51,871	53,069
550	1,485	50,729	51,892	53,180
560	1,427	50,314	51,580	53,049
570	1,290	49,238	50,730	52,399
580	1,134	47,770	49,568	51,391
590	1,029	46,497	48,575	50,443
600	1,020	46,050	48,252	50,174
610	1,056	45,973	48,173	50,216
620	1,098	45,781	48,084	50,151
630	1,098	45,255	47,662	49,830
640	1,062	44,353	46,954	49,204
650	1,039	43,514	46,285	48,610
660	1,077	43,084	45,955	48,342
670	1,199	43,269	46,163	48,575
680	1,442	44,022	46,807	49,241
690	1,756	44,912	47,576	49,996

	ND 02	ND 05	ND 06	ND 11
Thickness (mm)	2	1	1	2
Wavelength (nm)	%T	%T	%T	%T
700	2,017	45,306	47,891	50,373
710	2,161	45,021	47,624	50,177
720	2,176	44,201	46,896	49,499
730	2,110	43,040	45,872	48,564
740	2,000	41,663	44,661	47,411
750	1,862	40,196	43,346	46,138
760	1,714	38,695	41,993	44,866
770	1,562	37,163	40,627	43,546
780	1,417	35,655	39,220	42,226
790	1,282	34,256	37,954	40,993
800	1,145	32,776	36,558	39,606
810	1,046	31,522	35,381	38,496
820	0,951	30,347	34,274	37,451
830	0,852	29,215	33,195	36,444
840	0,781	28,173	32,206	35,514
850	0,694	27,164	31,232	34,602
900	0,442	23,052	27,217	30,793
950	0,271	19,967	24,112	27,725
1000	0,219	17,832	21,919	25,461
1050	0,169	16,521	20,559	23,987
1065	0,168	16,264	20,298	23,702
1100	0,164	15,919	19,958	23,295
1200	0,212	16,636	20,863	24,085
1300	0,414	20,125	24,708	27,913
1400	1,037	26,060	30,937	34,066
1500	2,072	32,169	37,105	40,463
1600	2,851	35,601	40,471	44,091
1700	3,052	36,777	41,596	45,601
1800	3,237	37,813	42,609	46,938
1900	3,763	39,609	44,358	48,848
2000	4,632	41,844	46,497	50,817
2100	5,763	44,136	48,677	52,600
2200	6,920	45,732	50,168	52,900
2300	8,392	47,912	52,200	54,654
2400	9,677	49,228	53,366	54,854
2500	10,959	50,421	54,403	54,894
2600	12,257	51,635	55,482	55,232
2700	11,920	49,346	53,080	48,930
2800	0,823	12,455	14,868	3,359
2900	0,958	12,947	15,373	3,372
3000	1,429	16,439	19,075	5,192

Glass Types

HEAT ABSORBING	HEBO	Schott	Hoya
	HA 02	≈ KG 2	≈ HA-50
	HA 03	≈ KG 3	≈ HA-30

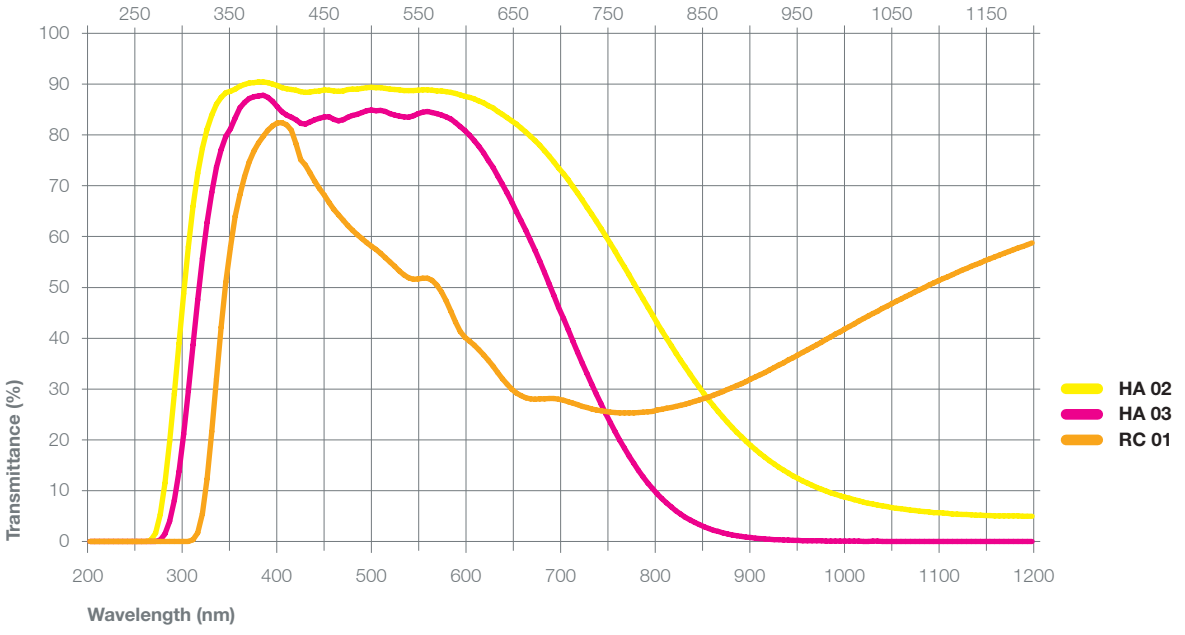
RISING COLOR	HEBO	Schott	Hoya
	RC 01	(≈ BG 34)	≈ LB-120

Heat Absorbing and Rising Color Glass Characteristics

Type	Thickness (mm)	A[2856K]			D65			Chemical Stability		N_D	α×10-7(°C)	T_g(°C)	T_s(°C)	ρ (g/cm³)
		x	y	Y	x	y	Y	D_A	D_W					
HA 02	2	0.440	0.441	93.9	0.331	0.331	92.9	3	2	1.510	59	587	656	2.54
HA 03	2	0.440	0.413	86.5	0.311	0.334	87.4	2	3	1.512	59	587	656	2.55
RC 01	1	0.412	0.427	71.0	0.281	0.330	72.7	2	4	1.521	102	602	672	2.57

Type		Bubbles	Striae	Stress
HA 02		C	3C	4
HA 03		D-C	3C	4

Type	Thickness (mm)	v (mired)			Bubbles	Striae	Stress
		Standard	Range				
RC 01	1	-130	-130 ± 13		C-B	4	3



	HA 02	HA 03	RC 01
Thickness (mm)	2	2	1
Wavelength (nm)	%T	%T	%T
200	0,001	$8 \cdot 10^{-4}$	0,003
210	$3 \cdot 10^{-4}$	$2 \cdot 10^{-4}$	0,001
220	0,001	$5 \cdot 10^{-4}$	0,001
230	0,001	0,002	0,004
240	$4 \cdot 10^{-4}$	$6 \cdot 10^{-4}$	0,003
250	$4 \cdot 10^{-4}$	$7 \cdot 10^{-4}$	0,003
260	0,257	$8 \cdot 10^{-4}$	0,001
270	5,316	0,288	0,001
280	19,641	3,999	$5 \cdot 10^{-4}$
290	39,011	13,765	0,001
300	57,968	29,632	0,032
310	72,430	47,530	1,691
320	81,126	62,757	12,300
330	86,021	73,659	31,986
340	88,274	79,725	51,001
350	89,006	83,329	64,015
360	89,965	86,387	71,767
370	90,308	87,503	76,821
380	90,434	87,804	79,763
390	89,985	86,640	81,790
400	89,331	84,549	82,391
410	88,970	83,469	80,968
420	88,499	82,270	75,119
430	88,465	82,555	72,492
440	88,661	83,273	69,452
450	88,833	83,587	66,666
460	88,574	82,753	64,252
470	88,933	83,519	62,171
480	89,023	84,077	60,351
490	89,293	84,773	58,848
500	89,269	84,787	57,471
510	89,190	84,613	55,826
520	88,935	83,928	54,164
530	88,741	83,524	52,420
540	88,714	83,736	51,617
550	88,886	84,493	51,821
560	88,824	84,434	51,357
570	88,676	83,914	49,117
580	88,393	83,114	45,316
590	87,860	81,676	41,321
600	87,380	79,961	39,416
610	86,695	77,757	37,737
620	85,753	75,005	35,619
630	84,643	71,948	33,259
640	83,434	68,586	30,942
650	82,118	64,950	29,230
660	80,564	61,203	28,311
670	78,860	57,252	28,015
680	76,912	52,956	28,088
690	74,728	48,402	28,108

	HA 02	HA 03	RC 01
Thickness (mm)	2	2	1
Wavelength (nm)	%T	%T	%T
700	72,330	43,858	27,776
710	69,829	39,393	27,213
720	67,178	35,063	26,610
730	64,414	30,979	26,088
740	61,555	27,065	25,711
750	58,606	23,361	25,456
760	55,525	19,928	25,323
770	52,410	16,797	25,289
780	49,220	13,972	25,362
790	46,122	11,500	25,523
800	42,928	9,328	25,884
810	39,982	7,564	26,189
820	37,091	6,040	26,581
830	34,290	4,767	27,026
840	31,619	3,753	27,585
850	29,072	2,897	28,142
900	18,877	0,760	31,932
950	12,408	0,187	36,683
1000	8,702	0,058	41,789
1050	6,675	0,016	46,764
1065	6,290	0,011	48,192
1100	5,649	0,020	51,284
1200	4,969	0,022	58,728
1300	5,288	0,002	65,072
1400	6,372	0,041	70,472
1500	8,373	0,051	73,987
1600	11,282	0,090	77,492
1700	13,998	0,206	79,678
1800	15,155	0,291	81,429
1900	14,640	0,272	83,455
2000	13,587	0,194	84,991
2100	12,894	0,186	86,061
2200	12,444	0,144	86,372
2300	13,575	0,183	86,975
2400	15,864	0,280	87,279
2500	17,980	0,484	87,123
2600	18,981	0,807	87,003
2700	19,392	1,221	85,650
2800	1,716	0,776	64,734
2900	0,230	0,525	61,952
3000	0,153	0,455	62,500

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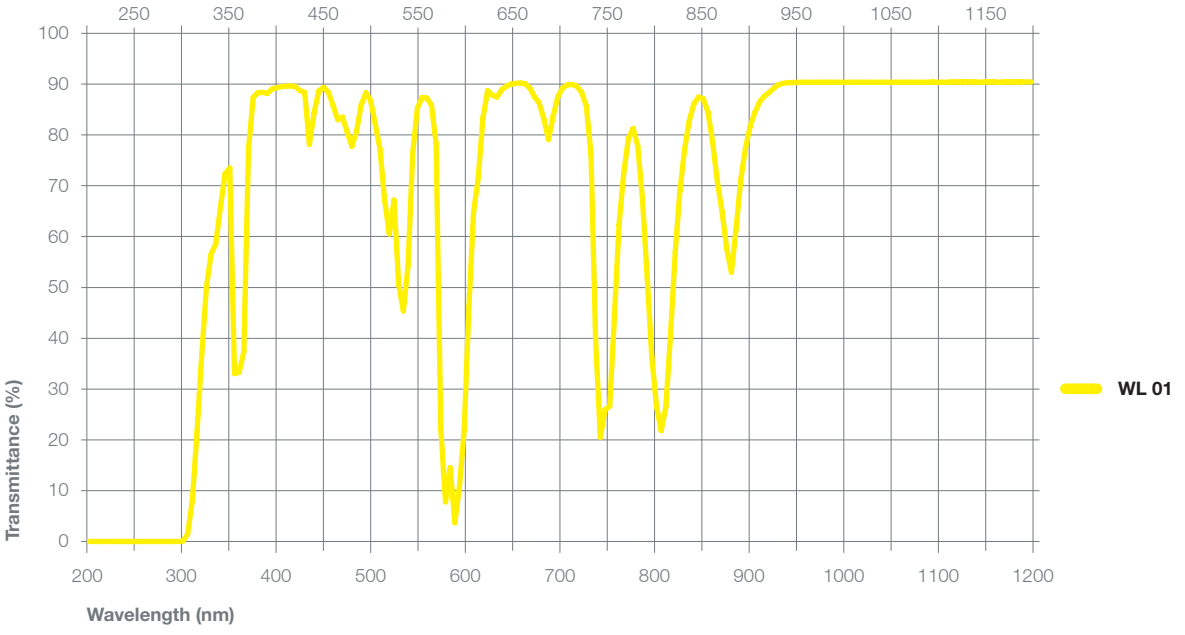
Glass Types

WAVELENGTH CALIBRATED	HEBO	Schott	Hoya
	WL 01	≈ BG 20	≈ V-10

Wavelength Calibrated Glass Characteristics

Type	Thickness (mm)	A[2856K]			D65			Chemical Stability		N_D	α×10-7(°C)	T_g(°C)	T_s(°C)	ρ (g/cm³)
		x	y	Y	x	y	Y	D_A	D_W					
WL 01	1	0.443	0.387	64.1	0.291	0.305	64.6	2	1	1.537	90	598	669	2.81

Type	Bubbles	Striae	Stress
WL 01	D-C	3C	3



HEBO SPEZIALGLAS
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WL 01	
Thickness (mm)	1
Wavelength (nm)	%T
200	0,001
210	$1 \cdot 10^{-4}$
220	0,001
230	0,002
240	0,001
250	0,001
260	$4 \cdot 10^{-4}$
270	0,001
280	0,002
290	0,001
300	1,521
310	21,513
320	49,940
330	58,558
340	72,374
350	33,046
360	37,342
370	87,387
380	88,349
390	88,983
400	89,489
410	89,630
420	88,738
430	78,107
440	88,690
450	88,358
460	83,022
470	80,588
480	80,728
490	88,280
500	82,237
510	67,156
520	67,165
530	45,352
540	76,460
550	87,419
560	85,930
570	22,170
580	14,520
590	11,031
600	46,191
610	71,584
620	88,729
630	87,466
640	89,579
650	90,180
660	90,103
670	87,516
680	83,173
690	83,695

WL 01	
Thickness (mm)	1
Wavelength (nm)	%T
700	89,289
710	89,903
720	88,404
730	76,238
740	20,487
750	26,605
760	62,387
770	79,287
780	77,821
790	52,152
800	26,590
810	26,524
820	56,978
830	77,190
840	86,211
850	87,127
900	81,660
950	90,336
1000	90,343
1050	90,363
1065	90,360
1100	90,394
1200	90,447
1300	90,448
1400	90,326
1500	90,165
1600	86,786
1700	88,816
1800	89,927
1900	89,990
2000	89,870
2100	89,583
2200	88,488
2300	83,295
2400	69,719
2500	74,364
2600	78,878
2700	82,293
2800	54,296
2900	49,942
3000	47,935

HEBO
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Pour un complément d'information

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