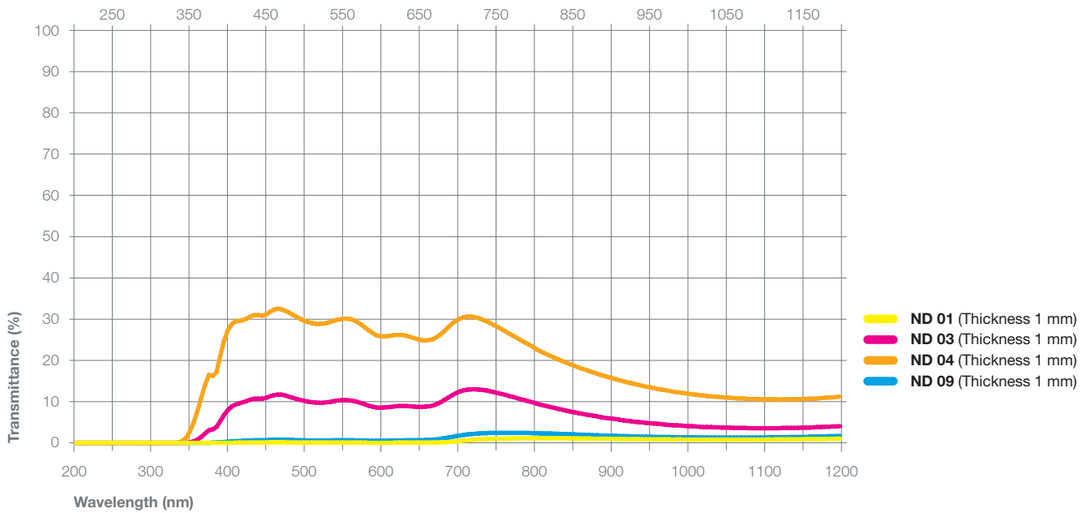
Glass Types

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



	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

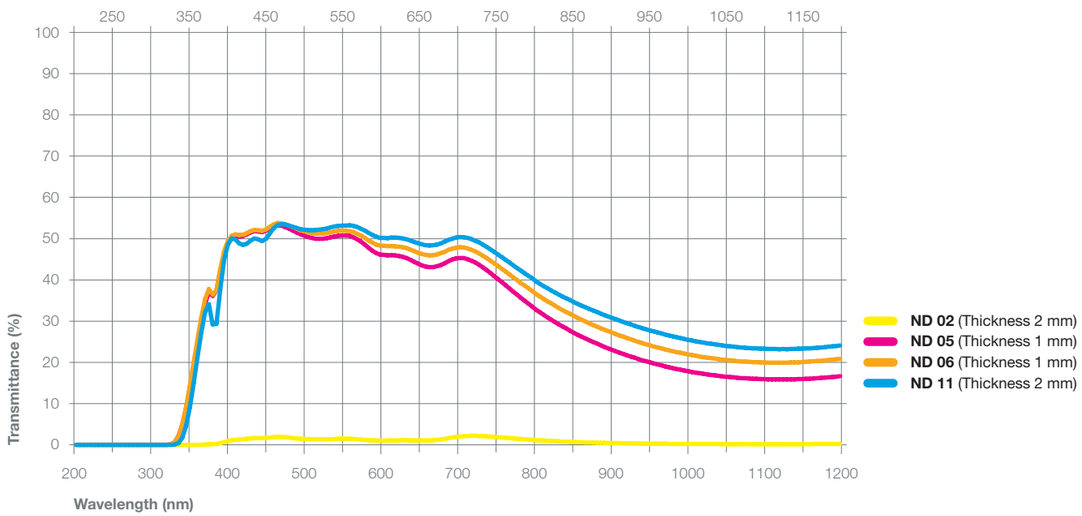
Glass Types

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