光学ガラスカタログ 【Japanese】

OPTICAL GLASS 【English】

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１．光学ガラスの種類と名称

光ガラスでは，地球の環境保護の観点から鉛，砒素を全く含有しない光学ガラスを開発し，環境対策ガラス（ECO OPTICAL GLASS）として提供しております。
従来の硝種名（原則としてショット社名称を使用）の先頭に “J-” または ”Q-“ をつける事により，改訂データの硝種を従来データの硝種と区別できるようにしました。

２．コード

コードは 6 桁の数字で表記されます。初めの 3 桁は屈折率の小数点以下 3 桁を表し，後ろの 3 桁はアッベ数の上 3 桁を表しています。例えば J-BK7A は，n_d = 1.516800, ν_d = 64.14 ですから，コード(d)は 517641 となります。本カタログでは，“n_d” と “ν_d” から成る “コード(d)” と，“n_e” と “ν_e” から成る “コード(e)” を併記しています。

３．光学的性質

（１）屈折率 n

屈折率は，表 1 の 21 のスペクトルに対して，可視域（i～A’）は小数点以下 6 桁，赤外域（s～2 μm）は 5 桁の数値で表示してあります。掲載されている屈折率は 3.(4)項の分散曲線方程式（ベキ級数式）により計算したものです。

表 1　スペクトル

スペクトル線	光　　源	波　長　[μm]
2.058	He	2.05809
1.970	Hg	1.97063
1.530	Hg	1.529582
1.129	Hg	1.12864
1.064	Nd(YAG)レーザー	1.06414
t	Hg	1.01398
S	Cs	0.85211
A’	K	0.768195
r	He	0.706519
C	H	0.656273
C’	Cd	0.643847
He-Ne	He-Ne レーザー	0.632816
D	Na	0.589294
d	He	0.587562
e	Hg	0.546074
F	H	0.486133
F’	Cd	0.479992
g	Hg	0.435835
h	Hg	0.404656
0.389	He	0.388865
i	Hg	0.365015

（２）分散

二つのスペクトル X，Y の屈折率差ｎX－ｎY を部分分散とよびます。簡略化して X－Y と表示しています。二つの部分分散の比を部分分散比とよびます。表１のいくつかのスペクトルに関する部分分散，部分分散比を掲載しています。

アッベ数 ν_d ，ν_e は，それぞれ次式により定義されます。

$$\nu_d = \frac{n_d - 1}{n_F - n_C} \qquad \nu_e = \frac{n_e - 1}{n_{F'} - n_{C'}}$$

数値を小数点以下２桁まで表示しています。

（３）異常分散性

一般的に光学ガラスの多くは，部分分散比とアッベ数の間にほぼ直線関係が成り立ち，このような硝種を正常部分分散ガラス（ノーマルガラス）と呼んでいます。他方，この直線関係から離れた位置にある硝種は異常部分分散ガラス（アブノーマルガラス）と呼んでいます。異常分散性の大きさは，ノーマルガラスの基準となる K7 と F2 を結んで得られる標準線からの部分分散比の偏差（$\Delta P_{x,y}$）で表します。データシートには P_{dc} と P_{gF} の２種類を表示しています。

（４）分散曲線方程式

データシートに記載されていない任意波長λに対する屈折率は，分散曲線方程式を利用して算出することが出来ます。一般に分散曲線方程式はいくつかありますが，このカタログでは次式で表される分散曲線方程式を採用しています。

$$n_{(\lambda)}{}^2 = A_0 + A_1\lambda^2 + A_2\lambda^4 + A_3\lambda^{-2} + A_4\lambda^{-4} + A_5\lambda^{-6} + A_6\lambda^{-8} + A_7\lambda^{-10} + A_8\lambda^{-12}$$

ここで、A_0～A_8 は硝種により定まる定数で，硝種ごとに精密に測定された屈折率から最小二乗法により算出しました。

参考までに分数式の分散曲線方程式も表示します。分数式は，セルマイヤーの式と左辺が異なります。

$$\frac{n^2 - 1}{n^2 + 2} = \frac{P_1\lambda^2}{\lambda^2 - Q_1} + \frac{P_2\lambda^2}{\lambda^2 - Q_2} + \frac{P_3\lambda^2}{\lambda^2 - Q_3}$$

これら２つの分散曲線方程式のフィッティング誤差を表記しているので参考にしてください。

分散曲線方程式の適用範囲は，屈折率がデータシートに記載されている波長範囲内のみに限られます。なお，波長λの単位は[μm]を使用します。

（５）屈折率の温度係数Δｎ/ΔＴ

相対屈折率および絶対屈折率の温度係数を，－70 ℃～90 ℃，0.389 μm～1.083 μm の範囲で 20 ℃間隔で表記しています。ただし温度の両端は 10 ℃間隔です。単位を[10^{-6}/℃]で表示します。

（６）内部透過率 τ

内部透過率は，表面反射による損失を含まない透過率です。このカタログでは，280 nm～2400 nm までの波長範囲について，厚さ 10 mm 当たりの内部透過率を表記してあります。i 線（365 nm）の透過率も表示しています。また，このカタログでは，内部透過率が 80%と 5%を示すときの波長を“内部透過”として表示しました。例えば，内部透過率が 80%を示すときの波長が 321 nm，5%を示すときの波長が 286 nm のときは，321/286 のように表記されます。

（７）着色度 CC

着色度は，厚さ 10 mm の表面反射を含む分光透過率曲線において，全透過率 80%を示す波長と 5%を示す波長をそれぞれ 5 nm 単位で表記してあります。例えば，全透過率 80%及び 5%を示す波長がそれぞれ 332 nm，286 nm のガラスは，330/285 のように表記されます。なお，n_e が 1.85 以上の高屈折率硝種に関しては，反射損失が大きいため 80%の代わりに 70%の透過率を示す波長を表記しました。

４．化学的性質

（１）表面法耐酸性 AR(S)

新鮮な研磨面を持つ試料を 30℃，pH4.6，pH5.9，pH6.8 の緩衝溶液中で浸漬処理し，研磨表面がうすいアンバー色の干渉色を呈するまでの時間を測定して次表に従い分類表記してあります。

表 2　表面法耐酸性

級	1	2	3	4	5	6	7
pH4.6	60 分以上	12 分以上 60 分未満	12 分未満				
pH5.9			60 分以上	12 分以上 60 分未満	12 分未満		
pH6.8					60 分以上	12 分以上 60 分未満	12 分未満

（２）耐洗剤性 PR(S)　(ISO 9689:1990)

新鮮な研磨面を持つ試料を 50 ℃の 0.01 mol/l トリポリリン酸ナトリウム水溶液で浸漬して，ガラスが 0.1 μm 浸食されるのに要する時間を測定し，次表に従い分類表記してあります。

表 3　耐洗剤性

級	1	2	3	4
0.1 μm 浸食するのに要する時間 [h]	4 以上	1 以上 4 未満	0.25 以上 1 未満	0.25 未満

（３）耐候性 CR(S)　(JOGIS 07-2006)

新鮮な研磨面を持つ試料を，57.5 ℃で 50 分，64 ℃で 50 分保持し，これを連続して 24

サイクル 48 時間繰り返し，発生した曇りをヘーズメータでヘーズを測定し，次表により分類表記してあります。

表 4　耐候性

級	1	2	3	4	5
ヘーズ	2%未満	2%以上 10%未満	10%以上 20%未満	20%以上 30%未満	30%以上

（4）粉末法耐水性 WR(P)　(JOGIS 06-1999)

粉砕されたガラスの比重グラムを白金製カゴに入れ，フラスコ内の純水（pH 6.5～7.5）80 ml 中に浸して沸騰水中で 60 分間加熱し，120 ℃にて乾燥後秤量し，その減量パーセントで次表に従い分類表記してあります。

表 5　粉末法耐水性

級	1	2	3	4	5	6
減量率 [mass%]	0.05 未満	0.05 以上 0.10 未満	0.10 以上 0.25 未満	0.25 以上 0.60 未満	0.60 以上 1.10 未満	1.10 以上

（5）粉末法耐酸性 AR(P)　(JOGIS 06-1999)

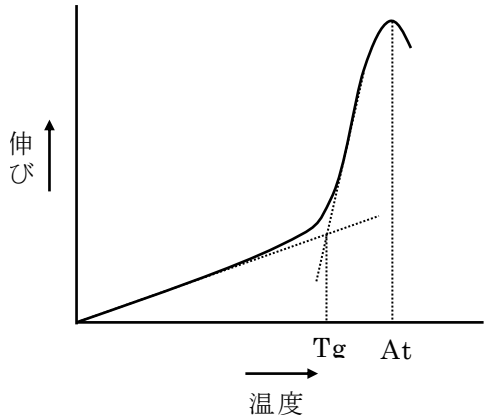
粉末法耐水性試験と同一の装置方法で 0.01 N 硝酸水溶液 80 ml を用い，その減量パーセントで次表に従い分類表記してあります。

表 6　粉末法耐酸性

級	1	2	3	4	5	6
減量率 [mass%]	0.20 未満	0.20 以上 0.35 未満	0.35 以上 0.65 未満	0.65 以上 1.20 未満	1.20 以上 2.20 未満	2.20 以上

5．熱的性質

ガラスの熱間加工や熱処理する際に必要な熱的性質として，転移点 Tg，屈伏点 At および高温と常温での平均線膨張係数 α を記載しました。Tg，At，高温 α は，十分に徐冷された長さ 50 mm, 直径 4 mm の試料を，毎分 4 ℃で昇温加熱したときに得られた，温度と試料の伸びの関係を示した膨張曲線（図 1 参照）から求めます。常温 α は，加熱・冷却可能な装置で 2 温度間の膨張を測定します。



<図 1> 膨張曲線

（1）転移点 Tg　(JOGIS 08-2003)

転移点は図 1 に示すように，熱膨張曲線における 2 つの直線部分を延長した交点に対応する温度[℃]で表示してあります。

（２）屈伏点 At （JOGIS 08-2003）

屈伏点は図 1 に示すように，熱膨張曲線におけるピーク点で，その温度[℃]で表示してあります。

（３）平均線膨張係数α （JOGIS 08-2003, JOGIS 16-2003）

常温（－30 ℃～70 ℃）および高温（100 ℃～300 ℃）における平均線膨張係数を[10^{-7}/℃]の単位で表示してあります。

（４）歪点 StP （JIS R 3103-2:2001）

歪点はガラスの内部応力が数時間で実質的に除去できる温度で、$10^{14.7}$dPa・s の粘度に相当します。

（５）徐冷点 AP （JIS R 3103-2:2001）

徐冷点はガラスの内部応力が数分で実質的に除去できる温度で、$10^{13.2}$dPa・s の粘度に相当します。

（６）軟化点 SP （ASTM C1351M-96）

軟化点はガラスの成形操作が可能となる下限の温度で、$10^{7.65}$dPa・s の粘度に相当します。

（７）熱伝導率λ，比熱 c，熱拡散率κ

室温における熱伝導率[W/(m･K)]，比熱[10^3 J/(kg･K)]，熱拡散率[10^{-6} m^2/sec]を表示してあります。熱伝導率は，比熱と熱拡散率より関係式で求めました。

６．機械的性質

（１）磨耗度 A （JOGIS 10-1994）

30×30×10 ｍｍの大きさの試料を水平に毎分 60 回転する鋳鉄製平面皿（φ250 ｍｍ）の中心から 80 ｍｍの定位置にのせ，9.8 Ｎの荷重をかけながら＃800（平均粒度 20 μｍ）のラップ剤 10 ｇを水 20 ｍｌに添加した研磨液を 5 分間一様に供給して摩耗させ，ラップ前後の試料重量を測定し摩耗質量 W を求めます。また，同様にして標準試料の摩耗質量 W_0 を求め，次式によって算出した値を表示してあります。

$$A=\frac{W/S}{W_0/S_0}\times 100$$

ここで，S，S_0 は試料および標準試料の比重を表します。

（２）ヌープ硬さ Hk （JOGIS 09-1975）

平面研磨されたガラス面に対稜角が 172°30′と 130°のダイヤモンド四角錐圧子（ヌープ圧子）に 0.98 Ｎの荷重を 15 秒間かけてくぼみをつけ，次式により算出してあります。

$$(\text{ヌープ硬さ}) = \frac{1.451F}{l^2}$$

ここで、F は荷重[N]，l はくぼみの長い方の対角線の長さ[mm]です。
このカタログには，測定値と測定値から次表により分類した級とを表示してあります。

表 7　ヌープ硬さ

級	1	2	3	4	5	6	7
ヌープ硬さ	150 未満	150 以上 250 未満	250 以上 350 未満	350 以上 450 未満	450 以上 550 未満	550 以上 650 未満	650 以上

（3）弾性率

ヤング率 E，剛性率 G は，超音波を用い，5 MHz の縦波速度（Vl）と 2 MHz の横波速度（Vs）を測定し，それぞれ次式により算出します。数値は，[10^9 Pa]単位で表記します

$$G = V_s^{\,2} \cdot \rho$$

$$E = \frac{4G^2 - 3G \cdot V_l \cdot \rho}{G - V_l \cdot \rho}$$

ここで，ρ はガラスの密度です。
ポアソン比 μ は，ヤング率と剛性率から，次式により求めます。

$$\mu = \frac{E}{2G} - 1$$

（4）光弾性定数 β

光学ガラスは，通常光学的に等方性ですが，応力が存在すると複屈折性を示すようになります。光弾性定数 β とは，応力 F と複屈折による光路差 δ との関係を表す定数で，ガラスの厚さを d とすると，

$$\delta = \beta \cdot d \cdot F$$

の関係があります。このカタログでは，[10^{-5} nm/cm／Pa]の単位で表示してあります。

7．その他の性質

（1）比重 SG　(JOGIS 05-1975)

比重は，4 ℃における同体積の純水に対する質量比で，小数点以下 2 桁まで表示してあります。よくアニールされた試料を，いわゆるアルキメデス法によって測定します。空気の浮力による補正は行なっていません。

（2）泡・異物

光学ガラスでは全く泡のないものをつくる事は極めて困難です。泡は，ガラス 100 ml 中における断面積の総和として表示されます。また，結晶や節のような異物などがある場合も，泡と同様とみなし，泡の断面積の総和に加算してあります。なお，この分類は泡及

び異物の直径または最大径が 0.03 mm 以上のものを対象としております。

表 8　泡・異物等級

級	1	2	3	4	5
100 ml 中の泡の 断面積の総和[mm²]	0.03 未満	0.03 以上 0.10 未満	0.10 以上 0.25 未満	0.25 以上 0.50 未満	0.50 以上

８．品質保証

（１）屈折率およびアッベ数

ファインアニールされた製品の屈折率及びアッベ数はこのカタログの値に対し通常次の公差に入っています。

n_d ： $\pm 300\times10^{-6}$

ν_d ： $\pm 0.5\%$

特別なご要望に対しましては

n_d：$\pm 200\times10^{-6}$

ν_d：$\pm 0.3\%$

の公差にも応じます。納品に際しましては，C，d，F，g の各スペクトル線に対する小数点以下 6 桁までの屈折率，及びこれより求めた小数点以下 2 桁までの ν_d 値を添付いたします。その他の光学恒数規格が必要な場合には，別途ご相談ください。

（２）歪（JOGIS 14-1975）

歪はガラス内部の残留応力によって生じた複屈折によるガラス厚さ 1 cm 当たりに生ずる光路差を次表により分類表記します。

表 9　歪等級

級	1	2	3	4
歪量 [nm/cm]	5 未満	5 以上 10 未満	10 以上 20 未満	20 以上

（３）脈理

JOGIS 11-1975 に定められた標準試料との比較検査にて次表の等級に格付けしています。

表 10　脈理等級

級	脈理の程度
1 2 3	認められないもの 標準試料Ｂ（薄くて分散した脈理で目に見える限界のもの）と同程度のもの 標準試料Ｃ（研磨面に対して垂直な方向と平行な脈理がわずかにあるもの）と同程度のもの

（４）泡・異物

各メルトごとに試料をとり，７．(2) 項に従ってその中に含まれる泡・異物の断面積の総和を算出して，等級を決めています。

（５）着色度

カタログに示された着色度を基準に，±10 の変動幅で管理しています。特にご要望があ

れば，納入メルトの着色度もしくは必要な波長範囲の分光透過率を測定してお知らせいたします。

９．製品区分

（１）ブロック品

幅・長さ・厚さ・形状等は，別途ご相談下さい。

（２）プレス品

ガラス材料を再加熱成型したプレス品です。プレス品の加工公差は表 11 の通りですが，特別の寸法公差を必要とする場合にはご相談に応じます。なお，ご注文の際には研磨取代を含んだ直径，中心肉厚，及び曲率の寸法をご指示下さい。

表 11　プレス製品寸法と加工公差

外径寸法[mm]	外径公差[mm]	肉厚公差[mm]
φ 12 未満	±0.10	±0.4
φ 12 以上 ～ 40 未満	±0.15	±0.3
φ 40 以上 ～ 60 未満	±0.20	±0.3
φ 60 以上 ～ 90 未満	±0.25	±0.3
φ 90 以上 ～ 150 未満	±0.40	±0.4
φ 150 以上 ～ 300 未満	±0.50	±0.5

（３）丸棒切断品

丸目加工により外径を仕上げた後切断したものです。プレス品より寸法精度が良い為，外径はそのまま使用することが可能です。

表 12　丸棒切断製品寸法と加工公差

製品寸法[mm]	外径公差[mm]	肉厚公差[mm]
φ 3～25	±0.05	±0.15

（４）その他の特殊形状品

指定寸法の丸目品、及び特殊形状品、指定重量の切断品、ＣＧ加工品なども取り扱っております。

１０．生産頻度

生産頻度は生産量，生産方法，硝種により異なりますが，以下のように大別されます。

A：生産頻度が非常に高い

B：生産頻度が高い

C：生産頻度が低い

D：要相談

Contents

1. Optical glass designation

To help safeguard Earth's ecology, HIKARI GLASS have developed a line of glass called ECO OPTICAL GLASS which is entirely free from lead (Pb) and arsenic (As).
A "J-" or a "Q-" is prefixed to the SCHOTT glass type to indicate an updated version of glass.

2. Optical glass code

Each glass type has a code of 6 digits. The initial 3 digits are the first three decimal places of the refractive index rounded up to the third decimal place. The latter 3 digits are the first three digits of the Abbe number rounded up to the first decimal place. For example, the glass code for J-BK7A (n_d 1.516800 and ν_d 64.14) is expressed as 517641. The optical glass codes for both d- and e-lines are included in each data sheet.

3. Optical properties

3.1 _Refractive index (n)

Refractive indices in the visible and infrared range are listed to the sixth and fifth decimal places, respectively, in each data sheet at the spectral lines given in Table 1. The refractive indices are calculated using the power series dispersion formula expressed in 3.4.

Table 1. Spectrum

Spectral line symbol	Light source	Wavelength [μm]
2.058	He	2.05809
1.970	Hg	1.97063
1.530	Hg	1.529582
1.129	Hg	1.12864
1.064	Nd(YAG) LASER	1.06414
t	Hg	1.01398
s	Cs	0.85211
A'	K	0.768195
r	He	0.706519
C	H	0.656273
C'	Cd	0.643847
He-Ne	He-Ne LASER	0.632816
D	Na	0.589294
d	He	0.587562
e	Hg	0.546074
F	H	0.486133
F'	Cd	0.479992

Table 1: Spectrum (Continued)

Spectral line symbol	Light source	Wavelength [μm]
g	Hg	0.435835
h	Hg	0.404656
0.389	He	0.388865
i	Hg	0.365015

3.2 _Dispersion

"Partial dispersion" is defined as the difference between two associated refractive indices, nX-nY, with two different spectra. For simplicity X-Y is used in place of nX-nY. "Relative partial dispersion" is defined as the ratio of two partial dispersions. Several partial dispersions and relative partial dispersions concerning spectra in Table 1 are listed in each data sheet.

Abbe numbers ν_d and ν_e are defined as:

$$\nu_d = \frac{n_d - 1}{n_F - n_C} \qquad \nu_e = \frac{n_e - 1}{n_{F'} - n_{C'}}$$

Both Abbe numbers are listed to the second decimal place. Reciprocal of the Abbe number is included in the excel file only.

3.3 _Abnormal dispersion (ΔP)

In a diagram of relative partial dispersion versus Abbe number, the glass types that are clustered linearly are called "normal partial dispersion glass (normal glass)." Glass types that fall away from the linear cluster are called "abnormal partial dispersion glass (abnormal glass)." The deviation of the relative partial dispersion from the straight line between glass types K7 and F2 are listed in the data sheet as the degree of abnormalness (ΔP_{dC}, ΔP_{gF}).

3.4 _Dispersion formula

The refractive indices for the wavelengths not listed in the data sheet can be calculated by using a dispersion formula. Generally several formulae are used to express the dispersion curve. For all data sheets, the dispersion formula with the smallest fitting error is utilized and shown below:

$$n_{(\lambda)}^{\ 2} = A_0 + A_1\lambda^2 + A_2\lambda^4 + A_3\lambda^{-2} + A_4\lambda^{-4} + A_5\lambda^{-6} + A_6\lambda^{-8} + A_7\lambda^{-10} + A_8\lambda^{-12}$$

Constants, A_0 to A_8, are determined by using the method of least squares from precisely measured refractive indices.

Another dispersion formula is shown below, which is nearly the same formula as that of Sellmeier. Since the Sellmeier formula is widely used in the theoretical field, a formula nearly equivalent to the Sellmeier formula, is included in each data sheet and is shown below:

$$\frac{n^2-1}{n^2+2}=\frac{P_1\lambda^2}{\lambda^2-Q_1}+\frac{P_2\lambda^2}{\lambda^2-Q_2}+\frac{P_3\lambda^2}{\lambda^2-Q_3}$$

Fitting errors of the two formulae above are listed for reference.
The applicable spectral range of the dispersion formula is limited to the range where refractive index data are given. Please note that wavelength λ is expressed in μm.

3.5 _Temperature coefficient of the refractive index (Δn/ΔT)

Temperature coefficients of the relative refractive index and of the absolute refractive index are listed at a temperature range from -70 °C to 90 °C and spectral range from 389 nm to 1083 nm. It should be noted that a 10 °C interval is used at the beginning and end of the temperature range, while a 20 °C interval is used in between -60 °C to 80 °C. The coefficients are expressed as 10^{-6}/°C.

3.6 _Internal transmittance (τ)

Internal transmittance is the value of transmittance that excludes losses from surface reflections. Data for glass with a 10 mm thickness are listed in the spectral range from 280 nm to 2400 nm. Please note that i-line data for 365 nm is included in the data sheet. The HIKARI GLASS Internal Color Code (Internal CC) are derived by linking together the wavelengths observed at 80% and 5% internal transmittance, respectively, for a given type of glass with a thickness of 10 mm. For instance, a glass whose internal transmittance is 80% at a wavelength of 321 nm and 5% at a wavelength of 286 nm is expressed as 321/286.

3.7 _Coloring

The Color Code (CC) is derived by linking together the wavelengths observed at 80% and 5% total transmittance, respectively, for a given type of glass with a thickness of 10 mm. The wavelength is expressed in 5nm step.
For instance, the CC of a glass whose total transmittance is 80% at a wavelength of 332 nm and 5% at a wavelength of 286 nm is expressed as 330/285. For a glass with a high refractive index, whose n_e value is higher than 1.85, 70% transmittance is used in place of 80% transmittance.

4. Chemical properties

4.1 _Acid resistance by surface method (AR(S))

To test the acid resistance of a glass sample using the surface method, a freshly polished surface of the sample is immersed in a set of buffer solutions with pH of 4.6, 5.9, and 6.8 at 30 °C until a slight amber interference color appears on the surface. Acid resistance is classified by the time it takes for the appearance of the

interference color as denoted in Table 2.

Table 2: Acid resistance by surface method

Class	1	2	3	4	5	6	7
pH 4.6	60 min ＜	12 min ＜ ≦ 60 min	≦ 12 min				
pH 5.9			60 min ＜	12 min ＜ ≦ 60 min	≦ 12 min		
pH 6.8					60 min ＜	12 min＜ ≦60 min	≦12 min

4.2 Alkaline detergent resistance by surface method (PR(S)) (ISO 9689:1990)

To test the alkaline detergent resistance of a glass sample using the surface method, a freshly polished surface of the sample is immersed in a solution of 0.01 mol/l sodium tripolyphosphate at 50 °C for the specified amount of time and measured for weight loss. Alkaline detergent resistance is classified according to the time taken to dissolve 0.1 µm as denoted in Table 3.

Table 3: Alkaline detergent resistance by surface method

Class	1	2	3	4
Time to dissolve 0.1 µm [h]	4 ＜	1 ＜ ≦ 4	0.25 ＜ ≦ 1	≦ 0.25

4.3 _Climate resistance by surface method (CR(S)) _(JOGIS 07-2006)

To measure the climate resistance of a glass sample using the surface method, a freshly polished surface of the sample is incubated in consecutive humid water baths for 50 min each at 57.5 °C and 64 °C respectively. The process is repeated for 24 cycles over a span of 48 h. Any haze that appears on the glass surface is then measured and converted into a percentage using a hazemeter. Climate resistance is classified according to the haze% as denoted in Table 4.

Table 4: Climate resistance by surface method

Class	1	2	3	4	5
Haze%	＜ 2	2 ≦ ＜ 10	10 ≦ ＜ 20	20 ≦ ＜ 30	30 ≦

4.4 _Water resistance by powder method (WR(P))_(JOGIS 06-1999)

To determine the water resistance of a glass sample using the powder method, the sample to be tested is ground into powder, weighed to an amount equivalent to the number of the sample's specific gravity [g], and placed into a platinum basket, immersed into 80 ml of distilled water (pH 6.5-7.5) and boiled for 60 min. The boiled powder is then dried at 120 °C and measured for weight loss. Water resistance is classified by the percentage of glass weight loss as denoted in Table 5.

Table 5: Water resistance by powder method

Class	1	2	3	4	5	6
Weight loss [mass %]	< 0.05	0.05 ≦ < 0.10	0.10 ≦ < 0.25	0.25 ≦ < 0.60	0.60 ≦ < 1.10	1.10 ≦

4.5 _Acid resistance by powder method (AR(P))_(JOGIS 06-1999)

The same protocol is employed as in 4.4 to measure the acid resistance of a glass sample using the powder method, except that 80 ml of 0.01 N solution of nitric acid is substituted in place of distilled water. Acid resistance is classified by the percentage of glass weight loss as denoted in Table 6.

Table 6: Acid resistance by powder method

Class	1	2	3	4	5	6
Weight loss [mass %]	< 0.20	0.20 ≦ < 0.35	0.35 ≦ < 0.65	0.65 ≦ < 1.20	1.20 ≦ < 2.20	2.20 ≦

5. Thermal properties

Thermal properties are essential to processing optical glass for annealing and heat treatment. The temperature of the transformation point (Tg), yield point (At), and the mean linear coefficient of thermal expansion (α) are derived from the thermal expansion curve shown in Fig.1.

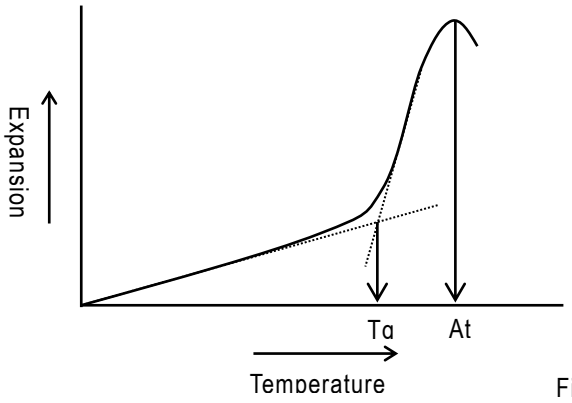


Fig. 1. Thermal expansion curve.

5.1 _Transformation point (Tg)_(JOGIS 08-2003)

The transformation point is denoted as the intersecting point of the two straight dotted lines shown in Fig. 1. Tg is expressed in °C.

5.2 _Yield point (At)_(JOGIS 08-2003)

The point at the peak of the thermal expansion curve is known as the yield point and is expressed in °C.

5.3 _Coefficient of linear thermal expansion (CTE, α)_(JOGIS 08-2003, JOGIS 16-2003)

Two coefficients of linear thermal expansion are included in each data sheet. One coefficient is utilized for the temperature range between -30°C.and 70°C, while the other is used for the temperature range between 100 °C and 300 °C. The former originates from a HIKARI GLASS designed instrument that measures thermal expansion, while the latter is derived from Fig. 1. Both coefficients are expressed as 10^{-7} /°C.

5.4 _Strain point (StP)_(JIS R3103-02:2001)

The strain point is the temperature at which the internal stresses of the glass can be substantially relieved within a few hours, and corresponds to a viscosity of $10^{14.7}$ dPa · s.

5.5 _Annealing point (AP)_(JIS R3103-02:2001)

The annealing point is the temperature at which the internal stresses of the glass can be substantially relieved within a few minutes, and corresponds to a viscosity of $10^{13.2}$ dPa · s.

5.6 _Softening point (SP)_(ASTM C1351M-96)

The softening point is the lower limit temperature at which molding of glasses becomes possible, and corresponds to a viscosity of $10^{7.65}$ dPa · s.

5.7 _Heat conductivity (λ), specific heat capacity (c), and thermal diffusivity (κ)

The heat conductivity, specific heat capacity, and thermal diffusivity of each glass sample at room temperature are listed and expressed in the data sheets as W/(m·K), 10^3 J/(kg·K), 10^{-6} m^2/s respectively. Heat conductivity is derived from the relationship below, where ρ is the density of the glass.

$$\lambda = \rho \cdot \kappa \cdot c$$

6. Mechanical properties

6.1 _Abrasion hardness (A)_(JOGIS 10-1994)

To determine the abrasion hardness of a glass sample, a 30 mm x 30 mm x 10 mm piece of the sample is placed on a cast iron abrasion plate with a diameter of Φ 250 mm that revolves at 60 rpm and is lapped for 5 min at a load of 9.8 N in lapping liquid with abrasives #800. The abraded weight is then measured and used to obtain the abrasion hardness. The abrasion hardness is defined as the ratio of the volume of the abraded sample vs. a standard sample abraded in the same manner.

$$A = \frac{W/S}{W_0/S_0} \times 100$$

6.2_Knoop hardness (Hk)_(JOGIS 09-1975)

To measure the Knoop hardness of a glass sample, a polished surface of the sample is indented with a diamond rhombic pyramid knoop indenter (vertex angles: 172°30' and 130°) under a load of 0.98 N for 15 s. The Knoop hardness is calculated by the following formula:

$$(Knoop \quad hardness) = \frac{1.451F}{l^2}$$

where F [N] denotes the applied load and l [mm] is the length of the longer indented diagonal line. In each data sheet, the measured value and the corresponding classified grade are denoted in Table 7.

Table 7: Knoop hardness

Class	1	2	3	4	5	6	7
Knoop hardness	< 150	150 ≦ < 250	250 ≦ < 350	350 ≦ < 450	450 ≦ < 550	550 ≦ < 650	650 ≦

6.3 _Modulus of elasticity (E, G, and μ)

Young's modulus (E) and shear modulus (G) are derived from the following formulae by measuring the velocities of the 5 MHz longitudinal wave (V_l), and the 2 MHz transverse wave (V_s). Both moduli are expressed as 10^9 Pa.

$$G = V_s^{\,2} \cdot \rho$$

$$E = \frac{4G^2 - 3G \cdot V_l \cdot \rho}{G - V_l \cdot \rho}$$

Poison's ratio (μ) is derived from the following formula:.

$$\mu = \frac{E}{2G} - 1$$

6.4 _Stress optical coefficient (β)

Optical glass is ordinarily optically isotropic. However, birefringence appears if stress is applied to the glass. The stress optical coefficient (β) relates the birefringence (δ) to the stress (F) and is expressed below, where d is the thickness of the glass.

$$\delta = \beta \cdot d \cdot F$$

β is expressed as (nm/cm)/10^5 Pa.

7. Other properties

7.1 _Specific gravity (SG)_(JOGIS 05-1975)

Specific gravity of glass is defined as the ratio of glass mass to pure water at 4 °C. Well-annealed glass is used as a test piece and is measured using the Archimedes method. A correction for the buoyancy of air is ignored.

7.2 _Bubbles and inclusions

It is extremely difficult to make optical glass completely free of bubbles. Bubbles are measured by their sum total in a cross sectional area per 100 ml of glass. It should be noted that some inclusions in the glass are optically identified with the bubbles and are accordingly counted and added to the cross sectional total. Only bubbles and inclusions with a diameter greater than 0.03 mm are subject to classification and are denoted in Table 8.

Table 8: Bubbles and inclusions

Class	1	2	3	4	5
Total cross sectional area per 100 ml of glass [mm^2]	$<$ 0.03	0.03 $\leqq$ $<$ 0.10	0.10 $\leqq$ $<$ 0.25	0.25 $\leqq$ $<$ 0.50	0.50 $\leqq$

8. Quality control

8.1 _Refractive index and Abbe number

The refractive index and Abbe number of finely annealed glass are typically within the following tolerances:

n_d : ± 300 x 10^{-6}

ν_d : ± 0.5 %

Upon request, we can supply glass to the following tolerances:

n_d : ± 200 x 10^{-6}

ν_d : ± 0.3 %

Our melt certification contains the refractive indices for the C, d, F, and g spectral lines. Please consult us if you have any special requests for additional spectral lines.

8.2 _Birefringence _(JOGIS 14-1975)

Birefringence is graded according to the following table specified by JOGIS.

Table 9. Birefringence grade

Class	1	2	3	4
Birefringence [nm/cm]	$<$ 5	5 $\leqq$ $<$ 10	10 $\leqq$ $<$ 20	20 $\leqq$

8.3 _Striae

The striae grade is determined by comparing the glass sample with the standard sample specified by JOGIS 11-1975 and is denoted in Table 10:

Table 10. Striae grade

Class	Degree of Striae
1	No visible striae
2	Standard degree B (Striae is light and scattered)
3	Standard degree C (Slight striae exist in vertical direction of polished face)

8.4 _Bubbles and inclusions

Quality control grading for bubbles and inclusions is determined by measuring several samples from each melt as stated in 7.2.

8.5 _Coloring

Since it is hard to avoid color variation among each glass melt, we have listed the average color code value, generally within a ± 10 range of variation, in each data sheet. On special request, we shall report the coloring of the glass to be supplied by measuring the spectral transmission in the necessary range of wavelength.

9. Forms of supply

9.1 _Glass block (slab glass)

Please contact us about the required width, length, thickness, and shape of glass.

9.2 _Pressings

Pressings are blanks formed by manually/automatically pressing softened glass in a mold. The tolerances of our pressings are shown in Table 11. Specified pressed blanks can be manufactured to the customer's own tolerances. We request the customer to specify the pressed blank size including an allowance for grinding of the diameter, center thickness, and curvature when placing orders.

Table 11. Pressings blank dimension and tolerances

Outer Diameter [mm]	Tolerance of OuterDiameter [mm]	Tolerance of Thickness[mm]
< Φ 12	± 0.10	± 0.4
Φ 12 to Φ 40	± 0.15	± 0.3
Φ 40 to Φ 60	± 0.20	± 0.3
Φ 60 to Φ 90	± 0.25	± 0.3
Φ 90 to Φ150	± 0.40	± 0.4
Φ150 to Φ300	± 0.50	± 0.5

9.3 _Round cut rod

Round cut rod are formed from cutting a precise ground rod into individual cut blanks. Since its dimensional accuracy is better than that of pressings, the outer diameter can most likely be used left intact. These blanks are excellent for small diameter/tight tolerance requirements.

Table 12. Rod cut size and tolerance

Rod Dimension [mm]	Tolerance of OuterDiameter [mm]	Tolerance of Thickness [mm]
Φ 3 to Φ25	± 0.05	± 0.15

9.4 _Other specified products

Cut glass according to the customer's specified dimensions, specified form pressings (moldings), and CG processing are all available.

10. Production frequency

Production frequency depends upon the glass type, volume, and production method of the optical glass.

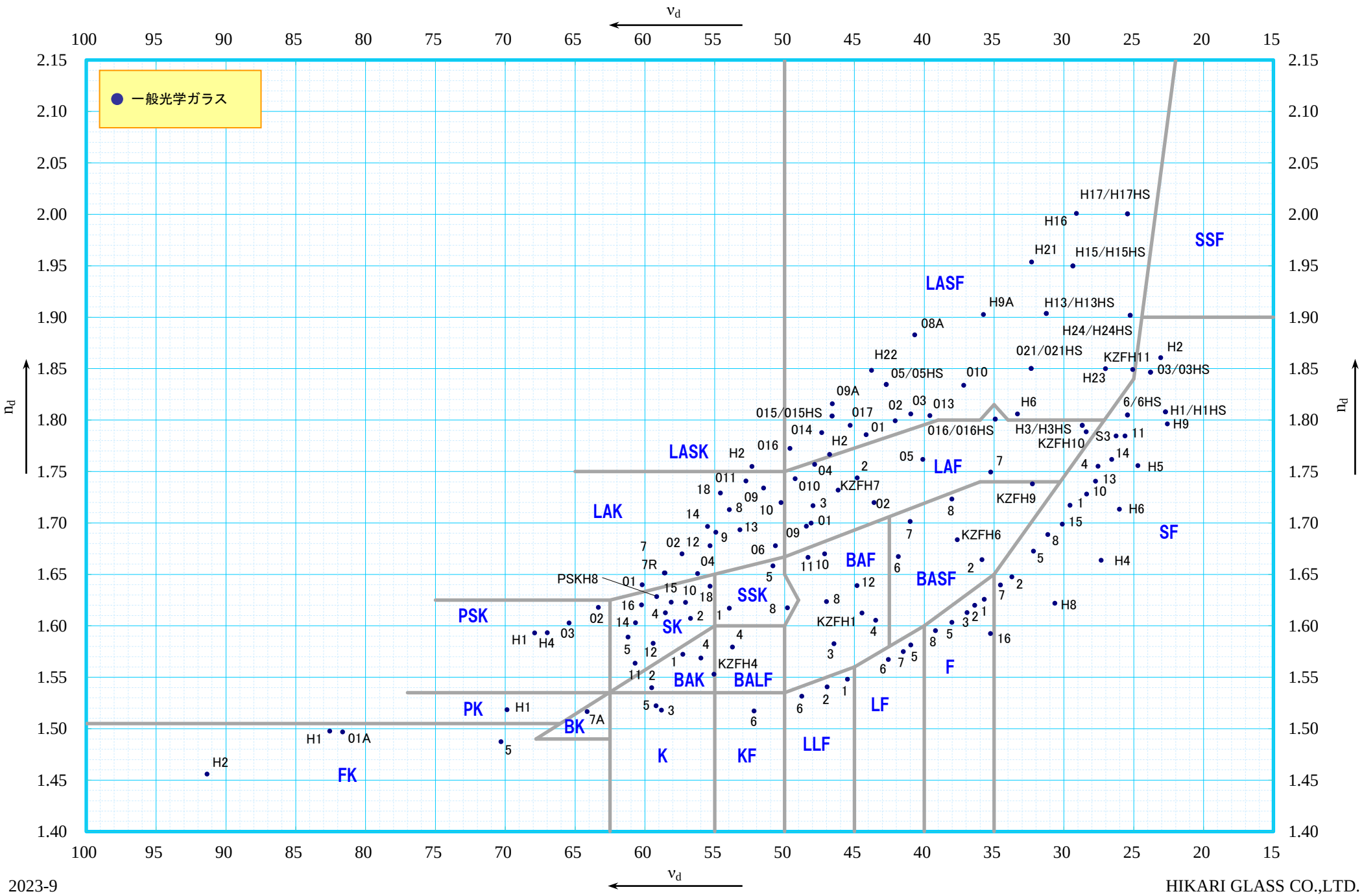
A: Very high frequency of production.

B: High frequency of production.

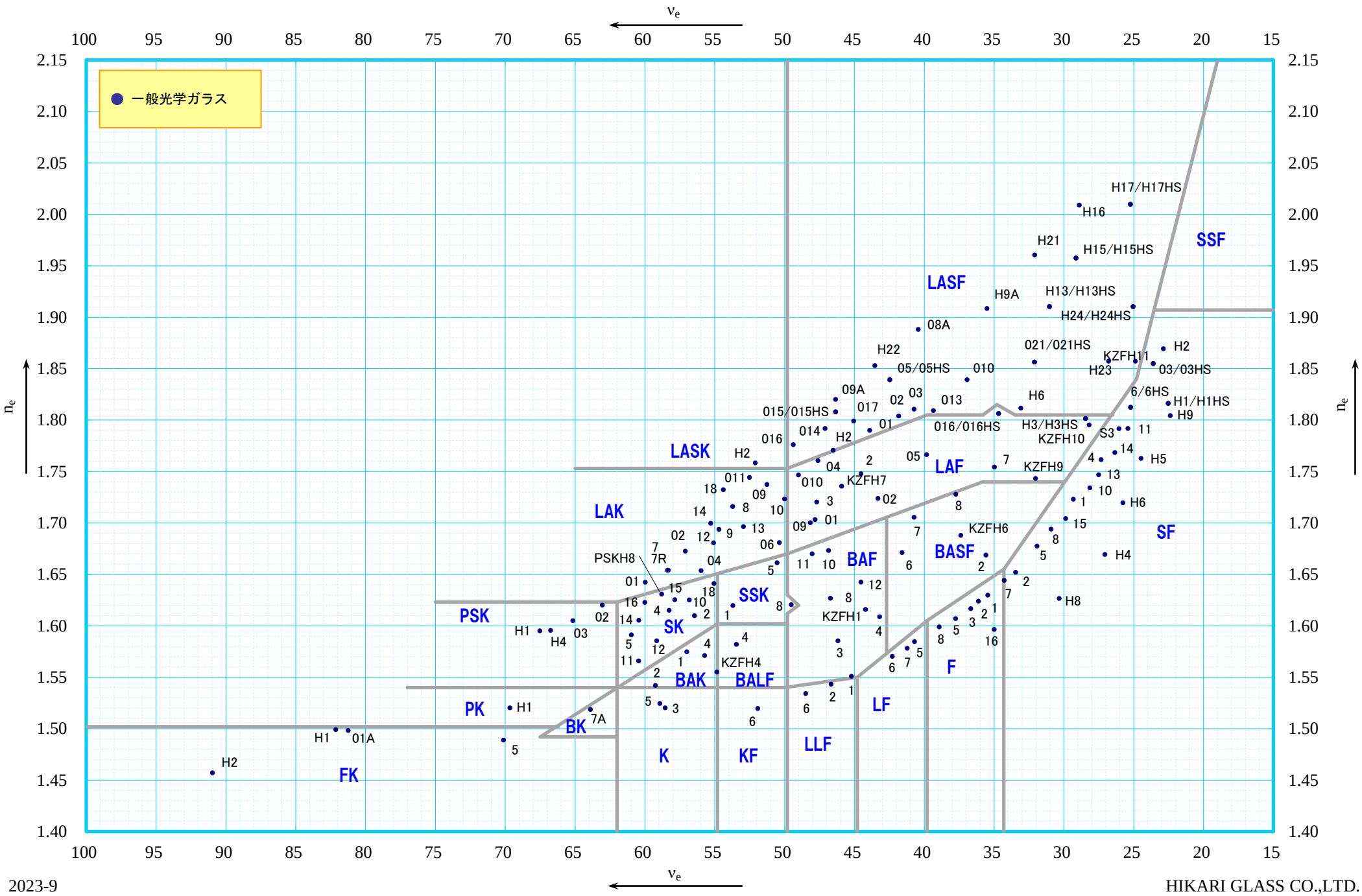
C: Low frequency of production.

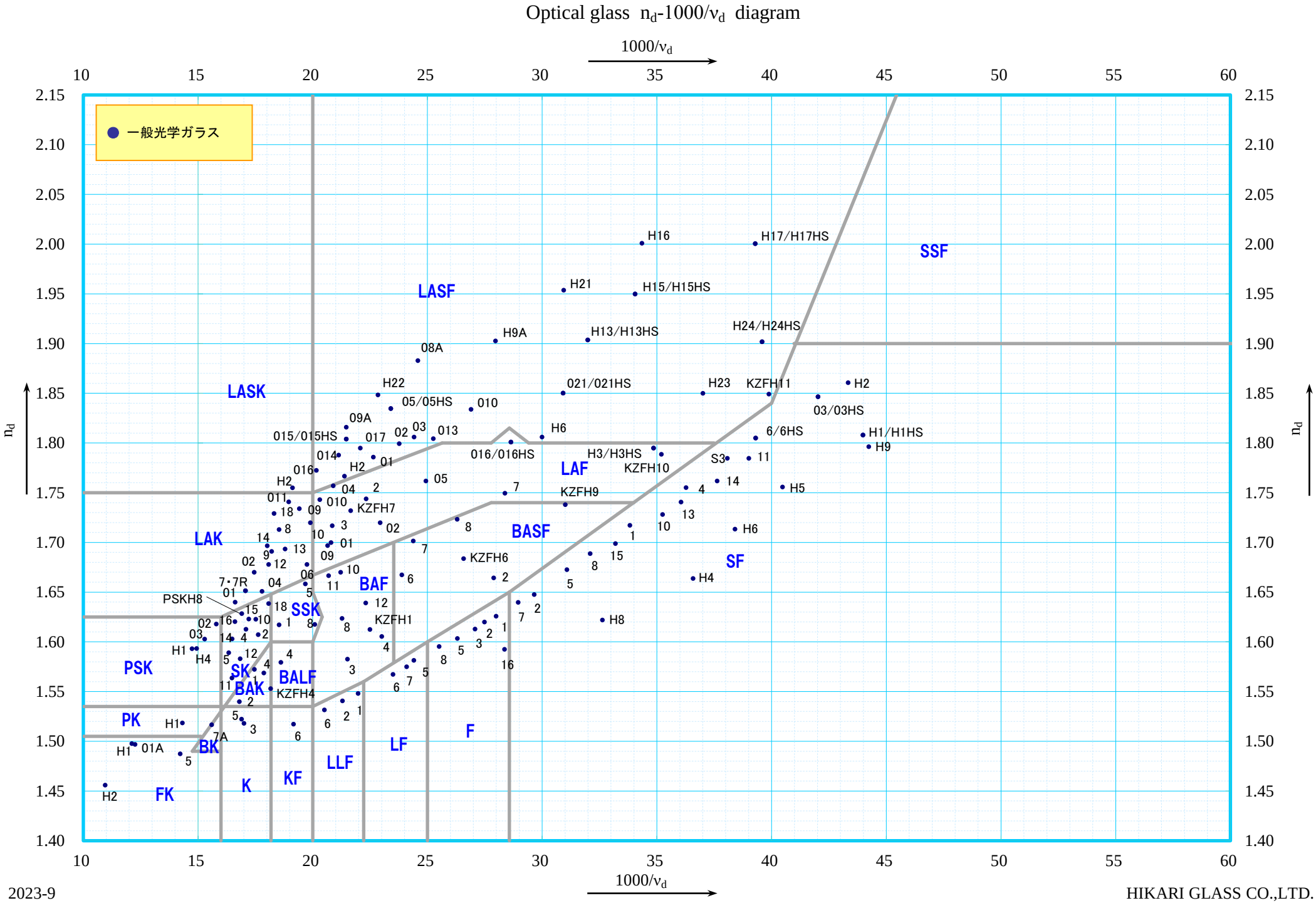
D: Need discussion.

Optical glass n_d-ν_d diagram



Optical glass n_e-ν_e diagram





2023-9

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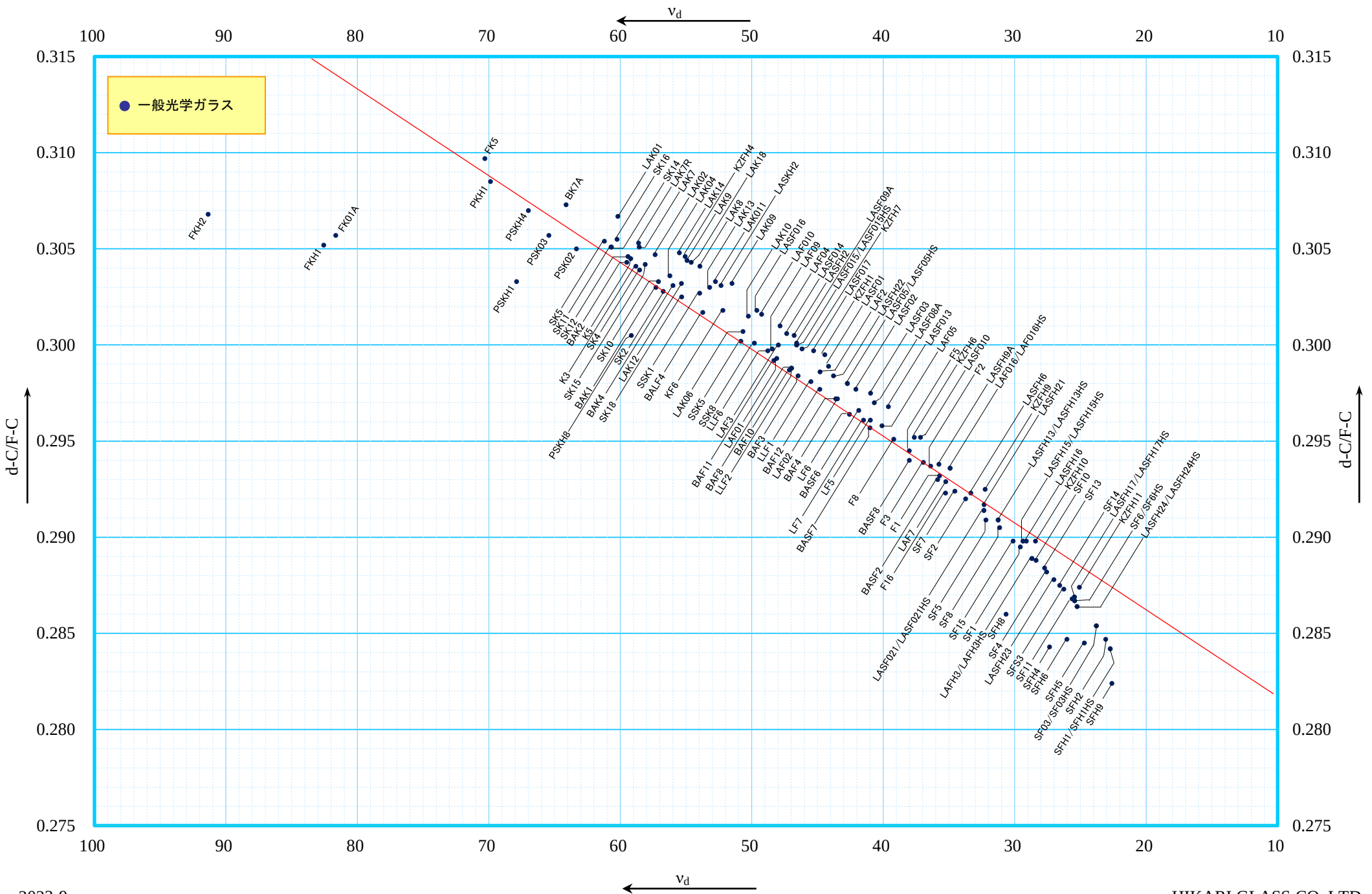
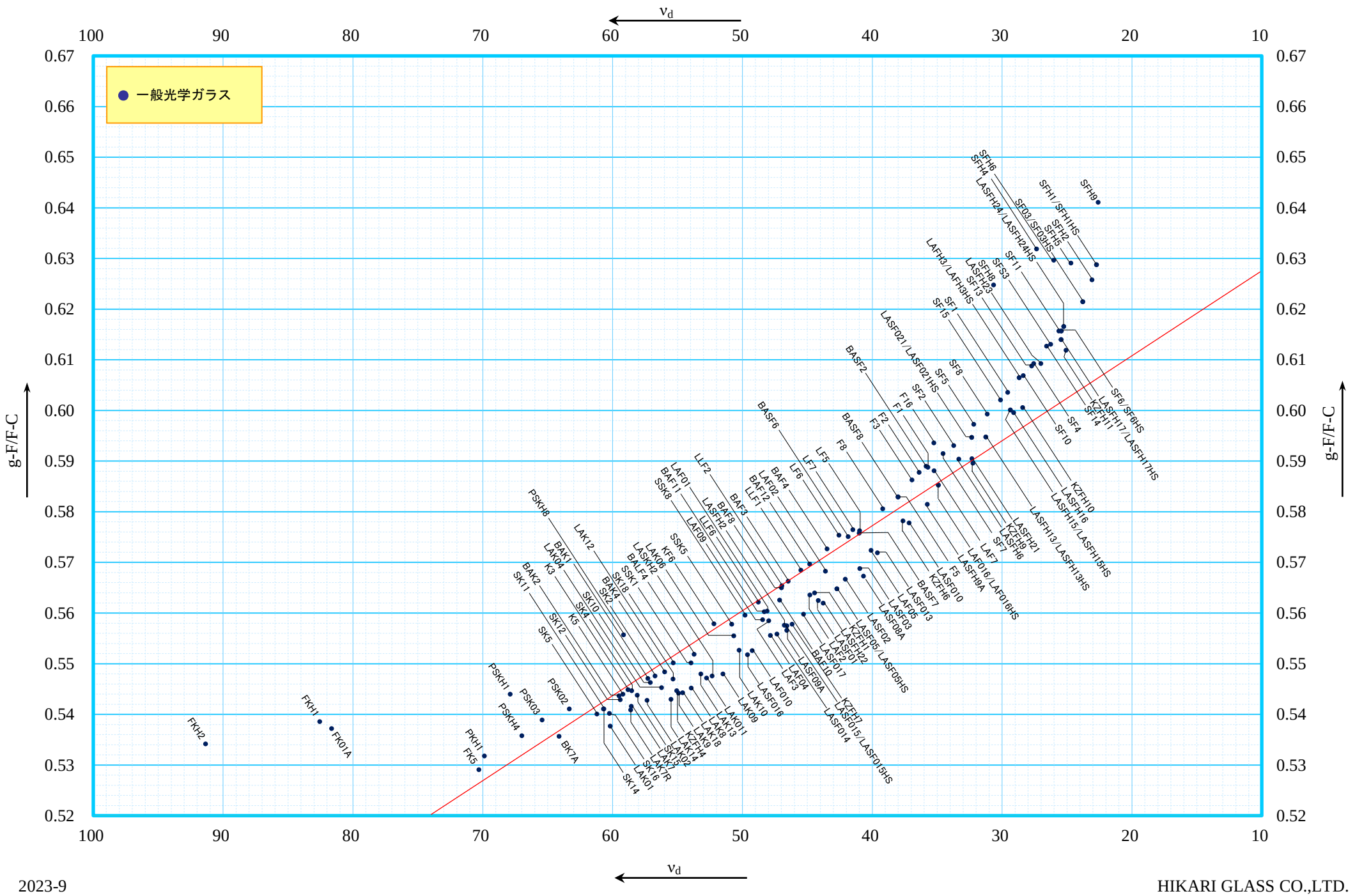
Optical glass d-C/F-C — ν_d diagram



2023-9

HIKARI GLASS CO.,LTD.

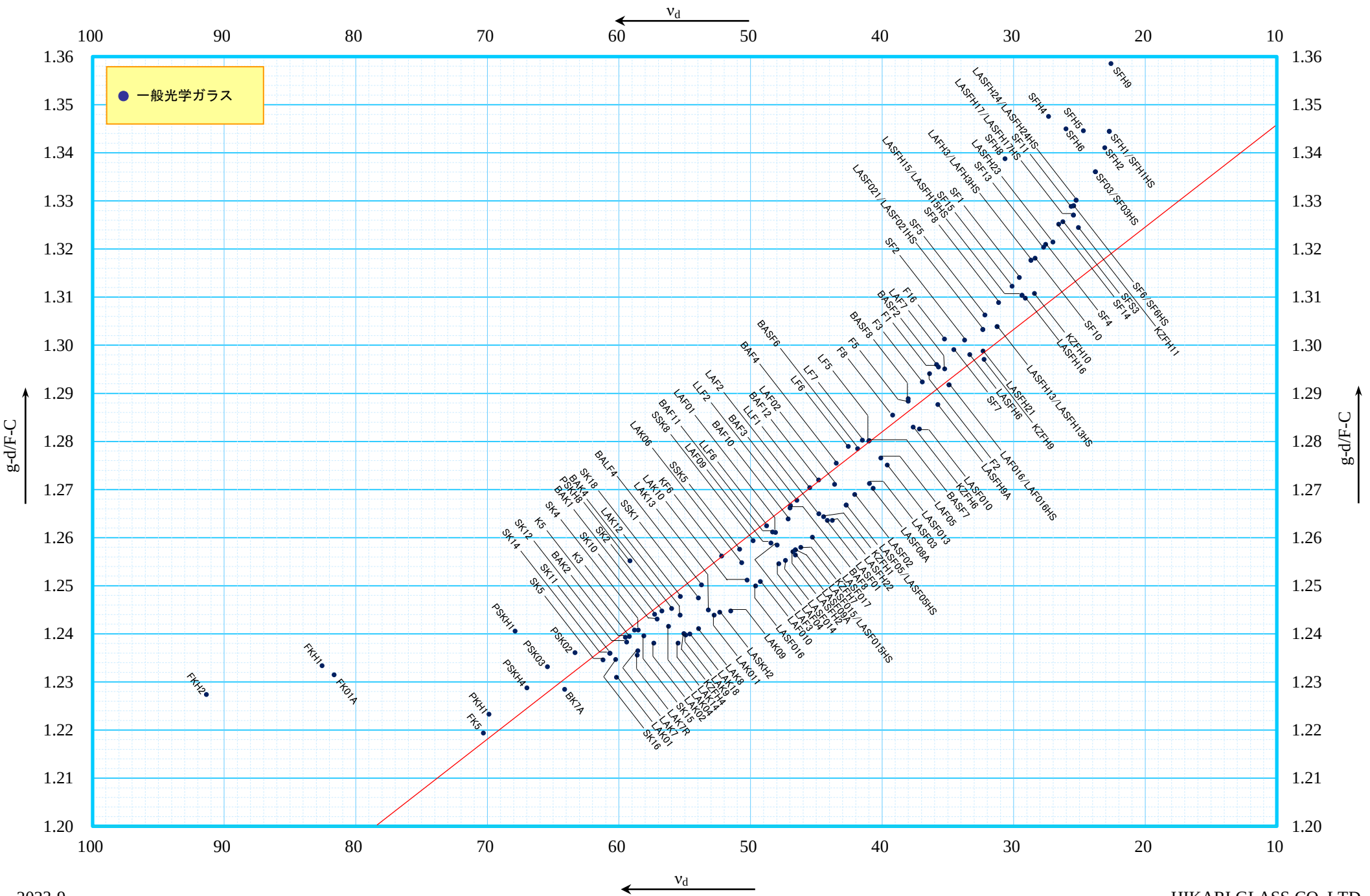
Optical glass g-F/F-C — ν_d diagram



2023-9

HIKARI GLASS CO.,LTD.

Optical glass g-d/F-C — ν_d diagram



2023-9

HIKARI GLASS CO.,LTD.

【一般光学ガラス】

データ改訂履歴

年-月-日	硝種他	内　　容
2009-9-1	09版カタログ発行	(1)物性値追加・修正，(2)硝種名変更(″J-″)，(3)6硝種廃止(E-SSFH1，E-LAKH1，E-LAF11，E-LAFH2，E-LASF04，E-LASFH10)
2011-2-1	17硝種	光弾性定数を訂正(J-K3，J-K5，J-KZFH1，J-KF6，J-BAF11，J-BASF2，J-SK2，J-SK5，J-SK10，J-SK11，J-SK12，J-LLF6，J-F1，J-F5，J-LASKH2，J-LAF3，J-LASF03)
	38硝種	他社相当硝種を修正
	J-LAK10	ΔPdcとΔPgFの数値を入れ替え
2012-4-1	J-LASFH24	新規開発硝種
	2硝種	他社相当硝種を修正(J-BAF10，J-BASF7)
2015-4-1	全硝種	着色度を2桁から3桁へ変更
	47硝種	生産頻度を変更
	49硝種	他社類似硝種を修正
	J-BK7	廃止
	J-BK7A	J-BK7の全データ更新硝種として掲載
	5硝種	比重，熱的性質，化学的性質，機械的性質，屈折率の温度係数を変更 (J-SK16，J-LLF6，J-LAK8，J-LASF021，J-LASFH6)
	2硝種	内部透過，内部透過率を変更 (J-LASF015，J-LASFH2)
	6硝種	開発硝種を掲載 (J-PSKH4，J-LAK7R，J-SF6HS，J-LASFH16，J-LASFH21，J-LASFH23)
2016-4-1	5硝種	開発硝種を掲載 (J-KZFH4，J-LASFH22，J-LASF021HS，J-LASFH13HS，J-LASFH17HS)
	11硝種	生産頻度を変更
	24硝種	他社類似硝種を修正
2016-12-1	J-FK01	比重，熱的性質，化学的性質，機械的性質，屈折率の温度係数を変更
2017-4-1	4硝種	廃止(J-FK01，J-LASF08，J-LASF09，J-LASFH9)
	4硝種	全データ更新硝種として掲載(J-FK01A，J-LASF08A，J-LASF09A，J-LASFH9A)
	5硝種	開発硝種を掲載(J-SF03HS，J-LAF016HS，J-LAFH3HS，J-LASF05HS，J-LASFH24HS)
	J-LASFH16	Tg，At，高温膨張係数を修正
	J-PKH1	生産頻度を変更
	3硝種	他社類似硝種を修正
2018-4-1	J-FKH1	磨耗度を変更
	2硝種	ヤング率，剛性率を変更 (J-SF6，J-SF6HS)
	47硝種	生産頻度を変更
	7硝種	他社類似硝種を修正
2018-9-1	2硝種	開発硝種を掲載 (J-KZFH6，J-KZFH7)
2019-4-1	3硝種	開発硝種を掲載 (J-SFH1HS，J-LASF015HS，J-LASFH15HS)
	J-BAF12	高温膨張係数を修正
	J-SK16	Tgを修正
	J-SFH1	生産頻度を変更
	全硝種	透過率データを更新(着色度，内部透過，内部透過率，CCI)
2019-6-15	J-PSK03	透過率データを修正(着色度，内部透過)
2020-4-1	5硝種	化学的性質を変更 (J-BAF8，J-SK15，J-LAK7，J-LASKH2，J-LAF05)
	26硝種	他社類似硝種を修正
	4硝種	開発硝種を掲載 (J-PSKH8，J-KZFH9，J-SFH4，J-SFH5)
2021-4-1	2硝種	屈折率，部分分散，部分分散比を修正(J-SFH4，J-SFH5)
	1硝種	開発硝種を掲載 (J-SFH6)
2022-7-1	2硝種	開発硝種を掲載 (J-KZFH10，J-SFH8)
	129硝種	熱的性質(歪点，徐冷点，軟化点)を追加
	4硝種	生産頻度を変更 (J-BAF3，J-LAK02，J-LAK04，J-SFH1HS)
	2硝種	他社類似硝種を修正(J-KZFH9，J-LASFH9A)
2023-9-1	2硝種	開発硝種を掲載 (J-KZFH11，J-SFH9)
	7硝種	生産頻度を変更 (J-FKH2，J-KZFH1，J-F5，J-SF10，J-LASKH2，J-LASFH15，J-LASFH15HS)

注)データは予告なく変更されることがあります

【Optical glass for general application】

Revision history of data

Y-M-D	Glass type	Note
2009-9-1	Release 09 version catalog	(1)Addition and correction of data, (2)changing the name of all glass types (″J-″), (3)obsoleting six glass types (E-SSFH1, E-LAKH1, E-LAF11, E-LAFH2, E-LASF04, E-LASFH10)
2011-2-1	17 glass types	Crrection of stress optical coefficient (J-K3, J-K5, J-KZFH1, J-KF6, J-BAF11, J-BASF2, J-SK2, J-SK5, J-SK10, J-SK11, J-SK12, J-LLF6, J-F1, J-F5, J-LASKH2, J-LAF3, J-LASF03)
	38 glass types	Correction of similar glass type
	J-LAK10	Exchange the data of ΔPdc and ΔPgF
2012-4-1	J-LASFH24	Developped
	2 glass types	Correction of similar glass type (J-BAF10, J-BASF7)
2015-4-1	All glass types	Changing color code from two digits to three
	47 glass types	Changing production frequency
	49 glass types	Correction of similar glass type
	J-BK7	Obsoleting
	J-BK7A	All of data changed from J-BK7
	5 glass types	Changing specific gravity, thermal properties, chemical properties, mechanical properties, and Δn/ΔT(J-SK16, J-LLF6, J-LAK8, J-LASF021, J-LASFH6)
	2 glass types	Changing internal CC and internal transmittance(J-LASF015, J-LASFH2)
	6 glass types	Developped(J-PSKH4, J-LAK7R, J-SF6HS, J-LASFH16, J-LASFH21, J-LASFH23)
2016-4-1	5 glass types	Developped(J-KZFH4, J-LASFH22, J-LASF021HS, J-LASFH13HS, J-LASFH17HS)
	11 glass types	Changing production frequency
	24 glass types	Correction of similar glass type
2016-12-1	J-FK01	Changing specific gravity, thermal properties, chemical properties, mechanical properties, and Δn/ΔT
2017-4-1	4 glass types	Obsoleting(J-FK01, J-LASF08, J-LASF09, J-LASFH9)
	4 glass types	All of data changed(J-FK01A, J-LASF08A, J-LASF09A, J-LASFH9A)
	5 glass types	Developped(J-SF03HS, J-LAF016HS, J-LAFH3HS, J-LASF05HS, J-LASFH24HS)
	J-LASFH16	Changing Tg, At and α(100,300)
	J-PKH1	Changing production frequency
	3 glass types	Correction of similar glass type
2018-4-1	J-FKH1	Changing abrasion hardness
	2 glass types	Changing young's mod and shear mod(J-SF6, J-SF6HS)
	47 glass types	Changing production frequency
	7 glass types	Correction of similar glass type
2018-9-1	2 glass types	Developped(J-KZFH6, J-KZFH7)
2019-4-1	3 glass types	Developped(J-SFH1HS, J-LASF015HS, J-LASFH15HS)
	J-BAF12	Changing α(100,300)
	J-SK16	Changing Tg
	J-SFH1	Changing production frequency
	All glass types	Changing transmittance data(color code, internal CC, internal transmittance and CCI)
2019-6-15	J-PSK03	Correction of transmittance data(color code and internal CC)
2020-4-1	5 glass types	Changing chemical properties(J-BAF8, J-SK15, J-LAK7, J-LASKH2, J-LAF05)
	26 glass types	Correction of similar glass type
	4 glass types	Developped(J-PSKH8, J-KZFH9, J-SFH4, J-SFH5)
2021-4-1	2 glass types	Changing refractive idx, partial dispersion, and relative partial dispersion(J-SFH4, J-SFH5)
	1 glass types	Developped(J-SFH6)
2022-7-1	2 glass types	Developped(J-KZFH10, J-SFH8)
	129 glass types	Addition of Thermal properties(Strain point, Annealing point, Softening point)
	4 glass types	Changing production frequency(J-BAF3, J-LAK02, J-LAK04, J-SFH1HS)
	2 glass types	Correction of similar glass type(J-KZFH9, J-LASFH9A)
2023-9-1	2 glass types	Developped(J-KZFH11, J-SFH9)
	7 glass types	Changing production frequency(J-FKH2, J-KZFH1, J-F5, J-SF10, J-LASKH2, J-LASFH15, J-LASFH15HS)

Note : Data are subject to change without prior notice.

J-FK5

n_d = 1.487490 n_e = 1.489145

ν_d = 70.31 ν_e = 70.14

Glass code (d)
487703
Glass code (e)
489701

Spectral l.	Refractive idx
2.058	1.46613
1.970	1.46742
1.530	1.47314
1.129	1.47773
1.064	1.47850
t	1.47912
s	1.48137
A'	1.482813
r	1.484095
C	1.485343
C'	1.485688
He-Ne	1.486009
D	1.487428
d	1.487490
e	1.489145
F	1.492276
F'	1.492662
g	1.495944
h	1.498956
0.389	1.500781
i	1.504034

Coef. disp. form. (pwr ser.)	
A0	2.18826855E+00
A1	-9.19044724E-03
A2	-1.11621071E-04
A3	9.26372815E-03
A4	7.34900733E-05
A5	4.19724242E-06
A6	-1.15412203E-07
A7	0.00000000E+00
A8	0.00000000E+00

Partial dispersion	
F-C	0.006933
F'-C'	0.006974
C-t	0.006227
C-A'	0.002530
d-C	0.002147
e-C	0.003802
g-d	0.008454
g-F	0.003668
h-g	0.003012
i-g	0.008090
C'-t	0.006572
e-C'	0.003457
F'-e	0.003517
i-F'	0.011372

Relative partial dispersion	
C-t／F-C	0.8982
C-A'／F-C	0.3649
d-C／F-C	0.3097
e-C／F-C	0.5484
g-d／F-C	1.2194
g-F／F-C	0.5291
h-g／F-C	0.4344
i-g／F-C	1.1669
C'-t／F'-C'	0.9424
e-C'／F'-C'	0.4957
F'-e／F'-C'	0.5043
i-F'／F'-C'	1.6306

Deviation of relative partial disp.	
ΔPdC	0.0007
ΔPgF	0.0027

Internal CC (80%/5%)
302/269
Color Code (80%/5%)
305/270

CCI	
B	0.00
G	0.02
R	0.00

Thermal properties	
CTE(-30,70) [1E-7/℃]	89
CTE(100,300) [1E-7/℃]	97
Tg [℃]	468
At [℃]	559
StP [℃]	422
AP [℃]	472
SP [℃]	677
Ht cndct. [W/m･K]	1.030
Sp. heat [kJ/kg･K]	0.795
Ht diffus. [1E-6 m2/sec]	0.532

Chemical properties [class]	
Acid res. (surface)	2
Alkaline detergent res.	3
Climate resistance	2
Water res. (powder)	4
Acid res. (powder)	5

Mechanical properties	
Knoop hardness	432 (4)
Abrasion hardness	126
Young's mod. [GPa]	60.1
Shear mod. [GPa]	24.3
Poisson's ratio	0.235
Stress optical coef. [1E-5 nm/cm／Pa]	2.97

Internal trans. (10mm)	
λ [nm]	τ
280	0.24
290	0.53
300	0.77
310	0.900
320	0.955
330	0.978
340	0.988
350	0.994
360	0.996
370	0.996
380	0.996
390	0.998
400	0.999
420	0.998
440	0.997
460	0.998
480	0.998
500	0.998
550	0.998
600	0.998
650	0.997
700	0.998
800	0.999
900	0.999
1000	0.999
1200	0.999
1400	0.969
1600	0.987
1800	0.980
2000	0.968
2200	0.82
2400	0.80

Specific gravity
2.45

Relative Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90 (ref.)	-1.3	-1.3	-1.2	-1.1	-1.1	-1.0	-1.0	-1.0	-0.9	-0.8	-0.6	-0.6	-0.4	-0.2	-0.1
60 to 80 (ref.)	-1.4	-1.4	-1.3	-1.3	-1.2	-1.2	-1.1	-1.1	-1.1	-1.0	-0.8	-0.8	-0.6	-0.4	-0.2
40 to 60	-1.6	-1.6	-1.5	-1.4	-1.4	-1.3	-1.3	-1.3	-1.2	-1.2	-1.0	-1.0	-0.8	-0.6	-0.4
20 to 40	-1.7	-1.7	-1.6	-1.6	-1.5	-1.5	-1.5	-1.5	-1.4	-1.3	-1.2	-1.1	-0.9	-0.8	-0.6
0 to 20	-1.8	-1.8	-1.8	-1.7	-1.7	-1.6	-1.6	-1.6	-1.5	-1.4	-1.3	-1.3	-1.1	-0.9	-0.8
-20 to 0	-1.9	-1.9	-1.8	-1.8	-1.7	-1.7	-1.7	-1.7	-1.6	-1.5	-1.4	-1.3	-1.2	-1.0	-0.9
-40 to -20	-1.9	-1.9	-1.8	-1.8	-1.7	-1.7	-1.7	-1.7	-1.6	-1.5	-1.4	-1.4	-1.2	-1.0	-0.9
-60 to -40 (ref.)	-1.8	-1.8	-1.8	-1.7	-1.7	-1.6	-1.6	-1.6	-1.5	-1.5	-1.3	-1.3	-1.1	-1.0	-0.9
-70 to -60 (ref.)	-1.7	-1.7	-1.6	-1.6	-1.5	-1.5	-1.5	-1.5	-1.4	-1.4	-1.2	-1.2	-1.0	-0.9	-0.8

Absolute Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90	-2.2	-2.2	-2.1	-2.0	-2.0	-1.9	-1.9	-1.9	-1.8	-1.7	-1.6	-1.6	-1.4	-1.2	-1.0
60 to 80	-2.4	-2.4	-2.3	-2.3	-2.2	-2.2	-2.2	-2.1	-2.1	-2.0	-1.8	-1.8	-1.6	-1.4	-1.3
40 to 60	-2.7	-2.7	-2.6	-2.6	-2.5	-2.5	-2.5	-2.4	-2.4	-2.3	-2.1	-2.1	-1.9	-1.7	-1.6
20 to 40	-3.0	-3.0	-2.9	-2.9	-2.8	-2.8	-2.8	-2.8	-2.7	-2.6	-2.5	-2.4	-2.3	-2.1	-2.0
0 to 20	-3.3	-3.3	-3.2	-3.2	-3.1	-3.1	-3.1	-3.1	-3.0	-2.9	-2.8	-2.8	-2.6	-2.4	-2.3
-20 to 0	-3.6	-3.6	-3.5	-3.5	-3.4	-3.4	-3.4	-3.4	-3.3	-3.3	-3.1	-3.1	-2.9	-2.8	-2.7
-40 to -20	-3.9	-3.9	-3.8	-3.8	-3.8	-3.7	-3.7	-3.7	-3.6	-3.6	-3.4	-3.4	-3.3	-3.1	-3.0
-60 to -40	-4.2	-4.2	-4.1	-4.1	-4.1	-4.0	-4.0	-4.0	-3.9	-3.9	-3.8	-3.7	-3.6	-3.4	-3.3
-70 to -60	-4.4	-4.4	-4.4	-4.3	-4.3	-4.3	-4.2	-4.2	-4.2	-4.1	-4.0	-4.0	-3.9	-3.7	-3.6

Coef. disp. form. (frac. eq.)(ref.)	
P1	1.29676653E-01
Q1	8.17573782E+01
P2	2.84127590E-02
Q2	1.70456177E-02
P3	2.55329066E-01
Q3	4.25672246E-03

Fitting error of disp. form. σ [1E-6]		
	Visible	Infrared
Power ser. eq.	0.3	6.1
Frac. eq. (ref.)	0.3	6.7

Prod. Freq. (A to D)	A

Similar glass type			
OHARA	S-FSL5	HOYA	FC5
CDGM	H-QK3L	SCHOTT	N-FK5

2022-7-1	StP, AP, SP
2019-4-1	Transmittance
2015-4-1	Color Code

J-FK01A

n_d = 1.497000 n_e = 1.498453

ν_d = 81.65 ν_e = 81.25

Glass code (d)
497817
Glass code (e)
498813

Spectral l.	Refractive idx
2.058	1.48179
1.970	1.48255
1.530	1.48604
1.129	1.48909
1.064	1.48964
t	1.49009
s	1.49183
A'	1.493004
r	1.494075
C	1.495139
C'	1.495435
He-Ne	1.495712
D	1.496946
d	1.497000
e	1.498453
F	1.501226
F'	1.501570
g	1.504496
h	1.507188
0.389	1.508820
i	1.511729

Coef. disp. form. (pwr ser.)	
A0	2.21785004E+00
A1	-5.52619544E-03
A2	-4.04219098E-05
A3	8.39820345E-03
A4	8.80190880E-05
A5	1.15723877E-07
A6	5.38178618E-08
A7	0.00000000E+00
A8	0.00000000E+00

Partial dispersion	
F-C	0.006087
F'-C'	0.006135
C-t	0.005046
C-A'	0.002135
d-C	0.001861
e-C	0.003314
g-d	0.007496
g-F	0.003270
h-g	0.002692
i-g	0.007233
C'-t	0.005342
e-C'	0.003018
F'-e	0.003117
i-F'	0.010159

Relative partial dispersion	
C-t／F-C	0.8290
C-A'／F-C	0.3507
d-C／F-C	0.3057
e-C／F-C	0.5444
g-d／F-C	1.2315
g-F／F-C	0.5372
h-g／F-C	0.4423
i-g／F-C	1.1883
C'-t／F'-C'	0.8707
e-C'／F'-C'	0.4919
F'-e／F'-C'	0.5081
i-F'／F'-C'	1.6559

Deviation of relative partial disp.	
ΔPdC	-0.0083
ΔPgF	0.0298

Internal CC (80%/5%)
330/282
Color Code (80%/5%)
335/285

CCI	
B	0.00
G	0.11
R	0.04

Thermal properties	
CTE(-30,70) [1E-7/℃]	120
CTE(100,300) [1E-7/℃]	146
Tg [℃]	459
At [℃]	490
StP [℃]	415
AP [℃]	446
SP [℃]	542
Ht cndct. [W/m･K]	0.770
Sp. heat [kJ/kg･K]	0.658
Ht diffus. [1E-6 m2/sec]	0.322

Chemical properties [class]	
Acid res. (surface)	5
Alkaline detergent res.	4
Climate resistance	1
Water res. (powder)	1
Acid res. (powder)	3

Mechanical properties	
Knoop hardness	344 (3)
Abrasion hardness	447
Young's mod. [GPa]	71.6
Shear mod. [GPa]	27.6
Poisson's ratio	0.297
Stress optical coef. [1E-5 nm/cm／Pa]	0.81

Internal trans. (10mm)	
λ [nm]	τ
280	0.04
290	0.11
300	0.24
310	0.44
320	0.65
330	0.80
340	0.902
350	0.953
360	0.978
370	0.990
380	0.995
390	0.997
400	0.997
420	0.996
440	0.996
460	0.997
480	0.998
500	0.999
550	0.999
600	0.998
650	0.997
700	0.999
800	0.999
900	0.999
1000	0.999
1200	0.999
1400	0.999
1600	0.998
1800	0.999
2000	0.999
2200	0.999
2400	0.998

Specific gravity
3.65

Relative Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90 (ref.)	-6.4	-6.4	-6.4	-6.3	-6.2	-6.2	-6.2	-6.1	-6.1	-6.0	-5.8	-5.8	-5.7	-5.5	-5.4
60 to 80 (ref.)	-6.3	-6.3	-6.2	-6.1	-6.1	-6.0	-6.0	-6.0	-5.9	-5.9	-5.7	-5.7	-5.5	-5.3	-5.3
40 to 60	-6.1	-6.0	-5.9	-5.9	-5.8	-5.8	-5.8	-5.8	-5.7	-5.6	-5.5	-5.5	-5.3	-5.1	-5.0
20 to 40	-5.8	-5.8	-5.7	-5.6	-5.6	-5.6	-5.5	-5.5	-5.5	-5.4	-5.3	-5.2	-5.1	-4.9	-4.8
0 to 20	-5.5	-5.5	-5.4	-5.4	-5.3	-5.3	-5.3	-5.2	-5.2	-5.1	-5.0	-5.0	-4.8	-4.6	-4.5
-20 to 0	-5.2	-5.1	-5.1	-5.0	-5.0	-4.9	-4.9	-4.9	-4.9	-4.8	-4.7	-4.6	-4.5	-4.3	-4.2
-40 to -20	-4.8	-4.8	-4.7	-4.6	-4.6	-4.6	-4.5	-4.5	-4.5	-4.4	-4.3	-4.3	-4.1	-3.9	-3.9
-60 to -40 (ref.)	-4.3	-4.3	-4.2	-4.2	-4.1	-4.1	-4.1	-4.1	-4.0	-3.9	-3.8	-3.8	-3.6	-3.5	-3.4
-70 to -60 (ref.)	-3.9	-3.8	-3.8	-3.7	-3.7	-3.7	-3.6	-3.6	-3.6	-3.5	-3.4	-3.4	-3.2	-3.1	-3.0

Absolute Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90	-7.4	-7.3	-7.3	-7.2	-7.1	-7.1	-7.1	-7.1	-7.0	-6.9	-6.8	-6.8	-6.6	-6.4	-6.4
60 to 80	-7.3	-7.3	-7.2	-7.1	-7.1	-7.0	-7.0	-7.0	-6.9	-6.9	-6.7	-6.7	-6.6	-6.4	-6.3
40 to 60	-7.2	-7.2	-7.1	-7.0	-7.0	-6.9	-6.9	-6.9	-6.9	-6.8	-6.7	-6.6	-6.5	-6.3	-6.2
20 to 40	-7.1	-7.1	-7.0	-6.9	-6.9	-6.9	-6.8	-6.8	-6.8	-6.7	-6.6	-6.6	-6.4	-6.2	-6.2
0 to 20	-7.0	-7.0	-6.9	-6.8	-6.8	-6.8	-6.7	-6.7	-6.7	-6.6	-6.5	-6.5	-6.3	-6.2	-6.1
-20 to 0	-6.9	-6.9	-6.8	-6.7	-6.7	-6.7	-6.7	-6.6	-6.6	-6.5	-6.4	-6.4	-6.2	-6.1	-6.0
-40 to -20	-6.8	-6.8	-6.7	-6.7	-6.6	-6.6	-6.6	-6.6	-6.5	-6.5	-6.3	-6.3	-6.2	-6.0	-5.9
-60 to -40	-6.7	-6.7	-6.6	-6.6	-6.5	-6.5	-6.5	-6.5	-6.4	-6.4	-6.3	-6.2	-6.1	-6.0	-5.9
-70 to -60	-6.6	-6.6	-6.5	-6.5	-6.5	-6.4	-6.4	-6.4	-6.4	-6.3	-6.2	-6.2	-6.0	-5.9	-5.8

Coef. disp. form. (frac. eq.)(ref.)	
P1	1.06331633E-01
Q1	1.14369714E+02
P2	8.31447076E-02
Q2	1.07948356E-02
P3	2.05591597E-01
Q3	2.53871701E-03

Fitting error of disp. form. σ [1E-6]		
	Visible	Infrared
Power ser. eq.	0.4	7.2
Frac. eq. (ref.)	0.4	7.0

Prod. Freq. (A to D)	A

Similar glass type			
OHARA	S-FPL51	HOYA	FCD1
CDGM	H-FK61	SCHOTT	N-PK52A

2022-7-1	StP, AP, SP
2019-4-1	Transmittance
2017-4-1	1st edition

HIKARI GLASS CO., LTD.

J-FKH1

n_d = 1.497820 n_e = 1.499259

ν_d = 82.57 ν_e = 82.14

Glass code (d)
498826
Glass code (e)
499821

Spectral l.	Refractive idx
2.058	1.48334
1.970	1.48404
1.530	1.48723
1.129	1.49009
1.064	1.49062
t	1.49105
s	1.49273
A'	1.493880
r	1.494932
C	1.495980
C'	1.496273
He-Ne	1.496547
D	1.497766
d	1.497820
e	1.499259
F	1.502009
F'	1.502351
g	1.505256
h	1.507932
0.389	1.509554
i	1.512445

Coef. disp. form. (pwr ser.)	
A0	2.22016073E+00
A1	-5.00725473E-03
A2	-3.55507111E-05
A3	8.42088796E-03
A4	7.02327459E-05
A5	2.47007900E-06
A6	-6.50002003E-08
A7	0.00000000E+00
A8	0.00000000E+00

Partial dispersion	
F-C	0.006029
F'-C'	0.006078
C-t	0.004929
C-A'	0.002100
d-C	0.001840
e-C	0.003279
g-d	0.007436
g-F	0.003247
h-g	0.002676
i-g	0.007189
C'-t	0.005222
e-C'	0.002986
F'-e	0.003092
i-F'	0.010094

Relative partial dispersion	
C-t／F-C	0.8175
C-A'／F-C	0.3483
d-C／F-C	0.3052
e-C／F-C	0.5439
g-d／F-C	1.2334
g-F／F-C	0.5386
h-g／F-C	0.4439
i-g／F-C	1.1924
C'-t／F'-C'	0.8592
e-C'／F'-C'	0.4913
F'-e／F'-C'	0.5087
i-F'／F'-C'	1.6607

Deviation of relative partial disp.	
ΔPdC	-0.0093
ΔPgF	0.0327

Internal CC (80%/5%)
328/270
Color Code (80%/5%)
335/270
CCI

B	0.00
G	0.11
R	0.08

Thermal properties	
CTE(-30,70) [1E-7/℃]	129
CTE(100,300) [1E-7/℃]	152
Tg [℃]	479
At [℃]	510
StP [℃]	434
AP [℃]	464
SP [℃]	561
Ht cndct. [W/m･K]	0.832
Sp. heat [kJ/kg･K]	0.596
Ht diffus. [1E-6 m2/sec]	0.361

Chemical properties [class]	
Acid res. (surface)	6
Alkaline detergent res.	4
Climate resistance	1
Water res. (powder)	2
Acid res. (powder)	3

Mechanical properties	
Knoop hardness	391 (4)
Abrasion hardness	449
Young's mod. [GPa]	77.4
Shear mod. [GPa]	29.7
Poisson's ratio	0.302
Stress optical coef. [1E-5 nm/cm／Pa]	0.69

Internal trans. (10mm)	
λ [nm]	τ
280	0.10
290	0.18
300	0.33
310	0.51
320	0.69
330	0.82
340	0.912
350	0.962
360	0.977
370	0.988
380	0.994
390	0.995
400	0.996
420	0.995
440	0.995
460	0.996
480	0.997
500	0.998
550	0.998
600	0.998
650	0.998
700	0.997
800	0.995
900	0.993
1000	0.995
1200	0.998
1400	0.999
1600	0.995
1800	0.991
2000	0.994
2200	0.988
2400	0.984

Specific gravity
3.86

Relative Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90 (ref.)	-7.1	-7.1	-7.1	-7.0	-6.9	-6.8	-6.8	-6.8	-6.7	-6.6	-6.4	-6.4	-6.2	-6.1	-6.0
60 to 80 (ref.)	-7.0	-6.9	-6.8	-6.8	-6.8	-6.7	-6.7	-6.7	-6.6	-6.5	-6.3	-6.3	-6.1	-6.0	-5.8
40 to 60	-6.7	-6.7	-6.6	-6.6	-6.5	-6.5	-6.5	-6.5	-6.4	-6.3	-6.1	-6.1	-5.9	-5.8	-5.7
20 to 40	-6.5	-6.5	-6.4	-6.4	-6.3	-6.3	-6.2	-6.2	-6.2	-6.1	-5.9	-5.9	-5.7	-5.6	-5.5
0 to 20	-6.2	-6.2	-6.1	-6.1	-6.0	-6.0	-6.0	-6.0	-5.9	-5.8	-5.7	-5.6	-5.5	-5.3	-5.2
-20 to 0	-5.8	-5.8	-5.8	-5.8	-5.7	-5.7	-5.7	-5.7	-5.6	-5.5	-5.4	-5.3	-5.2	-5.1	-5.0
-40 to -20	-5.4	-5.4	-5.4	-5.4	-5.3	-5.3	-5.3	-5.3	-5.2	-5.1	-5.0	-5.0	-4.8	-4.7	-4.6
-60 to -40 (ref.)	-4.9	-4.9	-4.9	-4.9	-4.9	-4.8	-4.8	-4.8	-4.8	-4.7	-4.6	-4.5	-4.4	-4.3	-4.2
-70 to -60 (ref.)	-4.5	-4.5	-4.5	-4.5	-4.5	-4.4	-4.4	-4.4	-4.4	-4.3	-4.2	-4.1	-4.0	-3.9	-3.8

Absolute Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90	-8.1	-8.0	-7.9	-7.9	-7.8	-7.8	-7.7	-7.7	-7.6	-7.5	-7.4	-7.3	-7.2	-7.0	-6.9
60 to 80	-8.0	-8.0	-7.9	-7.8	-7.8	-7.7	-7.7	-7.7	-7.6	-7.5	-7.3	-7.3	-7.2	-7.0	-6.9
40 to 60	-7.9	-7.8	-7.8	-7.7	-7.7	-7.6	-7.6	-7.6	-7.5	-7.4	-7.3	-7.3	-7.1	-7.0	-6.9
20 to 40	-7.8	-7.7	-7.7	-7.6	-7.6	-7.6	-7.5	-7.5	-7.5	-7.4	-7.2	-7.2	-7.1	-6.9	-6.8
0 to 20	-7.7	-7.6	-7.6	-7.6	-7.5	-7.5	-7.5	-7.5	-7.4	-7.3	-7.2	-7.2	-7.0	-6.9	-6.8
-20 to 0	-7.5	-7.5	-7.5	-7.5	-7.4	-7.4	-7.4	-7.4	-7.3	-7.3	-7.1	-7.1	-7.0	-6.8	-6.7
-40 to -20	-7.4	-7.4	-7.4	-7.4	-7.4	-7.3	-7.3	-7.3	-7.3	-7.2	-7.1	-7.0	-6.9	-6.8	-6.7
-60 to -40	-7.3	-7.3	-7.3	-7.3	-7.3	-7.3	-7.2	-7.2	-7.2	-7.1	-7.0	-7.0	-6.9	-6.8	-6.7
-70 to -60	-7.2	-7.2	-7.2	-7.2	-7.2	-7.2	-7.2	-7.2	-7.1	-7.1	-7.0	-7.0	-6.8	-6.7	-6.6

Coef. disp. form. (frac. eq.)(ref.)	
P1	1.22682060E-01
Q1	1.44413557E+02
P2	9.76901834E-02
Q2	1.01538863E-02
P3	1.91449766E-01
Q3	2.19355503E-03

Fitting error of disp. form. σ [1E-6]		
	Visible	Infrared
Power ser. eq.	0.4	9.1
Frac. eq. (ref.)	0.9	8.7

Prod. Freq. (A to D)	A

Similar glass type			
OHARA	-	HOYA	-
CDGM	-	SCHOTT	-

2022-7-1	StP, AP, SP
2019-4-1	Transmittance
2018-4-1	Abrasion hardness

HIKARI GLASS CO., LTD.

J-FKH2

n_d = 1.456000 n_e = 1.457192

ν_d = 91.36 ν_e = 90.97

Glass code (d)
456914
Glass code (e)
457910

Spectral l.	Refractive idx
2.058	1.44327
1.970	1.44391
1.530	1.44685
1.129	1.44943
1.064	1.44990
t	1.45028
s	1.45173
A'	1.452705
r	1.453592
C	1.454469
C'	1.454714
He-Ne	1.454942
D	1.455955
d	1.456000
e	1.457192
F	1.459460
F'	1.459740
g	1.462126
h	1.464317
0.389	1.465643
i	1.468003

Coef. disp. form. (pwr ser.)	
A0	2.10149795E+00
A1	-4.68337833E-03
A2	-1.34642385E-05
A3	6.77542246E-03
A4	4.53499889E-05
A5	2.24209054E-06
A6	-6.21790903E-08
A7	0.00000000E+00
A8	0.00000000E+00

Partial dispersion	
F-C	0.004991
F'-C'	0.005026
C-t	0.004192
C-A'	0.001764
d-C	0.001531
e-C	0.002723
g-d	0.006126
g-F	0.002666
h-g	0.002191
i-g	0.005877
C'-t	0.004437
e-C'	0.002478
F'-e	0.002548
i-F'	0.008263

Relative partial dispersion	
C-t／F-C	0.8399
C-A'／F-C	0.3534
d-C／F-C	0.3068
e-C／F-C	0.5456
g-d／F-C	1.2274
g-F／F-C	0.5342
h-g／F-C	0.4390
i-g／F-C	1.1775
C'-t／F'-C'	0.8828
e-C'／F'-C'	0.4930
F'-e／F'-C'	0.5070
i-F'／F'-C'	1.6441

Deviation of relative partial disp.	
ΔPdC	-0.0117
ΔPgF	0.0431

Internal CC (80%/5%)
341/299
Color Code (80%/5%)
345/300
CCI

B	0.00
G	0.19
R	0.13

Thermal properties	
CTE(-30,70) [1E-7/℃]	134
CTE(100,300) [1E-7/℃]	160
Tg [℃]	454
At [℃]	482
StP [℃]	410
AP [℃]	437
SP [℃]	530
Ht cndct. [W/m·K]	0.868
Sp. heat [kJ/kg·K]	0.684
Ht diffus. [1E-6 m2/sec]	0.345

Chemical properties [class]	
Acid res. (surface)	7
Alkaline detergent res.	4
Climate resistance	1
Water res. (powder)	1
Acid res. (powder)	3

Mechanical properties	
Knoop hardness	335 (3)
Abrasion hardness	404
Young's mod. [GPa]	71.4
Shear mod. [GPa]	27.3
Poisson's ratio	0.305
Stress optical coef. [1E-5 nm/cm／Pa]	0.82

Internal trans. (10mm)	
λ [nm]	τ
280	-
290	-
300	0.06
310	0.18
320	0.39
330	0.61
340	0.79
350	0.89
360	0.949
370	0.976
380	0.988
390	0.993
400	0.995
420	0.994
440	0.994
460	0.996
480	0.996
500	0.998
550	0.999
600	0.998
650	0.997
700	0.998
800	0.996
900	0.994
1000	0.994
1200	0.995
1400	0.994
1600	0.994
1800	0.991
2000	0.995
2200	0.994
2400	0.998

Specific gravity
3.67

Relative Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90 (ref.)	-6.9	-6.9	-6.9	-6.8	-6.8	-6.7	-6.7	-6.7	-6.6	-6.5	-6.4	-6.4	-6.3	-6.1	-6.0
60 to 80 (ref.)	-6.8	-6.7	-6.7	-6.6	-6.6	-6.5	-6.5	-6.5	-6.5	-6.4	-6.3	-6.3	-6.1	-6.0	-5.9
40 to 60	-6.5	-6.5	-6.5	-6.4	-6.4	-6.3	-6.3	-6.3	-6.2	-6.2	-6.1	-6.0	-5.9	-5.8	-5.7
20 to 40	-6.3	-6.3	-6.2	-6.2	-6.1	-6.1	-6.1	-6.0	-6.0	-5.9	-5.8	-5.8	-5.7	-5.5	-5.4
0 to 20	-6.0	-6.0	-5.9	-5.9	-5.8	-5.8	-5.8	-5.8	-5.7	-5.7	-5.5	-5.5	-5.4	-5.3	-5.2
-20 to 0	-5.6	-5.6	-5.6	-5.5	-5.5	-5.5	-5.4	-5.4	-5.4	-5.3	-5.2	-5.2	-5.1	-4.9	-4.9
-40 to -20	-5.2	-5.2	-5.2	-5.1	-5.1	-5.1	-5.1	-5.0	-5.0	-4.9	-4.8	-4.8	-4.7	-4.6	-4.5
-60 to -40 (ref.)	-4.8	-4.7	-4.7	-4.7	-4.6	-4.6	-4.6	-4.6	-4.5	-4.5	-4.4	-4.4	-4.2	-4.1	-4.0
-70 to -60 (ref.)	-4.3	-4.3	-4.3	-4.2	-4.2	-4.2	-4.2	-4.2	-4.1	-4.1	-3.9	-3.9	-3.8	-3.7	-3.6

Absolute Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90	-7.8	-7.8	-7.7	-7.7	-7.7	-7.6	-7.6	-7.6	-7.5	-7.5	-7.3	-7.3	-7.2	-7.0	-7.0
60 to 80	-7.7	-7.7	-7.7	-7.6	-7.6	-7.5	-7.5	-7.5	-7.5	-7.4	-7.3	-7.3	-7.1	-7.0	-6.9
40 to 60	-7.6	-7.6	-7.6	-7.5	-7.5	-7.4	-7.4	-7.4	-7.4	-7.3	-7.2	-7.2	-7.0	-6.9	-6.8
20 to 40	-7.5	-7.5	-7.5	-7.4	-7.4	-7.3	-7.3	-7.3	-7.3	-7.2	-7.1	-7.1	-7.0	-6.8	-6.7
0 to 20	-7.4	-7.4	-7.3	-7.3	-7.3	-7.2	-7.2	-7.2	-7.2	-7.1	-7.0	-7.0	-6.9	-6.8	-6.7
-20 to 0	-7.3	-7.3	-7.2	-7.2	-7.2	-7.1	-7.1	-7.1	-7.1	-7.0	-6.9	-6.9	-6.8	-6.7	-6.6
-40 to -20	-7.2	-7.2	-7.1	-7.1	-7.1	-7.0	-7.0	-7.0	-7.0	-6.9	-6.8	-6.8	-6.7	-6.6	-6.5
-60 to -40	-7.1	-7.1	-7.0	-7.0	-7.0	-6.9	-6.9	-6.9	-6.9	-6.8	-6.7	-6.7	-6.6	-6.5	-6.4
-70 to -60	-7.0	-7.0	-7.0	-6.9	-6.9	-6.9	-6.9	-6.9	-6.8	-6.8	-6.7	-6.7	-6.6	-6.5	-6.4

Coef. disp. form. (frac. eq.)(ref.)	
P1	-
Q1	-
P2	-
Q2	-
P3	-
Q3	-

Fitting error of disp. form. σ [1E-6]		
	Visible	Infrared
Power ser. eq.	0.3	3.8
Frac. eq. (ref.)	-	-

Prod. Freq. (A to D)	B

Similar glass type			
OHARA	-	HOYA	-
CDGM	-	SCHOTT	N-FK58

2023-9-1	Prod. Freq.
2022-7-1	StP, AP, SP
2019-4-1	Transmittance

J-PKH1

n_d = 1.518600 n_e = 1.520372

ν_d = 69.89 ν_e = 69.67

Glass code (d)
519699
Glass code (e)
520697

Spectral l.	Refractive idx
2.058	1.49701
1.970	1.49826
1.530	1.50384
1.129	1.50840
1.064	1.50918
t	1.50980
s	1.51212
A'	1.513636
r	1.514988
C	1.516311
C'	1.516678
He-Ne	1.517020
D	1.518533
d	1.518600
e	1.520372
F	1.523731
F'	1.524147
g	1.527677
h	1.530922
0.389	1.532889
i	1.536397

Coef. disp. form. (pwr ser.)	
A0	2.27892705E+00
A1	-9.04327622E-03
A2	-1.10679206E-04
A3	1.01870033E-02
A4	9.31149884E-05
A5	2.72256540E-06
A6	-1.82952398E-08
A7	0.00000000E+00
A8	0.00000000E+00

Partial dispersion	
F-C	0.007420
F'-C'	0.007469
C-t	0.006510
C-A'	0.002675
d-C	0.002289
e-C	0.004061
g-d	0.009077
g-F	0.003946
h-g	0.003245
i-g	0.008720
C'-t	0.006877
e-C'	0.003694
F'-e	0.003775
i-F'	0.012250

Relative partial dispersion	
C-t／F-C	0.8774
C-A'／F-C	0.3605
d-C／F-C	0.3085
e-C／F-C	0.5473
g-d／F-C	1.2233
g-F／F-C	0.5318
h-g／F-C	0.4373
i-g／F-C	1.1752
C'-t／F'-C'	0.9207
e-C'／F'-C'	0.4946
F'-e／F'-C'	0.5054
i-F'／F'-C'	1.6401

Deviation of relative partial disp.	
ΔPdC	-0.0003
ΔPgF	0.0047

Internal CC (80%/5%)
315/273
Color Code (80%/5%)
320/275

CCI	
B	0.00
G	0.20
R	0.22

Thermal properties	
CTE(-30,70) [1E-7/℃]	63
CTE(100,300) [1E-7/℃]	75
Tg [℃]	572
At [℃]	612
StP [℃]	515
AP [℃]	553
SP [℃]	696
Ht cndct. [W/m･K]	0.860
Sp. heat [kJ/kg･K]	0.777
Ht diffus. [1E-6 m2/sec]	0.425

Chemical properties [class]	
Acid res. (surface)	1
Alkaline detergent res.	3
Climate resistance	2
Water res. (powder)	1
Acid res. (powder)	1

Mechanical properties	
Knoop hardness	536 (5)
Abrasion hardness	188
Young's mod. [GPa]	73.1
Shear mod. [GPa]	29.8
Poisson's ratio	0.224
Stress optical coef. [1E-5 nm/cm／Pa]	2.78

Internal trans. (10mm)	
λ [nm]	τ
280	0.12
290	0.31
300	0.54
310	0.73
320	0.86
330	0.925
340	0.960
350	0.976
360	0.983
370	0.988
380	0.991
390	0.994
400	0.995
420	0.995
440	0.994
460	0.995
480	0.995
500	0.996
550	0.999
600	0.999
650	0.999
700	0.998
800	0.997
900	0.996
1000	0.996
1200	0.996
1400	0.992
1600	0.963
1800	0.904
2000	0.84
2200	0.70
2400	0.64

Specific gravity
2.6

Relative Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90 (ref.)	3.6	3.6	3.7	3.8	3.9	4.0	4.0	4.0	4.1	4.2	4.4	4.5	4.7	5.0	5.1
60 to 80 (ref.)	3.5	3.5	3.6	3.7	3.8	3.8	3.8	3.9	3.9	4.1	4.3	4.3	4.6	4.8	4.9
40 to 60	3.3	3.4	3.5	3.5	3.6	3.7	3.7	3.7	3.8	3.9	4.1	4.1	4.4	4.6	4.8
20 to 40	3.2	3.2	3.3	3.4	3.5	3.5	3.5	3.6	3.6	3.7	4.0	4.0	4.2	4.5	4.6
0 to 20	3.1	3.2	3.2	3.3	3.4	3.4	3.4	3.5	3.5	3.6	3.9	3.9	4.1	4.4	4.5
-20 to 0	3.1	3.1	3.2	3.3	3.3	3.4	3.4	3.4	3.5	3.6	3.8	3.8	4.1	4.3	4.4
-40 to -20	3.1	3.1	3.2	3.3	3.3	3.4	3.4	3.4	3.5	3.6	3.8	3.8	4.1	4.3	4.4
-60 to -40 (ref.)	3.2	3.2	3.3	3.4	3.4	3.5	3.5	3.5	3.6	3.7	3.9	3.9	4.1	4.4	4.5
-70 to -60 (ref.)	3.4	3.4	3.5	3.5	3.6	3.6	3.6	3.7	3.7	3.8	4.0	4.0	4.3	4.5	4.6

Absolute Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90	2.7	2.7	2.8	2.9	2.9	3.0	3.0	3.0	3.1	3.2	3.5	3.5	3.8	4.0	4.1
60 to 80	2.5	2.5	2.6	2.7	2.7	2.8	2.8	2.8	2.9	3.0	3.2	3.3	3.5	3.8	3.9
40 to 60	2.2	2.2	2.3	2.4	2.4	2.5	2.5	2.5	2.6	2.7	2.9	3.0	3.2	3.4	3.6
20 to 40	1.9	1.9	2.0	2.1	2.1	2.2	2.2	2.2	2.3	2.4	2.6	2.7	2.9	3.1	3.2
0 to 20	1.6	1.7	1.7	1.8	1.9	1.9	1.9	1.9	2.0	2.1	2.3	2.3	2.6	2.8	2.9
-20 to 0	1.4	1.4	1.5	1.5	1.6	1.6	1.6	1.7	1.7	1.8	2.0	2.0	2.3	2.5	2.6
-40 to -20	1.1	1.1	1.2	1.2	1.3	1.3	1.3	1.4	1.4	1.5	1.7	1.7	2.0	2.2	2.3
-60 to -40	0.8	0.8	0.9	0.9	1.0	1.0	1.1	1.1	1.1	1.2	1.4	1.4	1.6	1.8	1.9
-70 to -60	0.6	0.6	0.7	0.7	0.8	0.8	0.8	0.8	0.9	1.0	1.2	1.2	1.4	1.6	1.7

Coef. disp. form. (frac. eq.)(ref.)	
P1	1.14576746E-01
Q1	7.69727154E+01
P2	1.10968918E-02
Q2	2.34302770E-02
P3	2.87809559E-01
Q3	4.87585612E-03

Fitting error of disp. form. σ [1E-6]		
	Visible	Infrared
Power ser. eq.	0.5	5.2
Frac. eq. (ref.)	0.5	5.2

Prod. Freq. (A to D)	C

Similar glass type			
OHARA	-	HOYA	-
CDGM	-	SCHOTT	-

2022-7-1	StP, AP, SP
2019-4-1	Transmittance
2017-4-1	Prod. Freq.

HIKARI GLASS CO., LTD.

J-PSK02

n_d = 1.618000 n_e = 1.620328

ν_d = 63.34 ν_e = 63.06

Glass code (d)
618633
Glass code (e)
620631

Spectral l.	Refractive idx
2.058	1.59332
1.970	1.59459
1.530	1.60036
1.129	1.60533
1.064	1.60622
t	1.60695
s	1.60973
A'	1.611614
r	1.613326
C	1.615024
C'	1.615498
He-Ne	1.615941
D	1.617913
d	1.618000
e	1.620328
F	1.624781
F'	1.625335
g	1.630061
h	1.634432
0.389	1.637092
i	1.641858

Coef. disp. form. (pwr ser.)	
A0	2.57826227E+00
A1	-9.69723449E-03
A2	-1.07085207E-04
A3	1.43480110E-02
A4	1.59222199E-04
A5	5.33085601E-06
A6	-5.80638431E-08
A7	0.00000000E+00
A8	0.00000000E+00

Partial dispersion	
F-C	0.009757
F'-C'	0.009837
C-t	0.008074
C-A'	0.003410
d-C	0.002976
e-C	0.005304
g-d	0.012061
g-F	0.005280
h-g	0.004371
i-g	0.011797
C'-t	0.008548
e-C'	0.004830
F'-e	0.005007
i-F'	0.016523

Relative partial dispersion	
C-t／F-C	0.8275
C-A'／F-C	0.3495
d-C／F-C	0.3050
e-C／F-C	0.5436
g-d／F-C	1.2361
g-F／F-C	0.5411
h-g／F-C	0.4480
i-g／F-C	1.2091
C'-t／F'-C'	0.8690
e-C'／F'-C'	0.4910
F'-e／F'-C'	0.5090
i-F'／F'-C'	1.6797

Deviation of relative partial disp.	
ΔPdC	-0.0008
ΔPgF	0.0031

Internal CC (80%/5%)
363/317
Color Code (80%/5%)
375/315

CCI	
B	0.00
G	0.51
R	0.46

Thermal properties	
CTE(-30,70) [1E-7/℃]	90
CTE(100,300) [1E-7/℃]	107
Tg [℃]	620
At [℃]	661
StP [℃]	573
AP [℃]	606
SP [℃]	719
Ht cndct. [W/m･K]	0.692
Sp. heat [kJ/kg･K]	0.561
Ht diffus. [1E-6 m2/sec]	0.346

Chemical properties [class]	
Acid res. (surface)	5
Alkaline detergent res.	4
Climate resistance	1
Water res. (powder)	2
Acid res. (powder)	5

Mechanical properties	
Knoop hardness	355 (4)
Abrasion hardness	341
Young's mod. [GPa]	73.3
Shear mod. [GPa]	28.4
Poisson's ratio	0.291
Stress optical coef. [1E-5 nm/cm／Pa]	1.42

Internal trans. (10mm)	
λ [nm]	τ
280	–
290	–
300	–
310	–
320	0.08
330	0.22
340	0.41
350	0.60
360	0.76
370	0.86
380	0.923
390	0.956
400	0.974
420	0.987
440	0.991
460	0.993
480	0.996
500	0.997
550	0.998
600	0.998
650	0.996
700	0.997
800	0.995
900	0.993
1000	0.993
1200	0.994
1400	0.992
1600	0.986
1800	0.973
2000	0.956
2200	0.88
2400	0.77

Specific gravity
3.56

Relative Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90 (ref.)	-2.8	-2.8	-2.7	-2.6	-2.6	-2.5	-2.5	-2.4	-2.3	-2.2	-1.9	-1.9	-1.6	-1.3	-1.1
60 to 80 (ref.)	-2.9	-2.8	-2.7	-2.7	-2.6	-2.5	-2.5	-2.5	-2.4	-2.2	-2.0	-1.9	-1.7	-1.4	-1.2
40 to 60	-2.9	-2.8	-2.8	-2.7	-2.6	-2.5	-2.5	-2.5	-2.4	-2.3	-2.0	-2.0	-1.7	-1.5	-1.3
20 to 40	-2.9	-2.8	-2.7	-2.7	-2.6	-2.6	-2.5	-2.5	-2.4	-2.3	-2.0	-2.0	-1.8	-1.5	-1.3
0 to 20	-2.8	-2.8	-2.7	-2.7	-2.6	-2.5	-2.5	-2.5	-2.4	-2.3	-2.0	-2.0	-1.7	-1.5	-1.3
-20 to 0	-2.7	-2.7	-2.6	-2.6	-2.5	-2.4	-2.4	-2.4	-2.3	-2.2	-2.0	-1.9	-1.7	-1.5	-1.3
-40 to -20	-2.6	-2.5	-2.5	-2.4	-2.4	-2.3	-2.3	-2.3	-2.2	-2.0	-1.8	-1.8	-1.6	-1.3	-1.2
-60 to -40 (ref.)	-2.3	-2.3	-2.2	-2.2	-2.1	-2.1	-2.0	-2.0	-1.9	-1.8	-1.6	-1.6	-1.4	-1.1	-1.0
-70 to -60 (ref.)	-2.1	-2.0	-2.0	-1.9	-1.9	-1.8	-1.8	-1.8	-1.7	-1.6	-1.4	-1.3	-1.1	-0.9	-0.7

Absolute Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90	-3.8	-3.8	-3.7	-3.6	-3.6	-3.5	-3.5	-3.4	-3.3	-3.2	-2.9	-2.9	-2.6	-2.3	-2.1
60 to 80	-3.9	-3.9	-3.8	-3.8	-3.7	-3.6	-3.6	-3.6	-3.5	-3.3	-3.1	-3.0	-2.8	-2.5	-2.3
40 to 60	-4.1	-4.1	-4.0	-3.9	-3.9	-3.8	-3.8	-3.7	-3.6	-3.5	-3.3	-3.2	-3.0	-2.7	-2.5
20 to 40	-4.3	-4.2	-4.1	-4.1	-4.0	-4.0	-3.9	-3.9	-3.8	-3.7	-3.5	-3.4	-3.2	-3.0	-2.8
0 to 20	-4.4	-4.4	-4.3	-4.3	-4.2	-4.1	-4.1	-4.1	-4.0	-3.9	-3.7	-3.6	-3.4	-3.2	-3.0
-20 to 0	-4.6	-4.6	-4.5	-4.4	-4.4	-4.3	-4.3	-4.3	-4.2	-4.1	-3.9	-3.8	-3.6	-3.4	-3.2
-40 to -20	-4.7	-4.7	-4.6	-4.6	-4.5	-4.5	-4.5	-4.4	-4.4	-4.3	-4.1	-4.0	-3.8	-3.6	-3.5
-60 to -40	-4.9	-4.9	-4.8	-4.8	-4.7	-4.7	-4.6	-4.6	-4.5	-4.4	-4.2	-4.2	-4.0	-3.8	-3.7
-70 to -60	-5.0	-5.0	-4.9	-4.9	-4.8	-4.8	-4.8	-4.8	-4.7	-4.6	-4.4	-4.4	-4.2	-4.0	-3.8

Coef. disp. form. (frac. eq.)(ref.)	
P1	1.20459741E-01
Q1	8.62206490E+01
P2	4.43027945E-02
Q2	1.76922785E-02
P3	3.00450152E-01
Q3	4.19488634E-03

Fitting error of disp. form. σ [1E-6]		
	Visible	Infrared
Power ser. eq.	0.5	3.1
Frac. eq. (ref.)	0.5	3.2

Prod. Freq. (A to D)	A

Similar glass type			
OHARA	S-PHM52、S-PHM52Q	HOYA	PCD4
CDGM	H-ZPK1A	SCHOTT	N-PSK53A

2022-7-1	StP, AP, SP
2020-4-1	Similar glass type
2019-4-1	Transmittance

HIKARI GLASS CO., LTD.

J-PSK03

n_d = 1.603000 n_e = 1.605199

ν_d = 65.44 ν_e = 65.17

Glass code (d)
603654
Glass code (e)
605652

Spectral l.	Refractive idx
2.058	1.57914
1.970	1.58040
1.530	1.58607
1.129	1.59092
1.064	1.59178
t	1.59248
s	1.59515
A'	1.596945
r	1.598572
C	1.600183
C'	1.600633
He-Ne	1.601052
D	1.602918
d	1.603000
e	1.605199
F	1.609398
F'	1.609919
g	1.614364
h	1.618467
0.389	1.620961
i	1.625420

Partial dispersion	
F-C	0.009215
F'-C'	0.009286
C-t	0.007701
C-A'	0.003238
d-C	0.002817
e-C	0.005016
g-d	0.011364
g-F	0.004966
h-g	0.004103
i-g	0.011056
C'-t	0.008151
e-C'	0.004566
F'-e	0.004720
i-F'	0.015501

Relative partial dispersion	
C-t／F-C	0.8357
C-A'／F-C	0.3514
d-C／F-C	0.3057
e-C／F-C	0.5443
g-d／F-C	1.2332
g-F／F-C	0.5389
h-g／F-C	0.4453
i-g／F-C	1.1998
C'-t／F'-C'	0.8778
e-C'／F'-C'	0.4917
F'-e／F'-C'	0.5083
i-F'／F'-C'	1.6693

Deviation of relative partial disp.	
ΔPdC	−0.0010
ΔPgF	0.0043

Internal CC (80%/5%)
334/263
Color Code (80%/5%)
345/265

CCI	
B	0.00
G	0.19
R	0.17

Thermal properties	
CTE(−30,70) [1E-7/℃]	89
CTE(100,300) [1E-7/℃]	103
Tg [℃]	603
At [℃]	639
StP [℃]	551
AP [℃]	586
SP [℃]	701
Ht cndct. [W/m·K]	0.671
Sp. heat [kJ/kg·K]	0.570
Ht diffus. [1E-6 m2/sec]	0.335

Chemical properties [class]	
Acid res. (surface)	4
Alkaline detergent res.	4
Climate resistance	2
Water res. (powder)	1
Acid res. (powder)	5

Mechanical properties	
Knoop hardness	316 (3)
Abrasion hardness	398
Young's mod. [GPa]	70.0
Shear mod. [GPa]	27.2
Poisson's ratio	0.284
Stress optical coef. [1E-5 nm/cm／Pa]	1.40

Internal trans. (10mm)	
λ [nm]	τ
280	0.15
290	0.27
300	0.40
310	0.54
320	0.67
330	0.78
340	0.86
350	0.918
360	0.953
370	0.973
380	0.984
390	0.990
400	0.992
420	0.994
440	0.995
460	0.996
480	0.997
500	0.998
550	0.999
600	0.999
650	0.998
700	0.998
800	0.999
900	0.999
1000	0.999
1200	0.999
1400	0.995
1600	0.988
1800	0.965
2000	0.936
2200	0.85
2400	0.79

Specific gravity
3.52

Coef. disp. form. (pwr ser.)	
A0	2.53267453E+00
A1	−9.50416844E-03
A2	−1.06883723E-04
A3	1.34397360E-02
A4	1.41770605E-04
A5	4.73043880E-06
A6	−8.62000830E-08
A7	0.00000000E+00
A8	0.00000000E+00

Relative Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90 (ref.)	−2.8	−2.8	−2.7	−2.6	−2.5	−2.5	−2.4	−2.4	−2.3	−2.2	−2.0	−2.0	−1.7	−1.4	−1.3
60 to 80 (ref.)	−2.9	−2.9	−2.7	−2.7	−2.6	−2.5	−2.5	−2.5	−2.4	−2.3	−2.1	−2.0	−1.8	−1.5	−1.4
40 to 60	−2.9	−2.9	−2.8	−2.8	−2.7	−2.6	−2.6	−2.6	−2.5	−2.4	−2.2	−2.1	−1.9	−1.7	−1.5
20 to 40	−3.0	−3.0	−2.9	−2.8	−2.7	−2.7	−2.6	−2.6	−2.5	−2.4	−2.2	−2.2	−2.0	−1.8	−1.6
0 to 20	−3.0	−3.0	−2.9	−2.8	−2.7	−2.7	−2.7	−2.6	−2.6	−2.5	−2.3	−2.3	−2.0	−1.8	−1.7
−20 to 0	−2.9	−2.9	−2.8	−2.8	−2.7	−2.6	−2.6	−2.6	−2.5	−2.4	−2.3	−2.2	−2.0	−1.8	−1.7
−40 to −20	−2.8	−2.8	−2.7	−2.7	−2.6	−2.6	−2.5	−2.5	−2.4	−2.4	−2.2	−2.2	−2.0	−1.8	−1.7
−60 to −40 (ref.)	−2.6	−2.6	−2.5	−2.5	−2.4	−2.4	−2.3	−2.3	−2.3	−2.2	−2.0	−2.0	−1.8	−1.6	−1.5
−70 to −60 (ref.)	−2.4	−2.4	−2.3	−2.3	−2.2	−2.1	−2.1	−2.1	−2.0	−2.0	−1.8	−1.8	−1.6	−1.4	−1.3

Absolute Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90	−3.8	−3.8	−3.7	−3.6	−3.5	−3.5	−3.4	−3.4	−3.3	−3.2	−3.0	−3.0	−2.7	−2.5	−2.3
60 to 80	−3.9	−3.9	−3.8	−3.8	−3.7	−3.6	−3.6	−3.6	−3.5	−3.4	−3.2	−3.2	−2.9	−2.7	−2.5
40 to 60	−4.2	−4.1	−4.0	−4.0	−3.9	−3.8	−3.8	−3.8	−3.7	−3.6	−3.4	−3.4	−3.2	−2.9	−2.8
20 to 40	−4.4	−4.3	−4.2	−4.2	−4.1	−4.1	−4.0	−4.0	−3.9	−3.9	−3.7	−3.6	−3.4	−3.2	−3.1
0 to 20	−4.6	−4.5	−4.5	−4.4	−4.3	−4.3	−4.3	−4.2	−4.2	−4.1	−3.9	−3.9	−3.7	−3.5	−3.4
−20 to 0	−4.8	−4.7	−4.7	−4.6	−4.6	−4.5	−4.5	−4.5	−4.4	−4.3	−4.1	−4.1	−3.9	−3.8	−3.6
−40 to −20	−5.0	−4.9	−4.9	−4.8	−4.8	−4.7	−4.7	−4.7	−4.6	−4.5	−4.4	−4.4	−4.2	−4.0	−3.9
−60 to −40	−5.2	−5.1	−5.1	−5.0	−5.0	−4.9	−4.9	−4.9	−4.8	−4.8	−4.6	−4.6	−4.5	−4.3	−4.2
−70 to −60	−5.3	−5.3	−5.2	−5.2	−5.1	−5.1	−5.1	−5.1	−5.0	−5.0	−4.8	−4.8	−4.6	−4.5	−4.4

Coef. disp. form. (frac. eq.)(ref.)	
P1	1.14862526E-01
Q1	8.23972872E+01
P2	6.20276986E-02
Q2	1.47458503E-02
P3	2.76130278E-01
Q3	3.76713473E-03

Fitting error of disp. form. σ [1E-6]		
	Visible	Infrared
Power ser. eq.	0.4	2.8
Frac. eq. (ref.)	0.5	2.6

Prod. Freq. (A to D)	A

Similar glass type			
OHARA	S-PHM53	HOYA	-
CDGM	H-ZPK2A	SCHOTT	-

2022-7-1	StP, AP, SP
2019-4-1	Transmittance
2018-4-1	Transmittance

J-PSKH1

n_d = 1.593190 n_e = 1.595274

ν_d = 67.90 ν_e = 67.54

Glass code (d)
593679
Glass code (e)
595675

Spectral l.	Refractive idx
2.058	1.57343
1.970	1.57433
1.530	1.57847
1.129	1.58228
1.064	1.58299
t	1.58358
s	1.58592
A'	1.587541
r	1.589039
C	1.590540
C'	1.590961
He-Ne	1.591354
D	1.593112
d	1.593190
e	1.595274
F	1.599276
F'	1.599774
g	1.604028
h	1.607963
0.389	1.610358
i	–

Partial dispersion	
F-C	0.008736
F'-C'	0.008813
C-t	0.006956
C-A'	0.002999
d-C	0.002650
e-C	0.004734
g-d	0.010838
g-F	0.004752
h-g	0.003935
i-g	–
C'-t	0.007377
e-C'	0.004313
F'-e	0.004500
i-F'	–

Internal CC (80%/5%)
344/274
Color Code (80%/5%)
355/275

CCI	
B	0.00
G	0.20
R	0.18

Internal trans. (10mm)	
λ [nm]	τ
280	0.06
290	0.10
300	0.18
310	0.29
320	0.45
330	0.61
340	0.76
350	0.86
360	0.927
370	0.962
380	0.980
390	0.989
400	0.992
420	0.994
440	0.994
460	0.995
480	0.996
500	0.998
550	0.999
600	0.998
650	0.998
700	0.997
800	0.996
900	0.996
1000	0.997
1200	0.998
1400	0.999
1600	0.999
1800	0.997
2000	0.993
2200	0.989
2400	0.983

Relative partial dispersion	
C-t／F-C	0.7962
C-A'／F-C	0.3433
d-C／F-C	0.3033
e-C／F-C	0.5419
g-d／F-C	1.2406
g-F／F-C	0.5440
h-g／F-C	0.4504
i-g／F-C	–
C'-t／F'-C'	0.8371
e-C'／F'-C'	0.4894
F'-e／F'-C'	0.5106
i-F'／F'-C'	–

Thermal properties	
CTE(-30,70) [1E-7/℃]	114
CTE(100,300) [1E-7/℃]	132
Tg [℃]	564
At [℃]	591
StP [℃]	516
AP [℃]	545
SP [℃]	639
Ht cndct. [W/m·K]	0.663
Sp. heat [kJ/kg·K]	0.522
Ht diffus. [1E-6 m2/sec]	0.309

Chemical properties [class]	
Acid res. (surface)	3
Alkaline detergent res.	3
Climate resistance	1
Water res. (powder)	1
Acid res. (powder)	1

Coef. disp. form. (pwr ser.)	
A0	2.50208083E+00
A1	-6.72143907E-03
A2	-5.34313751E-05
A3	1.28264400E-02
A4	1.56205388E-04
A5	1.21593549E-06
A6	9.59550869E-08
A7	0.00000000E+00
A8	0.00000000E+00

Deviation of relative partial disp.	
ΔPdC	-0.0045
ΔPgF	0.0135

Mechanical properties	
Knoop hardness	290 (3)
Abrasion hardness	540
Young's mod. [GPa]	76.0
Shear mod. [GPa]	29.3
Poisson's ratio	0.298
Stress optical coef. [1E-5 nm/cm／Pa]	0.60

Specific gravity
4.1

Relative Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90 (ref.)	-6.1	-6.1	-6.0	-5.9	-5.9	-5.8	-5.8	-5.8	-5.7	-5.6	-5.3	-5.3	-5.0	-4.8	-4.6
60 to 80 (ref.)	-6.1	-6.0	-5.9	-5.9	-5.8	-5.8	-5.7	-5.7	-5.6	-5.5	-5.3	-5.3	-5.0	-4.7	-4.5
40 to 60	-6.0	-6.0	-5.9	-5.8	-5.8	-5.7	-5.7	-5.7	-5.6	-5.5	-5.3	-5.2	-5.0	-4.7	-4.5
20 to 40	-5.9	-5.8	-5.8	-5.7	-5.7	-5.6	-5.6	-5.6	-5.5	-5.4	-5.2	-5.1	-4.9	-4.6	-4.4
0 to 20	-5.7	-5.7	-5.6	-5.6	-5.5	-5.5	-5.4	-5.4	-5.3	-5.2	-5.0	-5.0	-4.8	-4.5	-4.3
-20 to 0	-5.5	-5.5	-5.4	-5.4	-5.3	-5.3	-5.3	-5.2	-5.2	-5.1	-4.9	-4.8	-4.6	-4.4	-4.2
-40 to -20	-5.3	-5.3	-5.2	-5.1	-5.1	-5.0	-5.0	-5.0	-4.9	-4.8	-4.6	-4.6	-4.4	-4.1	-4.0
-60 to -40 (ref.)	-4.9	-4.9	-4.9	-4.8	-4.7	-4.7	-4.7	-4.7	-4.6	-4.5	-4.3	-4.3	-4.0	-3.8	-3.7
-70 to -60 (ref.)	-4.6	-4.6	-4.5	-4.5	-4.4	-4.4	-4.3	-4.3	-4.2	-4.2	-4.0	-3.9	-3.7	-3.5	-3.3

Absolute Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90	-7.1	-7.1	-7.0	-6.9	-6.9	-6.8	-6.8	-6.8	-6.7	-6.6	-6.4	-6.3	-6.1	-5.8	-5.6
60 to 80	-7.1	-7.1	-7.0	-7.0	-6.9	-6.8	-6.8	-6.8	-6.7	-6.6	-6.4	-6.4	-6.1	-5.9	-5.7
40 to 60	-7.2	-7.2	-7.1	-7.0	-7.0	-6.9	-6.9	-6.9	-6.8	-6.7	-6.5	-6.5	-6.2	-6.0	-5.8
20 to 40	-7.2	-7.2	-7.1	-7.1	-7.0	-7.0	-7.0	-6.9	-6.9	-6.8	-6.6	-6.6	-6.3	-6.1	-5.9
0 to 20	-7.3	-7.3	-7.2	-7.2	-7.1	-7.0	-7.0	-7.0	-6.9	-6.8	-6.7	-6.6	-6.4	-6.2	-6.0
-20 to 0	-7.4	-7.3	-7.3	-7.2	-7.2	-7.1	-7.1	-7.1	-7.0	-6.9	-6.7	-6.7	-6.5	-6.3	-6.1
-40 to -20	-7.4	-7.4	-7.3	-7.3	-7.2	-7.2	-7.2	-7.2	-7.1	-7.0	-6.8	-6.8	-6.6	-6.4	-6.2
-60 to -40	-7.5	-7.5	-7.4	-7.3	-7.3	-7.3	-7.2	-7.2	-7.2	-7.1	-6.9	-6.9	-6.7	-6.5	-6.3
-70 to -60	-7.5	-7.5	-7.4	-7.4	-7.4	-7.3	-7.3	-7.3	-7.2	-7.1	-7.0	-6.9	-6.8	-6.5	-6.4

Coef. disp. form. (frac. eq.)(ref.)	
P1	1.07864082E-01
Q1	1.08487364E+02
P2	5.74402039E-02
Q2	1.50165453E-02
P3	2.76204496E-01
Q3	3.75883453E-03

Fitting error of disp. form. σ [1E-6]		
	Visible	Infrared
Power ser. eq.	0.4	5.3
Frac. eq. (ref.)	0.4	5.6

Prod. Freq. (A to D)	A

Similar glass type			
OHARA	S-FPM2	HOYA	FCD515
CDGM	H-ZPK5	SCHOTT	–

2022-7-1	StP, AP, SP
2020-4-1	Similar glass type
2019-4-1	Transmittance

HIKARI GLASS CO., LTD.

J-PSKH4

n_d = 1.593490 n_e = 1.595604

ν_d = 67.00 ν_e = 66.76

Glass code (d)
593670
Glass code (e)
596668

Spectral l.	Refractive idx
2.058	1.56926
1.970	1.57059
1.530	1.57659
1.129	1.58162
1.064	1.58249
t	1.58320
s	1.58586
A'	1.587621
r	1.589208
C	1.590771
C'	1.591206
He-Ne	1.591611
D	1.593411
d	1.593490
e	1.595604
F	1.599629
F'	1.600128
g	1.604375
h	1.608288
0.389	1.610663
i	1.614907

Partial dispersion	
F-C	0.008858
F'-C'	0.008922
C-t	0.007571
C-A'	0.003150
d-C	0.002719
e-C	0.004833
g-d	0.010885
g-F	0.004746
h-g	0.003913
i-g	0.010532
C'-t	0.008006
e-C'	0.004398
F'-e	0.004524
i-F'	0.014779

Relative partial dispersion	
C-t／F-C	0.8547
C-A'／F-C	0.3556
d-C／F-C	0.3070
e-C／F-C	0.5456
g-d／F-C	1.2288
g-F／F-C	0.5358
h-g／F-C	0.4417
i-g／F-C	1.1890
C'-t／F'-C'	0.8973
e-C'／F'-C'	0.4929
F'-e／F'-C'	0.5071
i-F'／F'-C'	1.6565

Deviation of relative partial disp.	
ΔPdC	−0.0005
ΔPgF	0.0038

Internal CC (80%/5%)
335/287
Color Code (80%/5%)
345/290

CCI	
B	0.00
G	0.20
R	0.19

Thermal properties	
CTE(−30,70) [1E-7/℃]	90
CTE(100,300) [1E-7/℃]	114
Tg [℃]	497
At [℃]	531
StP [℃]	448
AP [℃]	479
SP [℃]	582
Ht cndct. [W/m·K]	0.761
Sp. heat [kJ/kg·K]	0.619
Ht diffus. [1E-6 m2/sec]	0.375

Chemical properties [class]	
Acid res. (surface)	4
Alkaline detergent res.	4
Climate resistance	2
Water res. (powder)	2
Acid res. (powder)	5

Mechanical properties	
Knoop hardness	416 (4)
Abrasion hardness	267
Young's mod. [GPa]	81.6
Shear mod. [GPa]	32.0
Poisson's ratio	0.274
Stress optical coef. [1E-5 nm/cm／Pa]	1.56

Internal trans. (10mm)	
λ [nm]	τ
280	0.02
290	0.07
300	0.20
310	0.39
320	0.58
330	0.74
340	0.85
350	0.917
360	0.955
370	0.975
380	0.985
390	0.990
400	0.992
420	0.994
440	0.994
460	0.995
480	0.996
500	0.997
550	0.998
600	0.999
650	0.998
700	0.998
800	0.997
900	0.997
1000	0.997
1200	0.998
1400	0.995
1600	0.986
1800	0.968
2000	0.945
2200	0.87
2400	0.81

Specific gravity
3.28

Coef. disp. form. (pwr ser.)	
A0	2.50453078E+00
A1	−1.01597822E-02
A2	−1.08653142E-04
A3	1.27723327E-02
A4	1.33860625E-04
A5	3.37285381E-06
A6	−2.56491019E-08
A7	0.00000000E+00
A8	0.00000000E+00

Relative Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90 (ref.)	−1.9	−1.9	−1.9	−1.8	−1.7	−1.6	−1.6	−1.5	−1.4	−1.3	−1.1	−1.1	−0.7	−0.4	−0.3
60 to 80 (ref.)	−1.9	−1.9	−1.8	−1.8	−1.7	−1.6	−1.6	−1.6	−1.5	−1.4	−1.1	−1.1	−0.8	−0.5	−0.4
40 to 60	−1.9	−1.9	−1.9	−1.8	−1.7	−1.6	−1.6	−1.6	−1.5	−1.4	−1.2	−1.1	−0.8	−0.6	−0.4
20 to 40	−1.9	−1.9	−1.8	−1.7	−1.7	−1.6	−1.6	−1.6	−1.5	−1.4	−1.1	−1.1	−0.8	−0.6	−0.5
0 to 20	−1.8	−1.8	−1.8	−1.7	−1.6	−1.5	−1.5	−1.5	−1.4	−1.3	−1.1	−1.1	−0.8	−0.6	−0.4
−20 to 0	−1.7	−1.7	−1.6	−1.6	−1.5	−1.4	−1.4	−1.4	−1.3	−1.2	−1.0	−1.0	−0.7	−0.5	−0.4
−40 to −20	−1.5	−1.5	−1.5	−1.4	−1.3	−1.3	−1.2	−1.2	−1.1	−1.1	−0.9	−0.8	−0.6	−0.4	−0.3
−60 to −40 (ref.)	−1.3	−1.3	−1.2	−1.1	−1.1	−1.0	−1.0	−1.0	−0.9	−0.8	−0.6	−0.6	−0.4	−0.1	−0.1
−70 to −60 (ref.)	−1.0	−1.0	−0.9	−0.9	−0.8	−0.7	−0.7	−0.7	−0.6	−0.5	−0.4	−0.3	−0.1	0.1	0.2

Absolute Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90	−2.9	−2.9	−2.8	−2.7	−2.7	−2.6	−2.6	−2.5	−2.4	−2.3	−2.1	−2.1	−1.8	−1.5	−1.3
60 to 80	−3.0	−3.0	−2.9	−2.8	−2.8	−2.7	−2.7	−2.6	−2.6	−2.5	−2.2	−2.2	−1.9	−1.6	−1.5
40 to 60	−3.1	−3.1	−3.1	−3.0	−2.9	−2.8	−2.8	−2.8	−2.7	−2.6	−2.4	−2.4	−2.1	−1.8	−1.7
20 to 40	−3.3	−3.3	−3.2	−3.1	−3.0	−3.0	−3.0	−2.9	−2.9	−2.8	−2.6	−2.5	−2.3	−2.0	−1.9
0 to 20	−3.4	−3.4	−3.3	−3.3	−3.2	−3.1	−3.1	−3.1	−3.0	−2.9	−2.7	−2.7	−2.4	−2.2	−2.1
−20 to 0	−3.5	−3.5	−3.5	−3.4	−3.3	−3.3	−3.3	−3.2	−3.2	−3.1	−2.9	−2.9	−2.6	−2.4	−2.3
−40 to −20	−3.7	−3.7	−3.6	−3.5	−3.5	−3.4	−3.4	−3.4	−3.3	−3.2	−3.1	−3.0	−2.8	−2.6	−2.5
−60 to −40	−3.8	−3.8	−3.7	−3.7	−3.6	−3.6	−3.5	−3.5	−3.5	−3.4	−3.2	−3.2	−3.0	−2.8	−2.7
−70 to −60	−3.9	−3.9	−3.8	−3.8	−3.7	−3.7	−3.7	−3.6	−3.6	−3.5	−3.4	−3.3	−3.1	−2.9	−2.9

Coef. disp. form. (frac. eq.)(ref.)	
P1	1.27151677E-01
Q1	8.43272005E+01
P2	4.55367919E-02
Q2	1.57347586E-02
P3	2.88484152E-01
Q3	4.04391028E-03

Fitting error of disp. form. σ [1E-6]	Visible	Infrared
Power ser. eq.	0.4	2.2
Frac. eq. (ref.)	0.4	2.2

Prod. Freq. (A to D)	A

Similar glass type			
OHARA	−	HOYA	PCD51
CDGM	H-ZPK3	SCHOTT	−

2022-7-1	StP, AP, SP
2019-4-1	Transmittance
2015-4-1	1st edition

HIKARI GLASS CO., LTD.

J-PSKH8

n_d = 1.628460 n_e = 1.630988

ν_d = 59.17 ν_e = 58.81

Glass code (d)
628592
Glass code (e)
631588

Spectral l.	Refractive idx
2.058	1.60535
1.970	1.60635
1.530	1.61107
1.129	1.61549
1.064	1.61632
t	1.61702
s	1.61977
A'	1.621689
r	1.623473
C	1.625268
C'	1.625774
He-Ne	1.626246
D	1.628366
d	1.628460
e	1.630988
F	1.635889
F'	1.636503
g	1.641791
h	1.646759
0.389	1.649825
i	1.655415

Coef. disp. form. (pwr ser.)	
A0	2.60815614E+00
A1	-8.16775932E-03
A2	0.00000000E+00
A3	1.50613778E-02
A4	3.69238186E-04
A5	-1.11180030E-05
A6	1.41616753E-06
A7	-6.52373713E-08
A8	6.98536029E-09

Partial dispersion	
F-C	0.010621
F'-C'	0.010729
C-t	0.008250
C-A'	0.003579
d-C	0.003192
e-C	0.005720
g-d	0.013331
g-F	0.005902
h-g	0.004968
i-g	0.013624
C'-t	0.008756
e-C'	0.005214
F'-e	0.005515
i-F'	0.018912

Relative partial dispersion	
C-t／F-C	0.7768
C-A'／F-C	0.3370
d-C／F-C	0.3005
e-C／F-C	0.5386
g-d／F-C	1.2552
g-F／F-C	0.5557
h-g／F-C	0.4678
i-g／F-C	1.2827
C'-t／F'-C'	0.8161
e-C'／F'-C'	0.4860
F'-e／F'-C'	0.5140
i-F'／F'-C'	1.7627

Deviation of relative partial disp.	
ΔPdC	-0.0034
ΔPgF	0.0106

Internal CC (80%/5%)
379/348
Color Code (80%/5%)
390/350
CCI

B	0.00
G	0.95
R	0.90

Thermal properties	
CTE(-30,70) [1E-7/℃]	100
CTE(100,300) [1E-7/℃]	122
Tg [℃]	587
At [℃]	618
StP [℃]	540
AP [℃]	568
SP [℃]	661
Ht cndct. [W/m･K]	0.665
Sp. heat [kJ/kg･K]	0.520
Ht diffus. [1E-6 m2/sec]	0.316

Chemical properties [class]	
Acid res. (surface)	1
Alkaline detergent res.	2
Climate resistance	1
Water res. (powder)	1
Acid res. (powder)	2

Mechanical properties	
Knoop hardness	413 (4)
Abrasion hardness	391
Young's mod. [GPa]	82.2
Shear mod. [GPa]	31.9
Poisson's ratio	0.289
Stress optical coef. [1E-5 nm/cm／Pa]	0.70

Internal trans. (10mm)	
λ [nm]	τ
280	–
290	–
300	–
310	–
320	–
330	–
340	–
350	0.08
360	0.36
370	0.65
380	0.82
390	0.904
400	0.947
420	0.979
440	0.988
460	0.991
480	0.994
500	0.995
550	0.998
600	0.996
650	0.995
700	0.996
800	0.998
900	0.998
1000	0.999
1200	0.999
1400	0.999
1600	0.999
1800	0.995
2000	0.990
2200	0.983
2400	0.969

Specific gravity
4.05

Relative Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90 (ref.)	-4.6	-4.5	-4.5	-4.3	-4.2	-4.1	-4.1	-4.1	-3.9	-3.8	-3.4	-3.4	-3.0	-2.5	-2.3
60 to 80 (ref.)	-4.6	-4.5	-4.4	-4.3	-4.2	-4.1	-4.1	-4.1	-4.0	-3.8	-3.5	-3.4	-3.0	-2.6	-2.3
40 to 60	-4.6	-4.5	-4.4	-4.3	-4.2	-4.1	-4.1	-4.1	-4.0	-3.8	-3.5	-3.5	-3.1	-2.7	-2.4
20 to 40	-4.5	-4.5	-4.4	-4.3	-4.2	-4.1	-4.1	-4.1	-3.9	-3.8	-3.5	-3.5	-3.1	-2.7	-2.4
0 to 20	-4.4	-4.4	-4.3	-4.2	-4.1	-4.0	-4.0	-4.0	-3.9	-3.7	-3.4	-3.4	-3.1	-2.7	-2.4
-20 to 0	-4.3	-4.2	-4.2	-4.1	-4.0	-3.9	-3.9	-3.9	-3.8	-3.6	-3.3	-3.3	-3.0	-2.6	-2.4
-40 to -20	-4.1	-4.0	-4.0	-3.9	-3.8	-3.7	-3.7	-3.7	-3.6	-3.4	-3.2	-3.2	-2.8	-2.5	-2.3
-60 to -40 (ref.)	-3.8	-3.8	-3.7	-3.6	-3.5	-3.4	-3.4	-3.4	-3.3	-3.2	-2.9	-2.9	-2.6	-2.3	-2.1
-70 to -60 (ref.)	-3.5	-3.5	-3.4	-3.3	-3.2	-3.2	-3.1	-3.1	-3.0	-2.9	-2.7	-2.6	-2.3	-2.0	-1.8

Absolute Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90	-5.6	-5.5	-5.4	-5.3	-5.2	-5.1	-5.1	-5.1	-5.0	-4.8	-4.5	-4.4	-4.0	-3.6	-3.3
60 to 80	-5.7	-5.6	-5.5	-5.4	-5.3	-5.2	-5.2	-5.2	-5.1	-4.9	-4.6	-4.6	-4.2	-3.7	-3.5
40 to 60	-5.8	-5.8	-5.7	-5.6	-5.5	-5.4	-5.4	-5.3	-5.2	-5.1	-4.8	-4.7	-4.3	-4.0	-3.7
20 to 40	-5.9	-5.9	-5.8	-5.7	-5.6	-5.5	-5.5	-5.5	-5.4	-5.2	-4.9	-4.9	-4.5	-4.2	-3.9
0 to 20	-6.0	-6.0	-5.9	-5.8	-5.7	-5.7	-5.6	-5.6	-5.5	-5.4	-5.1	-5.1	-4.7	-4.4	-4.1
-20 to 0	-6.1	-6.1	-6.0	-5.9	-5.9	-5.8	-5.8	-5.7	-5.6	-5.5	-5.3	-5.2	-4.9	-4.6	-4.3
-40 to -20	-6.2	-6.2	-6.1	-6.1	-6.0	-5.9	-5.9	-5.9	-5.8	-5.7	-5.4	-5.4	-5.1	-4.8	-4.6
-60 to -40	-6.4	-6.3	-6.3	-6.2	-6.1	-6.1	-6.0	-6.0	-5.9	-5.8	-5.6	-5.6	-5.3	-5.0	-4.8
-70 to -60	-6.4	-6.4	-6.4	-6.3	-6.2	-6.2	-6.1	-6.1	-6.0	-5.9	-5.7	-5.7	-5.4	-5.1	-5.0

Coef. disp. form. (frac. eq.)(ref.)	
P1	9.37459258E-02
Q1	8.62953408E+01
P2	5.86291615E-03
Q2	4.93370242E-02
P3	3.43011681E-01
Q3	5.56912524E-03

Fitting error of disp. form. σ [1E-6]		
	Visible	Infrared
Power ser. eq.	0.4	13.6
Frac. eq. (ref.)	1.8	16.8

Prod. Freq. (A to D)	A

Similar glass type			
OHARA	–	HOYA	–
CDGM	–	SCHOTT	–

–	–
2022-7-1	StP, AP, SP
2020-4-1	1st edition

J-BK7A

n_d = 1.516800 n_e = 1.518723

ν_d = 64.14 ν_e = 63.91

Glass code (d)
517641
Glass code (e)
519639

Spectral l.	Refractive idx
2.058	1.49403
1.970	1.49532
1.530	1.50110
1.129	1.50588
1.064	1.50669
t	1.50736
s	1.50982
A'	1.511444
r	1.512897
C	1.514324
C'	1.514720
He-Ne	1.515089
D	1.516728
d	1.516800
e	1.518723
F	1.522382
F'	1.522836
g	1.526699
h	1.530262
0.389	1.532427
i	1.536301

Partial dispersion	
F-C	0.008058
F'-C'	0.008116
C-t	0.006968
C-A'	0.002880
d-C	0.002476
e-C	0.004399
g-d	0.009899
g-F	0.004317
h-g	0.003563
i-g	0.009602
C'-t	0.007364
e-C'	0.004003
F'-e	0.004113
i-F'	0.013465

Relative partial dispersion	
C-t／F-C	0.8647
C-A'／F-C	0.3574
d-C／F-C	0.3073
e-C／F-C	0.5459
g-d／F-C	1.2285
g-F／F-C	0.5357
h-g／F-C	0.4422
i-g／F-C	1.1916
C'-t／F'-C'	0.9073
e-C'／F'-C'	0.4932
F'-e／F'-C'	0.5068
i-F'／F'-C'	1.6591

Deviation of relative partial disp.	
ΔPdC	0.0011
ΔPgF	−0.0010

Internal CC (80%/5%)
321/280
Color Code (80%/5%)
325/280

CCI	
B	0.00
G	0.04
R	0.02

Thermal properties	
CTE(−30,70) [1E-7/℃]	74
CTE(100,300) [1E-7/℃]	90
Tg [℃]	550
At [℃]	613
StP [℃]	502
AP [℃]	544
SP [℃]	715
Ht cndct. [W/m·K]	1.018
Sp. heat [kJ/kg·K]	0.682
Ht diffus. [1E-6 m2/sec]	0.593

Chemical properties [class]	
Acid res. (surface)	1
Alkaline detergent res.	1
Climate resistance	1
Water res. (powder)	3
Acid res. (powder)	1

Mechanical properties	
Knoop hardness	506 (5)
Abrasion hardness	96
Young's mod. [GPa]	79.0
Shear mod. [GPa]	32.4
Poisson's ratio	0.220
Stress optical coef. [1E-5 nm/cm／Pa]	3.04

Internal trans. (10mm)	
λ [nm]	τ
280	0.08
290	0.15
300	0.36
310	0.61
320	0.80
330	0.903
340	0.954
350	0.977
360	0.988
370	0.993
380	0.995
390	0.997
400	0.998
420	0.999
440	0.998
460	0.998
480	0.999
500	0.999
550	0.999
600	0.999
650	0.998
700	0.998
800	0.998
900	0.997
1000	0.997
1200	0.997
1400	0.977
1600	0.987
1800	0.960
2000	0.921
2200	0.81
2400	0.75

Specific gravity
2.51

Coef. disp. form. (pwr ser.)	
A0	2.27110883E+00
A1	−9.38988354E-03
A2	−1.00277081E-04
A3	1.09572221E-02
A4	1.20210067E-04
A5	3.31079774E-06
A6	−1.48235581E-08
A7	0.00000000E+00
A8	0.00000000E+00

Relative Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90 (ref.)	1.9	2.0	2.1	2.2	2.3	2.3	2.4	2.4	2.5	2.7	2.9	3.0	3.3	3.6	3.8
60 to 80 (ref.)	1.9	2.0	2.1	2.1	2.2	2.3	2.3	2.4	2.5	2.6	2.9	2.9	3.2	3.5	3.7
40 to 60	1.9	1.9	2.0	2.1	2.2	2.3	2.3	2.3	2.4	2.6	2.8	2.9	3.1	3.4	3.6
20 to 40	1.9	1.9	2.0	2.1	2.2	2.2	2.3	2.3	2.4	2.5	2.8	2.8	3.1	3.3	3.5
0 to 20	1.9	2.0	2.1	2.1	2.2	2.3	2.3	2.3	2.4	2.6	2.8	2.8	3.1	3.3	3.5
−20 to 0	2.0	2.0	2.1	2.2	2.3	2.3	2.4	2.4	2.5	2.6	2.8	2.9	3.1	3.3	3.5
−40 to −20	2.1	2.2	2.3	2.3	2.4	2.5	2.5	2.5	2.6	2.7	3.0	3.0	3.2	3.4	3.6
−60 to −40 (ref.)	2.4	2.4	2.5	2.5	2.6	2.7	2.7	2.7	2.8	2.9	3.2	3.2	3.4	3.6	3.8
−70 to −60 (ref.)	2.6	2.6	2.7	2.8	2.8	2.9	2.9	3.0	3.0	3.2	3.4	3.4	3.6	3.8	4.0

Absolute Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90	1.0	1.1	1.2	1.2	1.3	1.4	1.4	1.5	1.6	1.7	2.0	2.0	2.3	2.6	2.8
60 to 80	0.9	0.9	1.0	1.1	1.2	1.3	1.3	1.3	1.4	1.6	1.8	1.9	2.1	2.4	2.6
40 to 60	0.7	0.8	0.9	0.9	1.0	1.1	1.1	1.1	1.3	1.4	1.7	1.7	1.9	2.2	2.4
20 to 40	0.6	0.6	0.7	0.8	0.9	0.9	1.0	1.0	1.1	1.2	1.5	1.5	1.7	2.0	2.2
0 to 20	0.4	0.5	0.6	0.6	0.7	0.8	0.8	0.8	0.9	1.0	1.3	1.3	1.5	1.8	1.9
−20 to 0	0.3	0.3	0.4	0.5	0.5	0.6	0.6	0.6	0.7	0.8	1.1	1.1	1.3	1.5	1.7
−40 to −20	0.1	0.2	0.2	0.3	0.3	0.4	0.4	0.5	0.5	0.7	0.9	0.9	1.1	1.3	1.5
−60 to −40	0.0	0.0	0.1	0.1	0.2	0.2	0.3	0.3	0.4	0.5	0.7	0.7	0.9	1.1	1.3
−70 to −60	−0.2	−0.1	−0.1	0.0	0.0	0.1	0.1	0.1	0.2	0.3	0.5	0.6	0.7	0.9	1.1

Coef. disp. form. (frac. eq.)(ref.)	
P1	1.32131192E-01
Q1	8.52147898E+01
P2	3.48697207E-02
Q2	1.83584959E-02
P3	2.62754051E-01
Q3	4.39929773E-03

Fitting error of disp. form. σ [1E-6]		
	Visible	Infrared
Power ser. eq.	0.4	3.8
Frac. eq. (ref.)	0.4	3.9

Prod. Freq. (A to D)	A

Similar glass type			
OHARA	S-BSL7	HOYA	BSC7
CDGM	H-K9L	SCHOTT	N-BK7

2022-7-1	StP, AP, SP
2019-4-1	Transmittance
2015-4-1	1st edition

HIKARI GLASS CO., LTD.

J-BAK1

n_d = 1.572500 n_e = 1.574882

ν_d = 57.30 ν_e = 57.01

Glass code (d)
573573
Glass code (e)
575570

Spectral l.	Refractive idx
2.058	1.54903
1.970	1.55016
1.530	1.55531
1.129	1.55991
1.064	1.56075
t	1.56145
s	1.56417
A'	1.566036
r	1.567755
C	1.569472
C'	1.569953
He-Ne	1.570402
D	1.572411
d	1.572500
e	1.574882
F	1.579464
F'	1.580036
g	1.584931
h	1.589484
0.389	1.592266
i	1.597270

Partial dispersion	
F-C	0.009992
F'-C'	0.010083
C-t	0.008023
C-A'	0.003436
d-C	0.003028
e-C	0.005410
g-d	0.012431
g-F	0.005467
h-g	0.004553
i-g	0.012339
C'-t	0.008504
e-C'	0.004929
F'-e	0.005154
i-F'	0.017234

Relative partial dispersion	
C-t／F-C	0.8029
C-A'／F-C	0.3439
d-C／F-C	0.3030
e-C／F-C	0.5414
g-d／F-C	1.2441
g-F／F-C	0.5471
h-g／F-C	0.4557
i-g／F-C	1.2349
C'-t／F'-C'	0.8434
e-C'／F'-C'	0.4888
F'-e／F'-C'	0.5112
i-F'／F'-C'	1.7092

Deviation of relative partial disp.	
ΔPdC	0.0000
ΔPgF	−0.0011

Internal CC (80%/5%)
324/281
Color Code (80%/5%)
335/280
CCI

B	0.00
G	0.07
R	0.05

Thermal properties	
CTE(−30,70) [1E-7/℃]	73
CTE(100,300) [1E-7/℃]	83
Tg [℃]	599
At [℃]	656
StP [℃]	540
AP [℃]	584
SP [℃]	757
Ht cndct. [W/m·K]	0.936
Sp. heat [kJ/kg·K]	0.618
Ht diffus. [1E-6 m2/sec]	0.476

Chemical properties [class]	
Acid res. (surface)	2
Alkaline detergent res.	2
Climate resistance	1
Water res. (powder)	2
Acid res. (powder)	2

Mechanical properties	
Knoop hardness	467 (5)
Abrasion hardness	138
Young's mod. [GPa]	73.3
Shear mod. [GPa]	29.3
Poisson's ratio	0.251
Stress optical coef. [1E-5 nm/cm／Pa]	3.02

Internal trans. (10mm)	
λ [nm]	τ
280	0.05
290	0.14
300	0.33
310	0.55
320	0.74
330	0.86
340	0.928
350	0.964
360	0.981
370	0.989
380	0.992
390	0.995
400	0.996
420	0.997
440	0.996
460	0.996
480	0.997
500	0.998
550	0.998
600	0.998
650	0.997
700	0.998
800	0.998
900	0.997
1000	0.997
1200	0.996
1400	0.989
1600	0.990
1800	0.976
2000	0.965
2200	0.916
2400	0.88

Specific gravity
3.17

Coef. disp. form. (pwr ser.)	
A0	2.43258691E+00
A1	−8.22086723E−03
A2	−9.21764324E−05
A3	1.43187501E−02
A4	1.59799832E−04
A5	8.58344462E−06
A6	−1.00538104E−07
A7	0.00000000E+00
A8	0.00000000E+00

Relative Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90 (ref.)	3.1	3.2	3.3	3.4	3.5	3.7	3.7	3.7	3.9	4.0	4.4	4.4	4.8	5.2	5.4
60 to 80 (ref.)	2.9	3.0	3.1	3.2	3.3	3.4	3.5	3.5	3.6	3.8	4.1	4.2	4.5	4.9	5.2
40 to 60	2.7	2.7	2.8	2.9	3.0	3.1	3.2	3.2	3.3	3.5	3.8	3.8	4.2	4.6	4.8
20 to 40	2.4	2.5	2.6	2.7	2.8	2.9	2.9	2.9	3.1	3.2	3.5	3.6	3.9	4.3	4.5
0 to 20	2.2	2.2	2.4	2.5	2.6	2.7	2.7	2.7	2.8	3.0	3.3	3.3	3.7	4.0	4.3
−20 to 0	2.0	2.1	2.2	2.3	2.4	2.5	2.5	2.5	2.7	2.8	3.1	3.1	3.5	3.8	4.1
−40 to −20	2.0	2.0	2.1	2.2	2.3	2.4	2.4	2.4	2.6	2.7	3.0	3.0	3.4	3.7	3.9
−60 to −40 (ref.)	1.9	2.0	2.1	2.2	2.3	2.4	2.4	2.4	2.5	2.7	3.0	3.0	3.3	3.7	3.9
−70 to −60 (ref.)	2.0	2.0	2.2	2.3	2.3	2.4	2.5	2.5	2.6	2.7	3.0	3.0	3.4	3.7	3.9

Absolute Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90	2.2	2.2	2.4	2.5	2.6	2.7	2.7	2.7	2.9	3.0	3.4	3.4	3.8	4.2	4.4
60 to 80	1.9	1.9	2.1	2.2	2.3	2.4	2.4	2.4	2.6	2.7	3.0	3.1	3.4	3.8	4.1
40 to 60	1.5	1.5	1.6	1.7	1.8	1.9	2.0	2.0	2.1	2.3	2.6	2.6	3.0	3.3	3.6
20 to 40	1.1	1.1	1.2	1.3	1.4	1.5	1.6	1.6	1.7	1.8	2.1	2.2	2.5	2.9	3.1
0 to 20	0.7	0.7	0.8	0.9	1.0	1.1	1.1	1.2	1.3	1.4	1.7	1.7	2.1	2.4	2.7
−20 to 0	0.3	0.3	0.4	0.5	0.6	0.7	0.7	0.7	0.8	1.0	1.3	1.3	1.6	2.0	2.2
−40 to −20	−0.1	−0.1	0.0	0.1	0.2	0.3	0.3	0.3	0.4	0.6	0.8	0.9	1.2	1.5	1.7
−60 to −40	−0.5	−0.5	−0.4	−0.3	−0.2	−0.2	−0.1	−0.1	0.0	0.1	0.4	0.4	0.7	1.0	1.2
−70 to −60	−0.9	−0.8	−0.7	−0.6	−0.6	−0.5	−0.5	−0.4	−0.3	−0.2	0.1	0.1	0.4	0.7	0.9

Coef. disp. form. (frac. eq.)(ref.)	
P1	1.25334798E−01
Q1	9.83783343E+01
P2	2.36950126E−02
Q2	2.51187977E−02
P3	2.99538486E−01
Q3	5.24516443E−03

Fitting error of disp. form. σ [1E-6]		
	Visible	Infrared
Power ser. eq.	0.4	5.7
Frac. eq. (ref.)	0.6	6.7

Prod. Freq. (A to D)	C

Similar glass type			
OHARA	−	HOYA	−
CDGM	H-BaK8	SCHOTT	N-BAK1

2022-7-1	StP, AP, SP
2020-4-1	Similar glass type
2019-4-1	Transmittance

HIKARI GLASS CO., LTD.

J-BAK2

n_d = 1.539960 n_e = 1.542123

ν_d = 59.52 ν_e = 59.26

Glass code (d)
540595
Glass code (e)
542593

Spectral l.	Refractive idx
2.058	1.51748
1.970	1.51862
1.530	1.52379
1.129	1.52829
1.064	1.52909
t	1.52976
s	1.53231
A'	1.534045
r	1.535627
C	1.537199
C'	1.537639
He-Ne	1.538049
D	1.539879
d	1.539960
e	1.542123
F	1.546271
F'	1.546787
g	1.551203
h	1.555299
0.389	1.557798
i	1.562285

Coef. disp. form. (pwr ser.)	
A0	2.33616060E+00
A1	-8.18245071E-03
A2	-9.82753897E-05
A3	1.27499096E-02
A4	1.22269251E-04
A5	8.48994057E-06
A6	-1.59525058E-07
A7	0.00000000E+00
A8	0.00000000E+00

Partial dispersion	
F-C	0.009072
F'-C'	0.009148
C-t	0.007438
C-A'	0.003154
d-C	0.002761
e-C	0.004924
g-d	0.011243
g-F	0.004932
h-g	0.004096
i-g	0.011082
C'-t	0.007878
e-C'	0.004484
F'-e	0.004664
i-F'	0.015498

Relative partial dispersion	
C-t／F-C	0.8199
C-A'／F-C	0.3477
d-C／F-C	0.3043
e-C／F-C	0.5428
g-d／F-C	1.2393
g-F／F-C	0.5437
h-g／F-C	0.4515
i-g／F-C	1.2216
C'-t／F'-C'	0.8612
e-C'／F'-C'	0.4902
F'-e／F'-C'	0.5098
i-F'／F'-C'	1.6941

Deviation of relative partial disp.	
ΔPdC	0.0003
ΔPgF	−0.0008

Internal CC (80%/5%)
324/287
Color Code (80%/5%)
330/290
CCI

B	0.00
G	0.05
R	0.02

Thermal properties	
CTE(-30,70) [1E-7/℃]	76
CTE(100,300) [1E-7/℃]	87
Tg [℃]	559
At [℃]	624
StP [℃]	503
AP [℃]	549
SP [℃]	738
Ht cndct. [W/m･K]	0.915
Sp. heat [kJ/kg･K]	0.632
Ht diffus. [1E-6 m2/sec]	0.508

Chemical properties [class]	
Acid res. (surface)	1
Alkaline detergent res.	2
Climate resistance	1
Water res. (powder)	2
Acid res. (powder)	2

Mechanical properties	
Knoop hardness	465 (5)
Abrasion hardness	119
Young's mod. [GPa]	70.7
Shear mod. [GPa]	28.7
Poisson's ratio	0.232
Stress optical coef. [1E-5 nm/cm／Pa]	2.80

Internal trans. (10mm)	
λ [nm]	τ
280	–
290	0.07
300	0.22
310	0.50
320	0.74
330	0.88
340	0.946
350	0.976
360	0.989
370	0.994
380	0.995
390	0.998
400	0.999
420	0.999
440	0.998
460	0.998
480	0.999
500	0.999
550	0.999
600	0.999
650	0.998
700	0.999
800	0.998
900	0.996
1000	0.996
1200	0.996
1400	0.990
1600	0.990
1800	0.972
2000	0.947
2200	0.89
2400	0.85

Specific gravity
2.84

Relative Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90 (ref.)	1.6	1.6	1.7	1.9	2.0	2.1	2.1	2.1	2.2	2.4	2.7	2.8	3.1	3.5	3.7
60 to 80 (ref.)	1.5	1.5	1.7	1.7	1.8	1.9	2.0	2.0	2.1	2.3	2.6	2.6	3.0	3.3	3.5
40 to 60	1.4	1.4	1.5	1.6	1.7	1.8	1.8	1.9	2.0	2.1	2.4	2.5	2.8	3.1	3.3
20 to 40	1.3	1.3	1.4	1.5	1.6	1.7	1.7	1.8	1.9	2.0	2.3	2.3	2.7	3.0	3.2
0 to 20	1.2	1.3	1.4	1.5	1.5	1.6	1.7	1.7	1.8	1.9	2.2	2.2	2.6	2.9	3.0
-20 to 0	1.2	1.3	1.4	1.4	1.5	1.6	1.6	1.7	1.8	1.9	2.2	2.2	2.5	2.8	3.0
-40 to -20	1.3	1.3	1.4	1.5	1.6	1.7	1.7	1.7	1.8	1.9	2.2	2.2	2.5	2.8	2.9
-60 to -40 (ref.)	1.4	1.5	1.6	1.6	1.7	1.8	1.8	1.8	1.9	2.0	2.3	2.3	2.6	2.9	3.0
-70 to -60 (ref.)	1.6	1.6	1.7	1.8	1.9	1.9	2.0	2.0	2.1	2.2	2.4	2.5	2.7	3.0	3.1

Absolute Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90	0.6	0.7	0.8	0.9	1.0	1.1	1.1	1.2	1.3	1.4	1.7	1.8	2.2	2.5	2.7
60 to 80	0.5	0.5	0.6	0.7	0.8	0.9	0.9	1.0	1.1	1.2	1.5	1.6	1.9	2.3	2.5
40 to 60	0.2	0.3	0.4	0.5	0.5	0.6	0.7	0.7	0.8	0.9	1.2	1.3	1.6	1.9	2.1
20 to 40	0.0	0.0	0.1	0.2	0.3	0.4	0.4	0.4	0.5	0.7	0.9	1.0	1.3	1.6	1.8
0 to 20	-0.3	-0.2	-0.1	-0.1	0.0	0.1	0.1	0.1	0.3	0.4	0.6	0.7	1.0	1.3	1.5
-20 to 0	-0.5	-0.5	-0.4	-0.3	-0.2	-0.2	-0.1	-0.1	0.0	0.1	0.4	0.4	0.7	0.9	1.1
-40 to -20	-0.8	-0.7	-0.6	-0.6	-0.5	-0.4	-0.4	-0.4	-0.3	-0.2	0.1	0.1	0.4	0.6	0.8
-60 to -40	-1.0	-1.0	-0.9	-0.8	-0.8	-0.7	-0.7	-0.7	-0.6	-0.5	-0.2	-0.2	0.1	0.3	0.4
-70 to -60	-1.2	-1.2	-1.1	-1.0	-1.0	-0.9	-0.9	-0.9	-0.8	-0.7	-0.5	-0.4	-0.2	0.1	0.2

Coef. disp. form. (frac. eq.)(ref.)	
P1	1.22545246E-01
Q1	9.24022804E+01
P2	1.79911705E-02
Q2	2.59658508E-02
P3	2.90195251E-01
Q3	5.32121925E-03

Fitting error of disp. form. σ [1E-6]		
	Visible	Infrared
Power ser. eq.	0.5	7.5
Frac. eq. (ref.)	0.7	7.5

Prod. Freq. (A to D)	C

Similar glass type			
OHARA	S-BAL12	HOYA	-
CDGM	H-BaK2	SCHOTT	N-BAK2

2022-7-1	StP, AP, SP
2019-4-1	Transmittance
2018-4-1	Prod. Freq.

J-BAK4

n_d = 1.568830 n_e = 1.571250

ν_d = 56.00 ν_e = 55.73

Glass code (d)
569560
Glass code (e)
571557

Spectral l.	Refractive idx
2.058	1.54426
1.970	1.54548
1.530	1.55104
1.129	1.55592
1.064	1.55680
t	1.55753
s	1.56033
A'	1.562249
r	1.564003
C	1.565751
C'	1.566241
He-Ne	1.566698
D	1.568740
d	1.568830
e	1.571250
F	1.575909
F'	1.576491
g	1.581480
h	1.586137
0.389	1.588993
i	1.594153

Partial dispersion	
F-C	0.010158
F'-C'	0.010250
C-t	0.008223
C-A'	0.003502
d-C	0.003079
e-C	0.005499
g-d	0.012650
g-F	0.005571
h-g	0.004657
i-g	0.012673
C'-t	0.008713
e-C'	0.005009
F'-e	0.005241
i-F'	0.017662

Relative partial dispersion	
C-t／F-C	0.8095
C-A'／F-C	0.3448
d-C／F-C	0.3031
e-C／F-C	0.5413
g-d／F-C	1.2453
g-F／F-C	0.5484
h-g／F-C	0.4585
i-g／F-C	1.2476
C'-t／F'-C'	0.8500
e-C'／F'-C'	0.4887
F'-e／F'-C'	0.5113
i-F'／F'-C'	1.7231

Deviation of relative partial disp.	
ΔPdC	0.0006
ΔPgF	−0.0020

Internal CC (80%/5%)
353/324
Color Code (80%/5%)
360/325
CCI

B	0.00
G	0.18
R	0.16

Thermal properties	
CTE(−30,70) [1E-7/℃]	70
CTE(100,300) [1E-7/℃]	84
Tg [℃]	580
At [℃]	635
StP [℃]	525
AP [℃]	566
SP [℃]	725
Ht cndct. [W/m･K]	0.993
Sp. heat [kJ/kg･K]	0.697
Ht diffus. [1E-6 m2/sec]	0.500

Chemical properties [class]	
Acid res. (surface)	1
Alkaline detergent res.	2
Climate resistance	1
Water res. (powder)	2
Acid res. (powder)	1

Mechanical properties	
Knoop hardness	509 (5)
Abrasion hardness	115
Young's mod. [GPa]	82.1
Shear mod. [GPa]	32.9
Poisson's ratio	0.246
Stress optical coef. [1E-5 nm/cm／Pa]	2.62

Internal trans. (10mm)	
λ [nm]	τ
280	–
290	–
300	–
310	–
320	0.02
330	0.16
340	0.47
350	0.75
360	0.89
370	0.951
380	0.974
390	0.985
400	0.991
420	0.995
440	0.996
460	0.997
480	0.997
500	0.998
550	0.999
600	0.998
650	0.998
700	0.998
800	0.998
900	0.998
1000	0.998
1200	0.999
1400	0.984
1600	0.990
1800	0.972
2000	0.955
2200	0.88
2400	0.83

Specific gravity
2.84

Coef. disp. form. (pwr ser.)	
A0	2.42114503E+00
A1	−8.99959341E-03
A2	−9.30006854E-05
A3	1.43071120E-02
A4	1.89993274E-04
A5	6.09602388E-06
A6	2.25737069E-07
A7	0.00000000E+00
A8	0.00000000E+00

Relative Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90 (ref.)	2.8	2.9	2.9	3.1	3.2	3.3	3.4	3.4	3.6	3.7	4.1	4.1	4.6	5.0	5.2
60 to 80 (ref.)	2.7	2.7	2.9	3.0	3.1	3.2	3.2	3.3	3.4	3.6	3.9	4.0	4.4	4.8	5.1
40 to 60	2.6	2.6	2.7	2.8	2.9	3.1	3.1	3.1	3.3	3.4	3.8	3.8	4.2	4.6	4.9
20 to 40	2.5	2.5	2.6	2.7	2.8	2.9	3.0	3.0	3.1	3.3	3.6	3.7	4.1	4.4	4.7
0 to 20	2.4	2.4	2.5	2.6	2.7	2.8	2.9	2.9	3.0	3.2	3.5	3.5	3.9	4.3	4.5
−20 to 0	2.4	2.4	2.5	2.6	2.7	2.8	2.8	2.9	3.0	3.1	3.4	3.5	3.9	4.2	4.4
−40 to −20	2.4	2.4	2.5	2.6	2.7	2.8	2.9	2.9	3.0	3.1	3.4	3.5	3.8	4.2	4.4
−60 to −40 (ref.)	2.5	2.5	2.6	2.7	2.8	2.9	3.0	3.0	3.1	3.2	3.5	3.6	3.9	4.3	4.5
−70 to −60 (ref.)	2.7	2.7	2.8	2.9	3.0	3.1	3.1	3.1	3.3	3.4	3.7	3.7	4.1	4.4	4.6

Absolute Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90	1.9	1.9	2.0	2.1	2.2	2.4	2.4	2.4	2.6	2.7	3.1	3.1	3.6	4.0	4.2
60 to 80	1.7	1.7	1.8	1.9	2.0	2.1	2.2	2.2	2.4	2.5	2.9	2.9	3.3	3.7	4.0
40 to 60	1.4	1.4	1.5	1.6	1.7	1.9	1.9	1.9	2.1	2.2	2.5	2.6	3.0	3.4	3.6
20 to 40	1.1	1.1	1.3	1.4	1.5	1.6	1.6	1.6	1.8	1.9	2.2	2.3	2.7	3.0	3.3
0 to 20	0.9	0.9	1.0	1.1	1.2	1.3	1.3	1.3	1.5	1.6	1.9	2.0	2.3	2.7	2.9
−20 to 0	0.6	0.6	0.7	0.8	0.9	1.0	1.0	1.0	1.2	1.3	1.6	1.6	2.0	2.3	2.5
−40 to −20	0.3	0.3	0.4	0.5	0.6	0.7	0.7	0.8	0.9	1.0	1.3	1.3	1.7	2.0	2.2
−60 to −40	0.1	0.1	0.1	0.2	0.3	0.4	0.4	0.5	0.6	0.7	1.0	1.0	1.3	1.7	1.8
−70 to −60	−0.2	−0.1	−0.1	0.0	0.1	0.2	0.2	0.2	0.3	0.5	0.7	0.8	1.1	1.4	1.6

Coef. disp. form. (frac. eq.)(ref.)	
P1	1.32025131E-01
Q1	9.47904687E+01
P2	1.03988255E-02
Q2	3.68050059E-02
P3	3.11070528E-01
Q3	5.79597844E-03

Fitting error of disp. form. σ [1E-6]		
	Visible	Infrared
Power ser. eq.	0.5	4.1
Frac. eq. (ref.)	0.5	5.1

Prod. Freq. (A to D)	C

Similar glass type			
OHARA	S-BAL14	HOYA	BAC4
CDGM	H-BaK7	SCHOTT	N-BAK4

2022-7-1	StP, AP, SP
2019-4-1	Transmittance
2015-4-1	Color Code

HIKARI GLASS CO., LTD.

J-K3

n_d = 1.518230 n_e = 1.520330

ν_d = 58.82 ν_e = 58.55

Glass code (d)
518588
Glass code (e)
520586

Spectral l.	Refractive idx
2.058	1.49627
1.970	1.49739
1.530	1.50247
1.129	1.50688
1.064	1.50767
t	1.50832
s	1.51081
A'	1.512490
r	1.514026
C	1.515551
C'	1.515978
He-Ne	1.516375
D	1.518152
d	1.518230
e	1.520330
F	1.524362
F'	1.524865
g	1.529163
h	1.533159
0.389	1.535601
i	1.539996

Coef. disp. form. (pwr ser.)	
A0	2.27169182E+00
A1	-8.15289465E-03
A2	-6.46337623E-05
A3	1.19516164E-02
A4	1.76673730E-04
A5	1.45062194E-06
A6	2.24852090E-07
A7	0.00000000E+00
A8	0.00000000E+00

Partial dispersion	
F-C	0.008811
F'-C'	0.008887
C-t	0.007229
C-A'	0.003061
d-C	0.002679
e-C	0.004779
g-d	0.010933
g-F	0.004801
h-g	0.003996
i-g	0.010833
C'-t	0.007656
e-C'	0.004352
F'-e	0.004535
i-F'	0.015131

Relative partial dispersion	
C-t／F-C	0.8205
C-A'／F-C	0.3474
d-C／F-C	0.3041
e-C／F-C	0.5424
g-d／F-C	1.2408
g-F／F-C	0.5449
h-g／F-C	0.4535
i-g／F-C	1.2295
C'-t／F'-C'	0.8615
e-C'／F'-C'	0.4897
F'-e／F'-C'	0.5103
i-F'／F'-C'	1.7026

Deviation of relative partial disp.	
ΔPdC	0.0003
ΔPgF	-0.0008

Internal CC (80%/5%)
340/310
Color Code (80%/5%)
345/310

CCI	
B	0.00
G	0.06
R	0.03

Thermal properties	
CTE(-30,70) [1E-7/℃]	89
CTE(100,300) [1E-7/℃]	111
Tg [℃]	508
At [℃]	559
StP [℃]	456
AP [℃]	499
SP [℃]	683
Ht cndct. [W/m･K]	1.020
Sp. heat [kJ/kg･K]	0.771
Ht diffus. [1E-6 m2/sec]	0.527

Chemical properties [class]	
Acid res. (surface)	1
Alkaline detergent res.	1
Climate resistance	2
Water res. (powder)	3
Acid res. (powder)	1

Mechanical properties	
Knoop hardness	451 (5)
Abrasion hardness	114
Young's mod. [GPa]	70.6
Shear mod. [GPa]	28.8
Poisson's ratio	0.226
Stress optical coef. [1E-5 nm/cm／Pa]	2.62

Internal trans. (10mm)	
λ [nm]	τ
280	–
290	–
300	–
310	0.05
320	0.25
330	0.57
340	0.81
350	0.923
360	0.969
370	0.985
380	0.991
390	0.995
400	0.997
420	0.997
440	0.996
460	0.997
480	0.997
500	0.998
550	0.998
600	0.998
650	0.997
700	0.998
800	0.998
900	0.998
1000	0.998
1200	0.997
1400	0.989
1600	0.990
1800	0.971
2000	0.945
2200	0.88
2400	0.85

Specific gravity
2.5

Relative Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90 (ref.)	0.4	0.5	0.5	0.7	0.8	0.9	0.9	0.9	1.0	1.2	1.5	1.6	2.0	2.4	2.5
60 to 80 (ref.)	0.3	0.4	0.5	0.6	0.7	0.8	0.8	0.8	0.9	1.1	1.4	1.5	1.9	2.3	2.4
40 to 60	0.3	0.3	0.4	0.5	0.6	0.7	0.7	0.7	0.8	1.0	1.3	1.3	1.8	2.1	2.3
20 to 40	0.2	0.2	0.4	0.4	0.5	0.6	0.6	0.6	0.7	0.9	1.2	1.2	1.6	2.0	2.1
0 to 20	0.2	0.2	0.3	0.4	0.5	0.6	0.6	0.6	0.7	0.8	1.1	1.2	1.6	1.9	2.0
-20 to 0	0.2	0.2	0.4	0.4	0.5	0.6	0.6	0.6	0.7	0.8	1.1	1.2	1.6	1.9	2.0
-40 to -20	0.3	0.3	0.4	0.5	0.6	0.6	0.7	0.7	0.8	0.9	1.2	1.2	1.6	1.9	2.0
-60 to -40 (ref.)	0.5	0.5	0.6	0.7	0.7	0.8	0.8	0.8	0.9	1.0	1.3	1.4	1.7	2.0	2.1
-70 to -60 (ref.)	0.7	0.7	0.8	0.9	0.9	1.0	1.0	1.0	1.1	1.2	1.5	1.5	1.9	2.2	2.3

Absolute Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90	-0.5	-0.5	-0.3	-0.3	-0.2	-0.1	-0.1	0.0	0.1	0.2	0.6	0.6	1.0	1.4	1.6
60 to 80	-0.7	-0.6	-0.5	-0.4	-0.3	-0.3	-0.2	-0.2	-0.1	0.0	0.4	0.4	0.8	1.2	1.3
40 to 60	-0.9	-0.8	-0.7	-0.6	-0.6	-0.5	-0.5	-0.4	-0.3	-0.2	0.1	0.2	0.6	0.9	1.1
20 to 40	-1.1	-1.1	-0.9	-0.9	-0.8	-0.7	-0.7	-0.7	-0.6	-0.4	-0.1	-0.1	0.3	0.6	0.8
0 to 20	-1.3	-1.3	-1.2	-1.1	-1.0	-0.9	-0.9	-0.9	-0.8	-0.7	-0.4	-0.4	0.0	0.3	0.5
-20 to 0	-1.5	-1.5	-1.4	-1.3	-1.2	-1.2	-1.2	-1.1	-1.0	-0.9	-0.6	-0.6	-0.2	0.1	0.2
-40 to -20	-1.7	-1.7	-1.6	-1.5	-1.5	-1.4	-1.4	-1.4	-1.3	-1.2	-0.9	-0.9	-0.5	-0.2	-0.1
-60 to -40	-1.9	-1.9	-1.8	-1.8	-1.7	-1.6	-1.6	-1.6	-1.5	-1.4	-1.2	-1.1	-0.8	-0.5	-0.4
-70 to -60	-2.1	-2.1	-2.0	-1.9	-1.9	-1.8	-1.8	-1.8	-1.7	-1.6	-1.3	-1.3	-1.0	-0.7	-0.6

Coef. disp. form. (frac. eq.)(ref.)	
P1	1.31786626E-01
Q1	9.86678624E+01
P2	1.83036821E-02
Q2	2.74845709E-02
P3	2.79397396E-01
Q3	5.25409101E-03

Fitting error of disp. form. σ [1E-6]		
	Visible	Infrared
Power ser. eq.	0.3	5.9
Frac. eq. (ref.)	0.3	6.3

Prod. Freq. (A to D)	C

Similar glass type			
OHARA	S-NSL3	HOYA	E-C3
CDGM	H-K10	SCHOTT	–

2022-7-1	StP, AP, SP
2019-4-1	Transmittance
2016-4-1	Prod. Freq.

J-K5

n_d = 1.522490 n_e = 1.524594

ν_d = 59.21 ν_e = 58.95

Glass code (d)
522592
Glass code (e)
525590

Spectral l.	Refractive idx
2.058	1.50022
1.970	1.50138
1.530	1.50659
1.129	1.51107
1.064	1.51187
t	1.51252
s	1.51503
A'	1.516727
r	1.518271
C	1.519803
C'	1.520231
He-Ne	1.520631
D	1.522411
d	1.522490
e	1.524594
F	1.528627
F'	1.529130
g	1.533427
h	1.537420
0.389	1.539861
i	1.544251

Coef. disp. form. (pwr ser.)	
A0	2.28421062E+00
A1	-8.15537489E-03
A2	-1.05573054E-04
A3	1.22386101E-02
A4	1.10833374E-04
A5	9.05979458E-06
A6	-1.07673777E-07
A7	0.00000000E+00
A8	0.00000000E+00

Partial dispersion	
F-C	0.008824
F'-C'	0.008899
C-t	0.007278
C-A'	0.003076
d-C	0.002687
e-C	0.004791
g-d	0.010937
g-F	0.004800
h-g	0.003993
i-g	0.010824
C'-t	0.007706
e-C'	0.004363
F'-e	0.004536
i-F'	0.015121

Relative partial dispersion	
C-t／F-C	0.8248
C-A'／F-C	0.3486
d-C／F-C	0.3045
e-C／F-C	0.5430
g-d／F-C	1.2395
g-F／F-C	0.5440
h-g／F-C	0.4525
i-g／F-C	1.2267
C'-t／F'-C'	0.8659
e-C'／F'-C'	0.4903
F'-e／F'-C'	0.5097
i-F'／F'-C'	1.6992

Deviation of relative partial disp.	
ΔPdC	0.0006
ΔPgF	-0.0010

Internal CC (80%/5%)
345/318
Color Code (80%/5%)
350/320
CCI
B –
G –
R –

Thermal properties	
CTE(-30,70) [1E-7/℃]	77
CTE(100,300) [1E-7/℃]	91
Tg [℃]	563
At [℃]	612
StP [℃]	503
AP [℃]	549
SP [℃]	735
Ht cndct. [W/m･K]	1.133
Sp. heat [kJ/kg･K]	0.728
Ht diffus. [1E-6 m2/sec]	0.617

Chemical properties [class]	
Acid res. (surface)	1
Alkaline detergent res.	1
Climate resistance	1
Water res. (powder)	3
Acid res. (powder)	1

Mechanical properties	
Knoop hardness	475 (5)
Abrasion hardness	94
Young's mod. [GPa]	73.1
Shear mod. [GPa]	29.9
Poisson's ratio	0.222
Stress optical coef. [1E-5 nm/cm／Pa]	2.79

Internal trans. (10mm)	
λ [nm]	τ
280	–
290	–
300	–
310	–
320	0.09
330	0.40
340	0.70
350	0.86
360	0.933
370	0.967
380	0.980
390	0.989
400	0.994
420	0.995
440	0.995
460	0.996
480	0.996
500	0.996
550	0.996
600	0.997
650	0.997
700	0.996
800	0.998
900	0.999
1000	0.999
1200	0.999
1400	0.970
1600	0.985
1800	0.974
2000	0.945
2200	0.80
2400	0.63

Specific gravity
2.52

Relative Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90 (ref.)	1.8	1.8	1.9	2.0	2.1	2.2	2.2	2.3	2.4	2.6	2.9	2.9	3.3	3.6	3.9
60 to 80 (ref.)	1.7	1.7	1.8	1.9	2.0	2.1	2.1	2.2	2.3	2.4	2.7	2.8	3.1	3.5	3.7
40 to 60	1.6	1.6	1.7	1.8	1.9	2.0	2.0	2.0	2.1	2.3	2.6	2.6	3.0	3.3	3.5
20 to 40	1.5	1.5	1.6	1.7	1.8	1.9	1.9	1.9	2.0	2.2	2.5	2.5	2.8	3.2	3.3
0 to 20	1.4	1.5	1.5	1.6	1.7	1.8	1.8	1.9	2.0	2.1	2.4	2.4	2.7	3.0	3.2
-20 to 0	1.4	1.5	1.5	1.6	1.7	1.8	1.8	1.8	1.9	2.1	2.3	2.4	2.7	3.0	3.1
-40 to -20	1.5	1.5	1.6	1.7	1.7	1.8	1.9	1.9	2.0	2.1	2.4	2.4	2.7	3.0	3.1
-60 to -40 (ref.)	1.6	1.7	1.7	1.8	1.9	2.0	2.0	2.0	2.1	2.2	2.5	2.5	2.8	3.0	3.2
-70 to -60 (ref.)	1.8	1.8	1.9	2.0	2.0	2.1	2.1	2.2	2.3	2.4	2.6	2.6	2.9	3.2	3.3

Absolute Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90	0.9	0.9	1.0	1.1	1.2	1.3	1.3	1.3	1.4	1.6	1.9	2.0	2.3	2.7	2.9
60 to 80	0.7	0.7	0.8	0.9	1.0	1.1	1.1	1.1	1.2	1.4	1.7	1.7	2.1	2.4	2.6
40 to 60	0.4	0.4	0.5	0.6	0.7	0.8	0.8	0.9	1.0	1.1	1.4	1.4	1.8	2.1	2.3
20 to 40	0.2	0.2	0.3	0.4	0.5	0.5	0.6	0.6	0.7	0.8	1.1	1.2	1.5	1.8	2.0
0 to 20	0.0	0.0	0.0	0.1	0.2	0.3	0.3	0.3	0.4	0.6	0.8	0.9	1.2	1.5	1.6
-20 to 0	-0.3	-0.3	-0.2	-0.1	-0.1	0.0	0.1	0.1	0.2	0.3	0.5	0.6	0.9	1.1	1.3
-40 to -20	-0.5	-0.5	-0.5	-0.4	-0.3	-0.2	-0.2	-0.2	-0.1	0.0	0.3	0.3	0.6	0.8	1.0
-60 to -40	-0.8	-0.8	-0.7	-0.6	-0.6	-0.5	-0.5	-0.5	-0.4	-0.3	0.0	0.0	0.3	0.5	0.6
-70 to -60	-1.0	-0.9	-0.9	-0.8	-0.8	-0.7	-0.7	-0.6	-0.6	-0.5	-0.2	-0.2	0.0	0.3	0.4

Coef. disp. form. (frac. eq.)(ref.)	
P1	1.36005021E-01
Q1	9.95639722E+01
P2	1.00006529E-02
Q2	3.33640621E-02
P3	2.89810235E-01
Q3	5.65060229E-03

Fitting error of disp. form. σ [1E-6]		
	Visible	Infrared
Power ser. eq.	0.5	9.2
Frac. eq. (ref.)	0.6	14.9

Prod. Freq. (A to D)	D

Similar glass type			
OHARA	–	HOYA	–
CDGM	H-K50	SCHOTT	N-K5

2022-7-1	StP, AP, SP
2020-4-1	Similar glass type
2019-4-1	Transmittance

J-KZFH1

n_d = 1.612660 n_e = 1.615934

ν_d = 44.46 ν_e = 44.21

Glass code (d)
613445
Glass code (e)
616442

Spectral l.	Refractive idx
2.058	1.58013
1.970	1.58175
1.530	1.58914
1.129	1.59556
1.064	1.59672
t	1.59767
s	1.60136
A'	1.603883
r	1.606206
C	1.608532
C'	1.609186
He-Ne	1.609797
D	1.612538
d	1.612660
e	1.615934
F	1.622313
F'	1.623117
g	1.630085
h	1.636718
0.389	1.640855
i	1.648477

Partial dispersion	
F-C	0.013781
F'-C'	0.013931
C-t	0.010858
C-A'	0.004649
d-C	0.004128
e-C	0.007402
g-d	0.017425
g-F	0.007772
h-g	0.006633
i-g	0.018392
C'-t	0.011512
e-C'	0.006748
F'-e	0.007183
i-F'	0.025360

Relative partial dispersion	
C-t／F-C	0.7879
C-A'／F-C	0.3373
d-C／F-C	0.2995
e-C／F-C	0.5371
g-d／F-C	1.2644
g-F／F-C	0.5640
h-g／F-C	0.4813
i-g／F-C	1.3346
C'-t／F'-C'	0.8264
e-C'／F'-C'	0.4844
F'-e／F'-C'	0.5156
i-F'／F'-C'	1.8204

Deviation of relative partial disp.	
ΔPdC	0.0023
ΔPgF	−0.0058

Internal CC (80%/5%)
348/319
Color Code (80%/5%)
355/320
CCI

B	0.00
G	0.19
R	0.21

Thermal properties	
CTE(−30,70) [1E-7/℃]	57
CTE(100,300) [1E-7/℃]	70
Tg [℃]	548
At [℃]	600
StP [℃]	500
AP [℃]	537
SP [℃]	679
Ht cndct. [W/m･K]	0.991
Sp. heat [kJ/kg･K]	0.738
Ht diffus. [1E-6 m2/sec]	0.479

Chemical properties [class]	
Acid res. (surface)	2
Alkaline detergent res.	2
Climate resistance	2
Water res. (powder)	3
Acid res. (powder)	4

Mechanical properties	
Knoop hardness	580 (6)
Abrasion hardness	133
Young's mod. [GPa]	81.3
Shear mod. [GPa]	32.6
Poisson's ratio	0.249
Stress optical coef. [1E-5 nm/cm／Pa]	3.54

Internal trans. (10mm)	
λ [nm]	τ
280	–
290	–
300	–
310	–
320	0.06
330	0.32
340	0.66
350	0.85
360	0.931
370	0.964
380	0.979
390	0.986
400	0.990
420	0.994
440	0.996
460	0.997
480	0.998
500	0.998
550	0.999
600	0.999
650	0.999
700	0.999
800	0.999
900	0.999
1000	0.999
1200	0.999
1400	0.977
1600	0.990
1800	0.980
2000	0.951
2200	0.82
2400	0.65

Specific gravity
2.8

Coef. disp. form. (pwr ser.)	
A0	2.54674023E+00
A1	−1.22652610E-02
A2	−1.34279040E-04
A3	1.85970683E-02
A4	5.22959966E-04
A5	−9.93145010E-06
A6	2.37371768E-06
A7	0.00000000E+00
A8	0.00000000E+00

Relative Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90 (ref.)	3.5	3.6	3.7	3.8	4.0	4.1	4.1	4.2	4.4	4.6	5.1	5.1	5.7	6.3	6.7
60 to 80 (ref.)	3.4	3.4	3.6	3.7	3.8	4.0	4.0	4.0	4.2	4.4	4.9	5.0	5.5	6.1	6.5
40 to 60	3.2	3.3	3.4	3.5	3.7	3.8	3.8	3.9	4.0	4.2	4.7	4.7	5.3	5.8	6.2
20 to 40	3.1	3.2	3.3	3.4	3.5	3.6	3.7	3.7	3.9	4.1	4.5	4.6	5.1	5.6	6.0
0 to 20	3.0	3.1	3.2	3.3	3.4	3.5	3.6	3.6	3.8	4.0	4.4	4.4	4.9	5.4	5.8
−20 to 0	3.0	3.0	3.2	3.3	3.4	3.5	3.5	3.5	3.7	3.9	4.3	4.3	4.8	5.3	5.6
−40 to −20	3.0	3.0	3.2	3.3	3.4	3.5	3.5	3.5	3.7	3.9	4.3	4.3	4.8	5.3	5.6
−60 to −40 (ref.)	3.2	3.2	3.3	3.4	3.5	3.6	3.6	3.6	3.8	4.0	4.3	4.4	4.8	5.3	5.6
−70 to −60 (ref.)	3.3	3.4	3.5	3.6	3.6	3.7	3.8	3.8	3.9	4.1	4.5	4.5	4.9	5.4	5.7

Absolute Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90	2.5	2.6	2.7	2.8	3.0	3.1	3.1	3.2	3.4	3.6	4.0	4.1	4.7	5.2	5.6
60 to 80	2.3	2.4	2.5	2.6	2.7	2.9	2.9	2.9	3.1	3.3	3.8	3.8	4.4	5.0	5.3
40 to 60	2.0	2.1	2.2	2.3	2.4	2.6	2.6	2.6	2.8	3.0	3.4	3.5	4.0	4.6	4.9
20 to 40	1.7	1.8	1.9	2.0	2.1	2.2	2.3	2.3	2.5	2.7	3.1	3.1	3.6	4.2	4.5
0 to 20	1.5	1.5	1.6	1.7	1.8	1.9	2.0	2.0	2.1	2.3	2.7	2.8	3.3	3.8	4.1
−20 to 0	1.2	1.2	1.3	1.4	1.5	1.6	1.6	1.7	1.8	2.0	2.4	2.4	2.9	3.4	3.7
−40 to −20	0.9	0.9	1.0	1.1	1.2	1.3	1.3	1.4	1.5	1.7	2.0	2.1	2.5	3.0	3.3
−60 to −40	0.6	0.6	0.7	0.8	0.9	1.0	1.0	1.1	1.2	1.3	1.7	1.7	2.2	2.6	2.9
−70 to −60	0.4	0.4	0.5	0.6	0.7	0.8	0.8	0.8	0.9	1.1	1.4	1.5	1.9	2.3	2.6

Coef. disp. form. (frac. eq.)(ref.)	
P1	1.12852557E-01
Q1	6.44828839E+01
P2	1.63091315E-02
Q2	4.47179637E-02
P3	3.23827161E-01
Q3	6.24486335E-03

Fitting error of disp. form. σ [1E-6]		
	Visible	Infrared
Power ser. eq.	1.3	10.3
Frac. eq. (ref.)	1.4	11.8

Prod. Freq. (A to D)	A

Similar glass type			
OHARA	S-NBM51	HOYA	E-ADF10
CDGM	H-TF3L	SCHOTT	N-KZFS4

2023-9-1	Prod. Freq.
2022-7-1	StP, AP, SP
2019-4-1	Transmittance

J-KZFH4

n_d = 1.552981 n_e = 1.555374

ν_d = 55.07 ν_e = 54.85

Glass code (d)
553551
Glass code (e)
555549

Spectral l.	Refractive idx
2.058	1.52623
1.970	1.52769
1.530	1.53428
1.129	1.53978
1.064	1.54074
t	1.54152
s	1.54445
A'	1.546406
r	1.548174
C	1.549923
C'	1.550410
He-Ne	1.550865
D	1.552892
d	1.552981
e	1.555374
F	1.559964
F'	1.560536
g	1.565433
h	1.569990
0.389	1.572780
i	1.577811

Partial dispersion	
F-C	0.010041
F'-C'	0.010126
C-t	0.008404
C-A'	0.003517
d-C	0.003058
e-C	0.005451
g-d	0.012452
g-F	0.005469
h-g	0.004557
i-g	0.012378
C'-t	0.008891
e-C'	0.004964
F'-e	0.005162
i-F'	0.017275

Relative partial dispersion	
C-t／F-C	0.8370
C-A'／F-C	0.3503
d-C／F-C	0.3046
e-C／F-C	0.5429
g-d／F-C	1.2401
g-F／F-C	0.5447
h-g／F-C	0.4538
i-g／F-C	1.2327
C'-t／F'-C'	0.8780
e-C'／F'-C'	0.4902
F'-e／F'-C'	0.5098
i-F'／F'-C'	1.7060

Deviation of relative partial disp.	
ΔPdC	0.0025
ΔPgF	−0.0073

Internal CC (80%/5%)
335/295
Color Code (80%/5%)
345/295
CCI

B	0.00
G	0.15
R	0.13

Thermal properties	
CTE(−30,70) [1E-7/℃]	48
CTE(100,300) [1E-7/℃]	63
Tg [℃]	544
At [℃]	594
StP [℃]	489
AP [℃]	532
SP [℃]	691
Ht cndct. [W/m･K]	0.934
Sp. heat [kJ/kg･K]	0.737
Ht diffus. [1E-6 m2/sec]	0.484

Chemical properties [class]	
Acid res. (surface)	2
Alkaline detergent res.	3
Climate resistance	2
Water res. (powder)	1
Acid res. (powder)	3

Mechanical properties	
Knoop hardness	409 (4)
Abrasion hardness	67
Young's mod. [GPa]	66.4
Shear mod. [GPa]	26.0
Poisson's ratio	0.275
Stress optical coef. [1E-5 nm/cm／Pa]	3.60

Internal trans. (10mm)	
λ [nm]	τ
280	–
290	–
300	0.12
310	0.35
320	0.58
330	0.74
340	0.84
350	0.906
360	0.945
370	0.969
380	0.981
390	0.988
400	0.992
420	0.996
440	0.997
460	0.998
480	0.999
500	0.999
550	0.999
600	0.999
650	0.999
700	0.999
800	0.999
900	0.997
1000	0.997
1200	0.998
1400	0.976
1600	0.985
1800	0.975
2000	0.945
2200	0.81
2400	0.59

Specific gravity
2.62

Coef. disp. form. (pwr ser.)	
A0	2.37404487E+00
A1	−1.07631771E-02
A2	−1.28642692E-04
A3	1.35709369E-02
A4	2.55765647E-04
A5	−2.23388334E-06
A6	4.91067955E-07
A7	0.00000000E+00
A8	0.00000000E+00

Relative Δn/ΔT [1E-6/℃]															
Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90 (ref.)	4.9	4.9	5.0	5.2	5.3	5.4	5.4	5.5	5.6	5.8	6.1	6.1	6.5	6.9	7.2
60 to 80 (ref.)	4.8	4.8	4.9	5.0	5.1	5.3	5.3	5.3	5.5	5.6	5.9	6.0	6.4	6.7	7.0
40 to 60	4.7	4.7	4.8	4.9	5.0	5.1	5.1	5.2	5.3	5.4	5.7	5.8	6.2	6.5	6.7
20 to 40	4.6	4.6	4.7	4.8	4.9	5.0	5.0	5.0	5.1	5.3	5.6	5.6	6.0	6.3	6.5
0 to 20	4.5	4.5	4.6	4.7	4.8	4.9	4.9	4.9	5.0	5.2	5.4	5.5	5.8	6.1	6.3
−20 to 0	4.5	4.5	4.5	4.6	4.7	4.8	4.8	4.9	5.0	5.1	5.4	5.4	5.7	6.0	6.2
−40 to −20	4.5	4.5	4.6	4.7	4.7	4.8	4.9	4.9	5.0	5.1	5.4	5.4	5.7	6.0	6.1
−60 to −40 (ref.)	4.6	4.6	4.7	4.8	4.8	4.9	5.0	5.0	5.1	5.2	5.4	5.5	5.7	6.0	6.1
−70 to −60 (ref.)	4.8	4.8	4.8	4.9	5.0	5.1	5.1	5.1	5.2	5.3	5.6	5.6	5.9	6.1	6.2

Absolute Δn/ΔT [1E-6/℃]															
Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90	4.0	4.0	4.1	4.2	4.3	4.4	4.5	4.5	4.6	4.8	5.1	5.2	5.6	5.9	6.2
60 to 80	3.8	3.8	3.9	4.0	4.1	4.2	4.2	4.3	4.4	4.6	4.9	4.9	5.3	5.7	5.9
40 to 60	3.5	3.5	3.6	3.7	3.8	3.9	3.9	4.0	4.1	4.2	4.5	4.6	4.9	5.3	5.5
20 to 40	3.2	3.2	3.3	3.4	3.5	3.6	3.6	3.7	3.8	3.9	4.2	4.2	4.6	4.9	5.1
0 to 20	3.0	3.0	3.0	3.1	3.2	3.3	3.3	3.4	3.5	3.6	3.9	3.9	4.2	4.5	4.7
−20 to 0	2.7	2.7	2.8	2.9	2.9	3.0	3.1	3.1	3.2	3.3	3.5	3.6	3.9	4.2	4.3
−40 to −20	2.4	2.4	2.5	2.6	2.7	2.7	2.8	2.8	2.9	3.0	3.2	3.2	3.5	3.8	3.9
−60 to −40	2.2	2.2	2.2	2.3	2.4	2.4	2.5	2.5	2.6	2.7	2.9	2.9	3.2	3.4	3.6
−70 to −60	2.0	1.9	2.0	2.1	2.1	2.2	2.2	2.3	2.3	2.4	2.6	2.7	2.9	3.1	3.3

Coef. disp. form. (frac. eq.)(ref.)	
P1	1.10309099E-01
Q1	6.59547831E+01
P2	3.47235922E-02
Q2	2.40152655E-02
P3	2.79391962E-01
Q3	4.71244161E-03

Fitting error of disp. form. σ [1E-6]		
	Visible	Infrared
Power ser. eq.	0.4	4.0
Frac. eq. (ref.)	0.6	6.1

Prod. Freq. (A to D)	B

Similar glass type			
OHARA	–	HOYA	–
CDGM	–	SCHOTT	–

2022-7-1	StP, AP, SP
2019-4-1	Transmittance
2016-4-1	1st edition

HIKARI GLASS CO., LTD.

J-KZFH6

n_d = 1.683760 n_e = 1.688068

ν_d = 37.64 ν_e = 37.39

Glass code (d)
684376
Glass code (e)
688374

Spectral l.	Refractive idx
2.058	1.64728
1.970	1.64877
1.530	1.65584
1.129	1.66259
1.064	1.66389
t	1.66499
s	1.66937
A'	1.672490
r	1.675419
C	1.678397
C'	1.679240
He-Ne	1.680031
D	1.683601
d	1.683760
e	1.688068
F	1.696564
F'	1.697644
g	1.707068
h	1.716148
0.389	1.721865
i	1.732514

Partial dispersion	
F-C	0.018167
F'-C'	0.018404
C-t	0.013408
C-A'	0.005907
d-C	0.005363
e-C	0.009671
g-d	0.023308
g-F	0.010504
h-g	0.009080
i-g	0.025446
C'-t	0.014251
e-C'	0.008828
F'-e	0.009576
i-F'	0.034870

Relative partial dispersion	
C-t／F-C	0.7380
C-A'／F-C	0.3251
d-C／F-C	0.2952
e-C／F-C	0.5323
g-d／F-C	1.2830
g-F／F-C	0.5782
h-g／F-C	0.4998
i-g／F-C	1.4007
C'-t／F'-C'	0.7743
e-C'／F'-C'	0.4797
F'-e／F'-C'	0.5203
i-F'／F'-C'	1.8947

Deviation of relative partial disp.	
ΔPdC	0.0010
ΔPgF	−0.0030

Internal CC (80%/5%)
354/324
Color Code (80%/5%)
370/325

CCI	
B	0.00
G	0.55
R	0.59

Thermal properties	
CTE(−30,70) [1E-7/℃]	66
CTE(100,300) [1E-7/℃]	87
Tg [℃]	539
At [℃]	598
StP [℃]	496
AP [℃]	534
SP [℃]	681
Ht cndct. [W/m·K]	0.940
Sp. heat [kJ/kg·K]	0.670
Ht diffus. [1E-6 m2/sec]	0.448

Chemical properties [class]	
Acid res. (surface)	1
Alkaline detergent res.	1
Climate resistance	1
Water res. (powder)	1
Acid res. (powder)	1

Mechanical properties	
Knoop hardness	533 (5)
Abrasion hardness	134
Young's mod. [GPa]	93.7
Shear mod. [GPa]	37.4
Poisson's ratio	0.254
Stress optical coef. [1E-5 nm/cm／Pa]	3.52

Internal trans. (10mm)	
λ [nm]	τ
280	–
290	–
300	–
310	–
320	0.01
330	0.18
340	0.53
350	0.75
360	0.86
370	0.918
380	0.948
390	0.964
400	0.974
420	0.983
440	0.987
460	0.990
480	0.992
500	0.994
550	0.997
600	0.997
650	0.998
700	0.997
800	0.999
900	0.999
1000	0.999
1200	0.999
1400	0.992
1600	0.994
1800	0.984
2000	0.971
2200	0.906
2400	0.81

Specific gravity
3.13

Coef. disp. form. (pwr ser.)	
A0	2.76011543E+00
A1	−1.23775063E-02
A2	0.00000000E+00
A3	2.44484473E-02
A4	1.15656997E-03
A5	−9.74000173E-05
A6	1.85226731E-05
A7	−1.41521524E-06
A8	5.92951085E-08

Relative Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90 (ref.)	3.2	3.3	3.4	3.6	3.8	4.1	4.1	4.2	4.5	4.8	5.6	5.7	6.7	7.7	8.4
60 to 80 (ref.)	3.1	3.1	3.4	3.5	3.7	3.9	4.0	4.0	4.3	4.7	5.4	5.5	6.4	7.4	8.1
40 to 60	2.9	3.0	3.2	3.4	3.6	3.7	3.8	3.9	4.1	4.5	5.2	5.2	6.1	7.0	7.7
20 to 40	2.8	2.9	3.1	3.3	3.4	3.6	3.7	3.7	4.0	4.3	4.9	5.0	5.8	6.7	7.3
0 to 20	2.8	2.8	3.0	3.2	3.3	3.5	3.6	3.6	3.9	4.1	4.8	4.8	5.6	6.4	7.0
−20 to 0	2.8	2.8	3.0	3.1	3.3	3.5	3.5	3.6	3.8	4.1	4.6	4.7	5.4	6.2	6.8
−40 to −20	2.8	2.9	3.0	3.2	3.3	3.5	3.5	3.6	3.8	4.1	4.6	4.7	5.3	6.1	6.6
−60 to −40 (ref.)	3.0	3.0	3.2	3.3	3.5	3.6	3.6	3.7	3.9	4.1	4.6	4.7	5.3	6.0	6.5
−70 to −60 (ref.)	3.1	3.2	3.4	3.5	3.6	3.8	3.8	3.9	4.0	4.3	4.8	4.8	5.4	6.1	6.5

Absolute Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90	2.2	2.2	2.4	2.6	2.8	3.0	3.1	3.1	3.4	3.8	4.5	4.6	5.6	6.6	7.3
60 to 80	2.0	2.0	2.2	2.4	2.6	2.8	2.8	2.9	3.2	3.5	4.2	4.3	5.2	6.2	6.9
40 to 60	1.7	1.7	1.9	2.1	2.3	2.5	2.5	2.6	2.8	3.2	3.8	3.9	4.8	5.7	6.3
20 to 40	1.4	1.5	1.6	1.8	2.0	2.2	2.2	2.3	2.5	2.8	3.4	3.5	4.3	5.2	5.8
0 to 20	1.1	1.2	1.4	1.5	1.7	1.8	1.9	1.9	2.2	2.5	3.1	3.1	3.9	4.7	5.3
−20 to 0	0.9	0.9	1.1	1.2	1.4	1.5	1.6	1.6	1.8	2.1	2.7	2.7	3.4	4.2	4.7
−40 to −20	0.6	0.6	0.8	0.9	1.1	1.2	1.3	1.3	1.5	1.8	2.3	2.3	3.0	3.7	4.2
−60 to −40	0.3	0.3	0.5	0.6	0.8	0.9	0.9	1.0	1.2	1.4	1.9	1.9	2.5	3.2	3.6
−70 to −60	0.1	0.1	0.3	0.4	0.5	0.7	0.7	0.7	0.9	1.1	1.6	1.6	2.2	2.8	3.2

Coef. disp. form. (frac. eq.)(ref.)	
P1	1.36151744E-01
Q1	8.82344575E+01
P2	2.58910372E-02
Q2	4.47526587E-02
P3	3.43689118E-01
Q3	6.53259775E-03

Fitting error of disp. form. σ [1E-6]	Visible	Infrared
Power ser. eq.	0.7	14.5
Frac. eq. (ref.)	2.7	11.2

Prod. Freq. (A to D)	A

Similar glass type			
OHARA	–	HOYA	–
CDGM	–	SCHOTT	–

2022-7-1	StP, AP, SP
2019-4-1	Transmittance
2018-9-1	1st edition

HIKARI GLASS CO., LTD.

J-KZFH7

n_d = 1.732110 n_e = 1.735883

ν_d = 46.18 ν_e = 45.93

Glass code (d)
732462
Glass code (e)
736459

Spectral l.	Refractive idx
2.058	1.69859
1.970	1.70002
1.530	1.70671
1.129	1.71299
1.064	1.71419
t	1.71520
s	1.71922
A'	1.722051
r	1.724693
C	1.727358
C'	1.728109
He-Ne	1.728812
D	1.731970
d	1.732110
e	1.735883
F	1.743210
F'	1.744130
g	1.752052
h	1.759489
0.389	1.764068
i	1.772368

Partial dispersion	
F-C	0.015852
F'-C'	0.016021
C-t	0.012156
C-A'	0.005307
d-C	0.004752
e-C	0.008525
g-d	0.019942
g-F	0.008842
h-g	0.007437
i-g	0.020316
C'-t	0.012907
e-C'	0.007774
F'-e	0.008247
i-F'	0.028238

Relative partial dispersion	
C-t／F-C	0.7668
C-A'／F-C	0.3348
d-C／F-C	0.2998
e-C／F-C	0.5378
g-d／F-C	1.2580
g-F／F-C	0.5578
h-g／F-C	0.4692
i-g／F-C	1.2816
C'-t／F'-C'	0.8056
e-C'／F'-C'	0.4852
F'-e／F'-C'	0.5148
i-F'／F'-C'	1.7626

Deviation of relative partial disp.	
ΔPdC	0.0017
ΔPgF	−0.0091

Internal CC (80%/5%)
335/290
Color Code (80%/5%)
365/290

CCI	
B	0.00
G	0.39
R	0.39

Thermal properties	
CTE(−30,70) [1E-7/℃]	65
CTE(100,300) [1E-7/℃]	89
Tg [℃]	508
At [℃]	563
StP [℃]	475
AP [℃]	507
SP [℃]	631
Ht cndct. [W/m·K]	0.868
Sp. heat [kJ/kg·K]	0.575
Ht diffus. [1E-6 m2/sec]	0.371

Chemical properties [class]	
Acid res. (surface)	4
Alkaline detergent res.	2
Climate resistance	1
Water res. (powder)	1
Acid res. (powder)	3

Mechanical properties	
Knoop hardness	580 (6)
Abrasion hardness	96
Young's mod. [GPa]	107.3
Shear mod. [GPa]	41.6
Poisson's ratio	0.290
Stress optical coef. [1E-5 nm/cm／Pa]	2.52

Internal trans. (10mm)	
λ [nm]	τ
280	0.04
290	0.07
300	0.24
310	0.46
320	0.64
330	0.76
340	0.85
350	0.902
360	0.938
370	0.960
380	0.972
390	0.979
400	0.983
420	0.987
440	0.990
460	0.993
480	0.995
500	0.995
550	0.998
600	0.998
650	0.998
700	0.998
800	0.999
900	0.998
1000	0.998
1200	0.997
1400	0.995
1600	0.995
1800	0.987
2000	0.972
2200	0.944
2400	0.82

Specific gravity
4.07

Coef. disp. form. (pwr ser.)	
A0	2.92982429E+00
A1	−1.15064058E-02
A2	−9.01320677E-05
A3	2.42192502E-02
A4	4.84339860E-04
A5	3.92109984E-06
A6	7.18628425E-07
A7	0.00000000E+00
A8	0.00000000E+00

Relative Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90 (ref.)	5.3	5.4	5.6	5.9	6.1	6.3	6.4	6.4	6.7	7.0	7.7	7.7	8.5	9.3	9.8
60 to 80 (ref.)	5.2	5.3	5.6	5.8	6.0	6.2	6.2	6.3	6.5	6.8	7.5	7.6	8.3	9.1	9.6
40 to 60	5.1	5.2	5.4	5.6	5.8	6.0	6.0	6.1	6.4	6.7	7.3	7.3	8.1	8.8	9.3
20 to 40	5.0	5.0	5.3	5.5	5.7	5.9	5.9	6.0	6.2	6.5	7.1	7.2	7.8	8.5	9.0
0 to 20	4.9	5.0	5.2	5.4	5.6	5.8	5.8	5.9	6.1	6.4	6.9	7.0	7.7	8.3	8.8
−20 to 0	4.9	5.0	5.2	5.4	5.5	5.7	5.8	5.8	6.0	6.3	6.8	6.9	7.5	8.2	8.6
−40 to −20	5.0	5.0	5.2	5.4	5.6	5.8	5.8	5.8	6.1	6.3	6.8	6.9	7.5	8.1	8.5
−60 to −40 (ref.)	5.1	5.2	5.4	5.6	5.7	5.9	5.9	6.0	6.2	6.4	6.9	7.0	7.5	8.1	8.5
−70 to −60 (ref.)	5.3	5.4	5.6	5.7	5.9	6.1	6.1	6.1	6.3	6.6	7.1	7.1	7.7	8.2	8.6

Absolute Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90	4.3	4.3	4.6	4.8	5.0	5.2	5.3	5.3	5.6	5.9	6.6	6.6	7.4	8.2	8.7
60 to 80	4.1	4.1	4.4	4.6	4.8	5.0	5.0	5.1	5.4	5.7	6.3	6.4	7.1	7.9	8.4
40 to 60	3.8	3.9	4.1	4.3	4.5	4.7	4.7	4.8	5.0	5.3	5.9	6.0	6.7	7.4	7.9
20 to 40	3.5	3.6	3.8	4.0	4.2	4.4	4.4	4.5	4.7	5.0	5.5	5.6	6.3	7.0	7.4
0 to 20	3.2	3.3	3.5	3.7	3.9	4.0	4.1	4.1	4.4	4.6	5.2	5.2	5.9	6.5	7.0
−20 to 0	2.9	3.0	3.2	3.4	3.6	3.7	3.8	3.8	4.0	4.3	4.8	4.9	5.5	6.1	6.5
−40 to −20	2.7	2.7	2.9	3.1	3.3	3.4	3.5	3.5	3.7	4.0	4.4	4.5	5.1	5.7	6.1
−60 to −40	2.4	2.4	2.6	2.8	2.9	3.1	3.1	3.2	3.4	3.6	4.1	4.1	4.7	5.2	5.6
−70 to −60	2.2	2.2	2.4	2.6	2.7	2.9	2.9	2.9	3.1	3.4	3.8	3.9	4.4	4.9	5.3

Coef. disp. form. (frac. eq.)(ref.)	
P1	1.34679629E-01
Q1	9.52571480E+01
P2	5.85653677E-02
Q2	2.35306968E-02
P3	3.32892041E-01
Q3	4.88022239E-03

Fitting error of disp. form. σ [1E-6]		
	Visible	Infrared
Power ser. eq.	0.6	7.8
Frac. eq. (ref.)	0.7	6.8

Prod. Freq. (A to D)	B

Similar glass type			
OHARA	−	HOYA	−
CDGM	−	SCHOTT	−

2022-7-1	StP, AP, SP
2019-4-1	Transmittance
2018-9-1	1st edition

HIKARI GLASS CO., LTD.

J-KZFH9

n_d = 1.738000 n_e = 1.743413

ν_d = 32.26 ν_e = 32.04

Glass code (d)
738323
Glass code (e)
743320

Spectral l.	Refractive idx
2.058	1.69481
1.970	1.69647
1.530	1.70434
1.129	1.71208
1.064	1.71361
t	1.71491
s	1.72020
A'	1.724010
r	1.727619
C	1.731309
C'	1.732358
He-Ne	1.733341
D	1.737801
d	1.738000
e	1.743413
F	1.754185
F'	1.755563
g	1.767673
h	1.779490
0.389	1.787012
i	1.801209

Partial dispersion	
F-C	0.022876
F'-C'	0.023205
C-t	0.016396
C-A'	0.007299
d-C	0.006691
e-C	0.012104
g-d	0.029673
g-F	0.013488
h-g	0.011817
i-g	0.033536
C'-t	0.017445
e-C'	0.011055
F'-e	0.012150
i-F'	0.045646

Internal CC (80%/5%)
358/330
Color Code (80%/5%)
385/330

CCI	
B	0.00
G	0.80
R	0.86

Internal trans. (10mm)	
λ [nm]	τ
280	–
290	–
300	–
310	–
320	–
330	0.05
340	0.35
350	0.67
360	0.82
370	0.89
380	0.926
390	0.947
400	0.962
420	0.977
440	0.984
460	0.988
480	0.991
500	0.993
550	0.998
600	0.998
650	0.999
700	0.999
800	0.999
900	0.999
1000	0.999
1200	0.999
1400	0.995
1600	0.995
1800	0.986
2000	0.975
2200	0.927
2400	0.86

Thermal properties	
CTE(-30,70) [1E-7/℃]	70
CTE(100,300) [1E-7/℃]	94
Tg [℃]	517
At [℃]	561
StP [℃]	469
AP [℃]	503
SP [℃]	636
Ht cndct. [W/m·K]	1.060
Sp. heat [kJ/kg·K]	0.719
Ht diffus. [1E-6 m2/sec]	0.462

Relative partial dispersion	
C-t／F-C	0.7167
C-A'／F-C	0.3191
d-C／F-C	0.2925
e-C／F-C	0.5291
g-d／F-C	1.2971
g-F／F-C	0.5896
h-g／F-C	0.5166
i-g／F-C	1.4660
C'-t／F'-C'	0.7518
e-C'／F'-C'	0.4764
F'-e／F'-C'	0.5236
i-F'／F'-C'	1.9671

Chemical properties [class]	
Acid res. (surface)	1
Alkaline detergent res.	1
Climate resistance	1
Water res. (powder)	1
Acid res. (powder)	1

Mechanical properties	
Knoop hardness	609 (6)
Abrasion hardness	128
Young's mod. [GPa]	99.9
Shear mod. [GPa]	39.8
Poisson's ratio	0.256
Stress optical coef. [1E-5 nm/cm／Pa]	3.55

Specific gravity
3.19

Coef. disp. form. (pwr ser.)	
A0	2.92190512E+00
A1	-1.31913454E-02
A2	-7.94286252E-05
A3	3.27997049E-02
A4	7.00950165E-04
A5	1.24169090E-04
A6	-1.12359582E-05
A7	9.11052912E-07
A8	0.00000000E+00

Deviation of relative partial disp.	
ΔPdC	0.0007
ΔPgF	-0.0006

Relative Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90 (ref.)	3.4	3.5	3.8	4.0	4.3	4.6	4.6	4.7	5.1	5.5	6.5	6.7	8.0	9.4	10.4
60 to 80 (ref.)	3.3	3.4	3.7	3.9	4.1	4.4	4.4	4.5	4.9	5.3	6.3	6.4	7.6	9.0	10.0
40 to 60	3.1	3.2	3.4	3.6	3.9	4.1	4.2	4.3	4.6	5.0	5.9	6.0	7.2	8.5	9.4
20 to 40	2.9	3.0	3.2	3.5	3.7	3.9	4.0	4.0	4.4	4.7	5.6	5.7	6.8	8.1	8.9
0 to 20	2.8	2.9	3.1	3.3	3.5	3.7	3.8	3.9	4.2	4.5	5.3	5.4	6.5	7.6	8.4
-20 to 0	2.7	2.8	3.0	3.2	3.4	3.6	3.7	3.7	4.0	4.4	5.1	5.2	6.2	7.3	8.0
-40 to -20	2.7	2.8	3.0	3.2	3.4	3.6	3.6	3.7	3.9	4.3	5.0	5.1	6.0	7.0	7.7
-60 to -40 (ref.)	2.8	2.9	3.1	3.3	3.4	3.6	3.7	3.7	4.0	4.3	4.9	5.0	5.9	6.8	7.4
-70 to -60 (ref.)	3.0	3.1	3.2	3.4	3.6	3.7	3.8	3.8	4.1	4.4	5.0	5.1	5.9	6.7	7.3

Absolute Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90	2.4	2.5	2.7	3.0	3.2	3.5	3.6	3.6	4.0	4.4	5.4	5.6	6.8	8.3	9.3
60 to 80	2.1	2.2	2.5	2.7	2.9	3.2	3.3	3.3	3.7	4.1	5.1	5.2	6.4	7.8	8.7
40 to 60	1.8	1.9	2.1	2.3	2.5	2.8	2.9	2.9	3.3	3.7	4.6	4.7	5.8	7.1	8.0
20 to 40	1.5	1.5	1.8	2.0	2.2	2.4	2.5	2.5	2.8	3.2	4.1	4.2	5.3	6.5	7.3
0 to 20	1.1	1.2	1.4	1.6	1.8	2.0	2.1	2.1	2.4	2.8	3.6	3.7	4.7	5.8	6.6
-20 to 0	0.8	0.8	1.1	1.2	1.4	1.6	1.7	1.7	2.0	2.3	3.1	3.2	4.1	5.2	5.9
-40 to -20	0.4	0.5	0.7	0.9	1.0	1.2	1.3	1.3	1.6	1.9	2.6	2.7	3.6	4.5	5.2
-60 to -40	0.1	0.2	0.3	0.5	0.7	0.8	0.9	0.9	1.2	1.5	2.1	2.2	3.0	3.9	4.5
-70 to -60	-0.1	-0.1	0.1	0.2	0.4	0.5	0.6	0.6	0.9	1.1	1.7	1.8	2.6	3.4	4.0

Coef. disp. form. (frac. eq.)(ref.)	
P1	1.47480163E-01
Q1	9.14659513E+01
P2	2.74082006E-02
Q2	5.00590165E-02
P3	3.63073654E-01
Q3	7.34787952E-03

Fitting error of disp. form. σ [1E-6]		
	Visible	Infrared
Power ser. eq.	0.9	7.1
Frac. eq. (ref.)	3.1	7.6

Prod. Freq. (A to D)	A

Similar glass type			
OHARA	S-NBH53V	HOYA	NBFD32
CDGM	–	SCHOTT	–

–	–
2022-7-1	StP, AP, SP, Similar glass type
2020-4-1	1st edition

HIKARI GLASS CO., LTD.

J-KZFH10

n_d = 1.788800 n_e = 1.795356

ν_d = 28.42 ν_e = 28.21

Glass code (d)
789284
Glass code (e)
795282

Spectral l.	Refractive idx
2.058	1.74014
1.970	1.74182
1.530	1.74993
1.129	1.75831
1.064	1.76003
t	1.76151
s	1.76760
A'	1.772078
r	1.776354
C	1.780756
C'	1.782011
He-Ne	1.783191
D	1.788559
d	1.788800
e	1.795356
F	1.808514
F'	1.810206
g	1.825186
h	1.839981
0.389	1.849498
i	1.867685

Partial dispersion	
F-C	0.027758
F'-C'	0.028195
C-t	0.019247
C-A'	0.008678
d-C	0.008044
e-C	0.014600
g-d	0.036386
g-F	0.016672
h-g	0.014795
i-g	0.042499
C'-t	0.020502
e-C'	0.013345
F'-e	0.014850
i-F'	0.057479

Internal CC (80%/5%)
366/336
Color Code (80%/5%)
415/335

CCI	
B	0.00
G	1.31
R	1.52

Internal trans. (10mm)	
λ [nm]	τ
280	–
290	–
300	–
310	–
320	–
330	–
340	0.14
350	0.51
360	0.74
370	0.82
380	0.87
390	0.907
400	0.931
420	0.959
440	0.969
460	0.975
480	0.980
500	0.984
550	0.991
600	0.995
650	0.996
700	0.997
800	0.999
900	0.999
1000	0.999
1200	0.999
1400	0.996
1600	0.994
1800	0.983
2000	0.977
2200	0.943
2400	0.933

Coef. disp. form. (pwr ser.)	
A0	3.07658400E+00
A1	-1.33765417E-02
A2	-7.86716819E-05
A3	4.02814050E-02
A4	8.62482819E-04
A5	2.06057925E-04
A6	-2.00214781E-05
A7	1.63512379E-06
A8	0.00000000E+00

Relative partial dispersion	
C-t／F-C	0.6934
C-A'／F-C	0.3126
d-C／F-C	0.2898
e-C／F-C	0.5260
g-d／F-C	1.3108
g-F／F-C	0.6006
h-g／F-C	0.5330
i-g／F-C	1.5311
C'-t／F'-C'	0.7272
e-C'／F'-C'	0.4733
F'-e／F'-C'	0.5267
i-F'／F'-C'	2.0386

Deviation of relative partial disp.	
ΔPdC	-0.0002
ΔPgF	0.0039

Thermal properties	
CTE(-30,70) [1E-7/℃]	70
CTE(100,300) [1E-7/℃]	94
Tg [℃]	562
At [℃]	601
StP [℃]	511
AP [℃]	546
SP [℃]	679
Ht cndct. [W/m･K]	1.040
Sp. heat [kJ/kg･K]	0.702
Ht diffus. [1E-6 m2/sec]	0.445

Chemical properties [class]	
Acid res. (surface)	1
Alkaline detergent res.	1
Climate resistance	1
Water res. (powder)	1
Acid res. (powder)	1

Mechanical properties	
Knoop hardness	600 (6)
Abrasion hardness	126
Young's mod. [GPa]	102.7
Shear mod. [GPa]	41.3
Poisson's ratio	0.245
Stress optical coef. [1E-5 nm/cm／Pa]	3.11

Specific gravity
3.33

Relative Δn/ΔT [1E-6/℃]															
Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90 (ref.)	3.1	3.1	3.4	3.7	4.0	4.3	4.4	4.5	4.9	5.5	6.7	6.9	8.6	10.5	11.9
60 to 80 (ref.)	2.9	3.0	3.3	3.5	3.8	4.1	4.2	4.3	4.7	5.2	6.5	6.6	8.2	10.1	11.4
40 to 60	2.7	2.8	3.0	3.3	3.6	3.8	3.9	4.0	4.4	4.9	6.1	6.2	7.8	9.5	10.8
20 to 40	2.5	2.6	2.9	3.1	3.4	3.6	3.7	3.8	4.2	4.7	5.8	5.9	7.3	9.0	10.2
0 to 20	2.4	2.4	2.7	2.9	3.2	3.5	3.5	3.6	4.0	4.4	5.5	5.6	6.9	8.5	9.6
-20 to 0	2.3	2.4	2.6	2.8	3.1	3.3	3.4	3.5	3.8	4.3	5.2	5.4	6.6	8.1	9.1
-40 to -20	2.3	2.3	2.6	2.8	3.0	3.3	3.4	3.4	3.8	4.2	5.1	5.2	6.4	7.7	8.7
-60 to -40 (ref.)	2.4	2.4	2.7	2.9	3.1	3.3	3.4	3.5	3.8	4.2	5.0	5.1	6.2	7.5	8.4
-70 to -60 (ref.)	2.5	2.6	2.8	3.0	3.2	3.5	3.5	3.6	3.9	4.3	5.1	5.2	6.2	7.4	8.2

Absolute Δn/ΔT [1E-6/℃]															
Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90	2.0	2.1	2.3	2.6	2.9	3.2	3.3	3.4	3.8	4.4	5.6	5.8	7.4	9.3	10.7
60 to 80	1.7	1.8	2.1	2.3	2.6	2.9	3.0	3.1	3.5	4.0	5.2	5.4	7.0	8.8	10.1
40 to 60	1.4	1.4	1.7	1.9	2.2	2.5	2.6	2.7	3.1	3.6	4.7	4.8	6.3	8.1	9.3
20 to 40	1.0	1.1	1.3	1.6	1.8	2.1	2.2	2.2	2.6	3.1	4.2	4.3	5.7	7.3	8.5
0 to 20	0.6	0.7	1.0	1.2	1.4	1.7	1.8	1.8	2.2	2.7	3.6	3.8	5.1	6.6	7.7
-20 to 0	0.3	0.3	0.6	0.8	1.0	1.3	1.4	1.4	1.8	2.2	3.1	3.3	4.5	5.9	6.9
-40 to -20	-0.1	0.0	0.2	0.4	0.6	0.9	1.0	1.0	1.3	1.7	2.6	2.7	3.9	5.2	6.1
-60 to -40	-0.4	-0.4	-0.1	0.1	0.3	0.5	0.5	0.6	0.9	1.3	2.1	2.2	3.2	4.4	5.3
-70 to -60	-0.7	-0.6	-0.4	-0.2	0.0	0.2	0.2	0.3	0.6	0.9	1.7	1.8	2.8	3.9	4.7

Coef. disp. form. (frac. eq.)(ref.)	
P1	1.27426259E-01
Q1	8.33940499E+01
P2	2.97710686E-02
Q2	5.39052175E-02
P3	3.79284474E-01
Q3	8.02008706E-03

Fitting error of disp. form. σ [1E-6]		
	Visible	Infrared
Power ser. eq.	1.1	6.2
Frac. eq. (ref.)	3.9	16.0

Prod. Freq. (A to D)	A

Similar glass type			
OHARA	S-NBH58	HOYA	NBFD29
CDGM	–	SCHOTT	–

–	–
–	–
2022-7-1	1st edition

HIKARI GLASS CO., LTD.

J-KZFH11

n_d = 1.849340 n_e = 1.857324

ν_d = 25.08 ν_e = 24.89

Glass code (d)
849251
Glass code (e)
857249

Spectral l.	Refractive idx
2.058	1.79293
1.970	1.79477
1.530	1.80374
1.129	1.81316
1.064	1.81513
t	1.81682
s	1.82391
A'	1.829208
r	1.834313
C	1.839605
C'	1.841119
He-Ne	1.842544
D	1.849048
d	1.849340
e	1.857324
F	1.873474
F'	1.875564
g	1.894198
h	1.912850
0.389	1.924986
i	1.948532

Partial dispersion	
F-C	0.033869
F'-C'	0.034445
C-t	0.022783
C-A'	0.010397
d-C	0.009735
e-C	0.017719
g-d	0.044858
g-F	0.020724
h-g	0.018652
i-g	0.054334
C'-t	0.024297
e-C'	0.016205
F'-e	0.018240
i-F'	0.072968

Relative partial dispersion	
C-t／F-C	0.6727
C-A'／F-C	0.3070
d-C／F-C	0.2874
e-C／F-C	0.5232
g-d／F-C	1.3245
g-F／F-C	0.6119
h-g／F-C	0.5507
i-g／F-C	1.6042
C'-t／F'-C'	0.7054
e-C'／F'-C'	0.4705
F'-e／F'-C'	0.5295
i-F'／F'-C'	2.1184

Deviation of relative partial disp.	
ΔPdC	−0.0011
ΔPgF	0.0096

Internal CC (80%/5%)
389/352
Color Code (70%/5%)
400/355

CCI	
B	0.00
G	2.80
R	3.14

Thermal properties	
CTE(−30,70) [1E-7/℃]	67
CTE(100,300) [1E-7/℃]	91
Tg [℃]	571
At [℃]	610
StP [℃]	519
AP [℃]	554
SP [℃]	682
Ht cndct. [W/m·K]	1.060
Sp. heat [kJ/kg·K]	0.650
Ht diffus. [1E-6 m2/sec]	0.462

Chemical properties [class]	
Acid res. (surface)	1
Alkaline detergent res.	1
Climate resistance	1
Water res. (powder)	1
Acid res. (powder)	1

Mechanical properties	
Knoop hardness	578 (6)
Abrasion hardness	141
Young's mod. [GPa]	104.4
Shear mod. [GPa]	41.7
Poisson's ratio	0.253
Stress optical coef. [1E-5 nm/cm／Pa]	3.25

Internal trans. (10mm)	
λ [nm]	τ
280	–
290	–
300	–
310	–
320	–
330	–
340	–
350	0.02
360	0.23
370	0.53
380	0.71
390	0.81
400	0.86
420	0.920
440	0.946
460	0.959
480	0.968
500	0.976
550	0.988
600	0.995
650	0.996
700	0.996
800	0.998
900	0.999
1000	0.999
1200	0.999
1400	0.997
1600	0.996
1800	0.989
2000	0.983
2200	0.955
2400	0.940

Specific gravity
3.53

Coef. disp. form. (pwr ser.)	
A0	3.27154343E+00
A1	−1.58798974E-02
A2	0.00000000E+00
A3	4.25178613E-02
A4	5.33307755E-03
A5	−1.01514038E-03
A6	1.98676075E-04
A7	−1.79935663E-05
A8	7.55791557E-07

Relative Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90 (ref.)	2.7	2.8	3.2	3.5	3.9	4.3	4.4	4.5	5.1	5.7	7.3	7.5	9.7	12.3	14.3
60 to 80 (ref.)	2.5	2.6	3.0	3.3	3.6	4.0	4.1	4.2	4.8	5.4	6.9	7.1	9.2	11.7	13.6
40 to 60	2.2	2.3	2.7	3.0	3.3	3.7	3.8	3.9	4.4	5.0	6.4	6.6	8.6	11.0	12.7
20 to 40	2.0	2.1	2.4	2.7	3.0	3.4	3.5	3.6	4.0	4.6	6.0	6.2	8.0	10.3	11.9
0 to 20	1.8	1.9	2.2	2.5	2.8	3.1	3.2	3.3	3.7	4.3	5.6	5.7	7.5	9.6	11.1
−20 to 0	1.7	1.8	2.1	2.3	2.6	2.9	3.0	3.1	3.5	4.0	5.2	5.4	7.0	9.0	10.4
−40 to −20	1.6	1.7	2.0	2.2	2.5	2.7	2.8	2.9	3.3	3.8	4.9	5.1	6.6	8.4	9.8
−60 to −40 (ref.)	1.7	1.7	2.0	2.2	2.5	2.7	2.8	2.9	3.2	3.7	4.8	4.9	6.3	8.0	9.3
−70 to −60 (ref.)	1.8	1.8	2.1	2.3	2.5	2.8	2.9	2.9	3.3	3.7	4.7	4.9	6.2	7.8	9.0

Absolute Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90	1.6	1.7	2.1	2.4	2.7	3.1	3.2	3.4	3.9	4.6	6.1	6.4	8.5	11.1	13.0
60 to 80	1.3	1.4	1.7	2.1	2.4	2.8	2.9	3.0	3.5	4.2	5.6	5.9	7.9	10.4	12.3
40 to 60	0.9	1.0	1.3	1.6	1.9	2.3	2.4	2.5	3.0	3.6	5.0	5.2	7.1	9.5	11.2
20 to 40	0.4	0.5	0.8	1.1	1.4	1.8	1.9	2.0	2.4	3.0	4.3	4.5	6.4	8.6	10.2
0 to 20	0.0	0.1	0.4	0.7	0.9	1.3	1.4	1.4	1.9	2.4	3.7	3.9	5.6	7.6	9.2
−20 to 0	−0.4	−0.3	0.0	0.2	0.5	0.8	0.8	0.9	1.3	1.9	3.0	3.2	4.8	6.7	8.1
−40 to −20	−0.8	−0.7	−0.5	−0.3	0.0	0.3	0.3	0.4	0.8	1.3	2.4	2.5	4.0	5.8	7.1
−60 to −40	−1.2	−1.2	−0.9	−0.7	−0.5	−0.2	−0.2	−0.1	0.3	0.7	1.7	1.9	3.2	4.9	6.1
−70 to −60	−1.5	−1.5	−1.3	−1.1	−0.8	−0.6	−0.5	−0.5	−0.1	0.3	1.2	1.4	2.6	4.2	5.3

Coef. disp. form. (frac. eq.)(ref.)	
P1	5.98846067E-02
Q1	4.13978242E+01
P2	3.07567172E-02
Q2	5.84554752E-02
P3	3.99482781E-01
Q3	8.83760941E-03

Fitting error of disp. form. σ [1E-6]		
	Visible	Infrared
Power ser. eq.	1.9	13.7
Frac. eq. (ref.)	5.2	47.3

Prod. Freq. (A to D)	A

Similar glass type			
OHARA	S-NBH56	HOYA	NBFD25
CDGM	–	SCHOTT	–

–	–
–	–
2023-9-1	1st edition

HIKARI GLASS CO., LTD.

J-KF6

n_d = 1.517420 n_e = 1.519777

ν_d = 52.20 ν_e = 51.93

Glass code (d)
517522
Glass code (e)
520519

Spectral l.	Refractive idx
2.058	1.49223
1.970	1.49357
1.530	1.49959
1.129	1.50471
1.064	1.50561
t	1.50635
s	1.50914
A'	1.511021
r	1.512730
C	1.514429
C'	1.514905
He-Ne	1.515348
D	1.517332
d	1.517420
e	1.519777
F	1.524341
F'	1.524914
g	1.529871
h	1.534576
0.389	1.537508
i	1.542910

Coef. disp. form. (pwr ser.)	
A0	2.26653222E+00
A1	-9.74283829E-03
A2	-8.49115572E-05
A3	1.27195343E-02
A4	3.15395806E-04
A5	-8.83703038E-06
A6	1.84064027E-06
A7	0.00000000E+00
A8	0.00000000E+00

Partial dispersion	
F-C	0.009912
F'-C'	0.010009
C-t	0.008080
C-A'	0.003408
d-C	0.002991
e-C	0.005348
g-d	0.012451
g-F	0.005530
h-g	0.004705
i-g	0.013039
C'-t	0.008556
e-C'	0.004872
F'-e	0.005137
i-F'	0.017996

Relative partial dispersion	
C-t／F-C	0.8152
C-A'／F-C	0.3438
d-C／F-C	0.3018
e-C／F-C	0.5395
g-d／F-C	1.2562
g-F／F-C	0.5579
h-g／F-C	0.4747
i-g／F-C	1.3155
C'-t／F'-C'	0.8548
e-C'／F'-C'	0.4868
F'-e／F'-C'	0.5132
i-F'／F'-C'	1.7980

Deviation of relative partial disp.	
ΔPdC	0.0010
ΔPgF	0.0011

Internal CC (80%/5%)
359/334
Color Code (80%/5%)
365/335
CCI

B	0.00
G	0.30
R	0.31

Thermal properties	
CTE(-30,70) [1E-7/℃]	68
CTE(100,300) [1E-7/℃]	79
Tg [℃]	443
At [℃]	524
StP [℃]	399
AP [℃]	444
SP [℃]	642
Ht cndct. [W/m･K]	1.023
Sp. heat [kJ/kg･K]	0.748
Ht diffus. [1E-6 m2/sec]	0.555

Chemical properties [class]	
Acid res. (surface)	1
Alkaline detergent res.	1
Climate resistance	1
Water res. (powder)	3
Acid res. (powder)	1

Mechanical properties	
Knoop hardness	458 (5)
Abrasion hardness	84
Young's mod. [GPa]	66.9
Shear mod. [GPa]	27.5
Poisson's ratio	0.214
Stress optical coef. [1E-5 nm/cm／Pa]	3.52

Internal trans. (10mm)	
λ [nm]	τ
280	–
290	–
300	–
310	–
320	–
330	–
340	0.18
350	0.55
360	0.83
370	0.940
380	0.970
390	0.982
400	0.988
420	0.991
440	0.992
460	0.994
480	0.996
500	0.997
550	0.999
600	0.999
650	0.999
700	0.999
800	0.999
900	0.999
1000	0.999
1200	0.999
1400	0.989
1600	0.994
1800	0.990
2000	0.985
2200	0.921
2400	0.88

Specific gravity
2.47

Relative Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90 (ref.)	2.5	2.5	2.6	2.7	2.8	2.9	3.0	3.0	3.1	3.3	3.7	3.7	4.1	4.6	4.9
60 to 80 (ref.)	2.3	2.4	2.5	2.6	2.7	2.8	2.8	2.8	3.0	3.1	3.5	3.5	3.9	4.4	4.7
40 to 60	2.2	2.2	2.3	2.4	2.5	2.6	2.6	2.7	2.8	2.9	3.3	3.3	3.7	4.2	4.5
20 to 40	2.0	2.1	2.2	2.2	2.3	2.4	2.5	2.5	2.6	2.8	3.1	3.1	3.5	3.9	4.2
0 to 20	1.9	1.9	2.0	2.1	2.2	2.3	2.3	2.4	2.5	2.6	2.9	3.0	3.4	3.8	4.1
-20 to 0	1.9	1.9	2.0	2.1	2.1	2.2	2.3	2.3	2.4	2.5	2.8	2.9	3.2	3.6	3.9
-40 to -20	1.9	1.9	2.0	2.0	2.1	2.2	2.2	2.3	2.4	2.5	2.8	2.8	3.2	3.6	3.9
-60 to -40 (ref.)	1.9	2.0	2.1	2.1	2.2	2.3	2.3	2.3	2.4	2.6	2.9	2.9	3.2	3.6	3.9
-70 to -60 (ref.)	2.1	2.1	2.2	2.3	2.3	2.4	2.4	2.5	2.6	2.7	3.0	3.0	3.3	3.7	4.0

Absolute Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90	1.5	1.6	1.7	1.8	1.9	2.0	2.0	2.1	2.2	2.4	2.7	2.7	3.2	3.6	3.9
60 to 80	1.3	1.4	1.5	1.6	1.7	1.8	1.8	1.8	1.9	2.1	2.4	2.5	2.9	3.3	3.6
40 to 60	1.0	1.1	1.2	1.3	1.3	1.4	1.5	1.5	1.6	1.8	2.1	2.1	2.5	3.0	3.3
20 to 40	0.7	0.8	0.9	0.9	1.0	1.1	1.1	1.2	1.3	1.4	1.8	1.8	2.2	2.6	2.9
0 to 20	0.4	0.5	0.6	0.6	0.7	0.8	0.8	0.9	1.0	1.1	1.4	1.4	1.8	2.2	2.5
-20 to 0	0.1	0.2	0.2	0.3	0.4	0.5	0.5	0.5	0.6	0.8	1.1	1.1	1.4	1.8	2.1
-40 to -20	-0.2	-0.1	-0.1	0.0	0.1	0.2	0.2	0.2	0.3	0.4	0.7	0.8	1.1	1.5	1.7
-60 to -40	-0.5	-0.4	-0.4	-0.3	-0.2	-0.2	-0.1	-0.1	0.0	0.1	0.4	0.4	0.7	1.1	1.3
-70 to -60	-0.7	-0.7	-0.6	-0.5	-0.5	-0.4	-0.4	-0.4	-0.3	-0.1	0.1	0.1	0.5	0.8	1.1

Coef. disp. form. (frac. eq.)(ref.)	
P1	1.31586600E-01
Q1	8.28160644E+01
P2	7.42229602E-03
Q2	5.27857629E-02
P3	2.89400464E-01
Q3	6.01259424E-03

Fitting error of disp. form. σ [1E-6]		
	Visible	Infrared
Power ser. eq.	0.8	5.0
Frac. eq. (ref.)	0.5	6.5

Prod. Freq. (A to D)	C

Similar glass type			
OHARA	–	HOYA	E-CF6
CDGM	H-KF6	SCHOTT	–

2022-7-1	StP, AP, SP
2020-4-1	Similar glass type
2019-4-1	Transmittance

HIKARI GLASS CO., LTD.

J-BALF4

n_d = 1.579570 n_e = 1.582139

ν_d = 53.74 ν_e = 53.46

Glass code (d)
580537
Glass code (e)
582535

Spectral l.	Refractive idx
2.058	1.55505
1.970	1.55620
1.530	1.56144
1.129	1.56618
1.064	1.56706
t	1.56780
s	1.57066
A'	1.572644
r	1.574478
C	1.576316
C'	1.576832
He-Ne	1.577314
D	1.579474
d	1.579570
e	1.582139
F	1.587100
F'	1.587721
g	1.593052
h	1.598037
0.389	1.601097
i	1.606631

Coef. disp. form. (pwr ser.)	
A0	2.45156936E+00
A1	-8.35914203E-03
A2	-8.88499407E-05
A3	1.53016408E-02
A4	2.24512880E-04
A5	5.89498036E-06
A6	2.59209632E-07
A7	0.00000000E+00
A8	0.00000000E+00

Partial dispersion	
F-C	0.010784
F'-C'	0.010889
C-t	0.008521
C-A'	0.003672
d-C	0.003254
e-C	0.005823
g-d	0.013482
g-F	0.005952
h-g	0.004985
i-g	0.013579
C'-t	0.009037
e-C'	0.005307
F'-e	0.005582
i-F'	0.018910

Relative partial dispersion	
C-t／F-C	0.7902
C-A'／F-C	0.3405
d-C／F-C	0.3017
e-C／F-C	0.5400
g-d／F-C	1.2502
g-F／F-C	0.5519
h-g／F-C	0.4623
i-g／F-C	1.2592
C'-t／F'-C'	0.8299
e-C'／F'-C'	0.4874
F'-e／F'-C'	0.5126
i-F'／F'-C'	1.7366

Deviation of relative partial disp.	
ΔPdC	0.0003
ΔPgF	-0.0023

Internal CC (80%/5%)
354/320
Color Code (80%/5%)
360/320

CCI	
B	0.00
G	0.25
R	0.22

Thermal properties	
CTE(-30,70) [1E-7/℃]	80
CTE(100,300) [1E-7/℃]	99
Tg [℃]	529
At [℃]	577
StP [℃]	478
AP [℃]	516
SP [℃]	662
Ht cndct. [W/m･K]	0.793
Sp. heat [kJ/kg･K]	0.623
Ht diffus. [1E-6 m2/sec]	0.409

Chemical properties [class]	
Acid res. (surface)	5
Alkaline detergent res.	3
Climate resistance	1
Water res. (powder)	1
Acid res. (powder)	4

Mechanical properties	
Knoop hardness	511 (5)
Abrasion hardness	131
Young's mod. [GPa]	74.3
Shear mod. [GPa]	29.4
Poisson's ratio	0.262
Stress optical coef. [1E-5 nm/cm／Pa]	3.09

Internal trans. (10mm)	
λ [nm]	τ
280	-
290	-
300	-
310	-
320	0.05
330	0.23
340	0.52
350	0.75
360	0.88
370	0.941
380	0.970
390	0.984
400	0.991
420	0.995
440	0.995
460	0.995
480	0.997
500	0.998
550	0.999
600	0.999
650	0.998
700	0.999
800	0.998
900	0.998
1000	0.998
1200	0.998
1400	0.993
1600	0.990
1800	0.977
2000	0.962
2200	0.907
2400	0.84

Specific gravity
3.13

Relative Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90 (ref.)	2.2	2.2	2.3	2.5	2.7	2.8	2.8	2.9	3.1	3.3	3.7	3.8	4.3	4.8	5.1
60 to 80 (ref.)	2.1	2.1	2.3	2.4	2.5	2.7	2.7	2.8	2.9	3.1	3.6	3.6	4.1	4.6	4.9
40 to 60	2.0	2.0	2.1	2.3	2.4	2.5	2.6	2.6	2.8	3.0	3.4	3.4	3.9	4.4	4.7
20 to 40	1.9	1.9	2.1	2.2	2.3	2.4	2.5	2.5	2.7	2.8	3.2	3.3	3.8	4.2	4.5
0 to 20	1.8	1.9	2.0	2.1	2.2	2.4	2.4	2.4	2.6	2.8	3.1	3.2	3.6	4.1	4.3
-20 to 0	1.8	1.8	2.0	2.1	2.2	2.3	2.4	2.4	2.5	2.7	3.1	3.1	3.5	4.0	4.2
-40 to -20	1.9	1.9	2.0	2.1	2.2	2.4	2.4	2.4	2.6	2.7	3.1	3.1	3.5	3.9	4.2
-60 to -40 (ref.)	2.0	2.0	2.2	2.3	2.4	2.5	2.5	2.6	2.7	2.8	3.2	3.2	3.6	4.0	4.2
-70 to -60 (ref.)	2.2	2.2	2.3	2.4	2.6	2.7	2.7	2.7	2.9	3.0	3.3	3.4	3.8	4.1	4.4

Absolute Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90	1.2	1.3	1.4	1.5	1.7	1.8	1.9	1.9	2.1	2.3	2.7	2.8	3.3	3.8	4.1
60 to 80	1.0	1.1	1.2	1.3	1.5	1.6	1.6	1.7	1.9	2.1	2.5	2.5	3.0	3.5	3.8
40 to 60	0.8	0.8	1.0	1.1	1.2	1.3	1.4	1.4	1.6	1.8	2.2	2.2	2.7	3.1	3.4
20 to 40	0.5	0.6	0.7	0.8	0.9	1.1	1.1	1.1	1.3	1.5	1.8	1.9	2.3	2.8	3.1
0 to 20	0.3	0.3	0.4	0.5	0.7	0.8	0.8	0.8	1.0	1.2	1.5	1.6	2.0	2.4	2.7
-20 to 0	0.0	0.1	0.2	0.3	0.4	0.5	0.5	0.6	0.7	0.9	1.2	1.3	1.7	2.1	2.3
-40 to -20	-0.2	-0.2	-0.1	0.0	0.1	0.2	0.3	0.3	0.4	0.6	0.9	1.0	1.3	1.7	2.0
-60 to -40	-0.5	-0.5	-0.3	-0.2	-0.1	0.0	0.0	0.0	0.1	0.3	0.6	0.6	1.0	1.4	1.6
-70 to -60	-0.7	-0.6	-0.5	-0.4	-0.4	-0.3	-0.2	-0.2	-0.1	0.1	0.4	0.4	0.8	1.1	1.3

Coef. disp. form. (frac. eq.)(ref.)	
P1	1.18078949E-01
Q1	9.26271780E+01
P2	1.61813352E-02
Q2	3.26808720E-02
P3	3.09920889E-01
Q3	5.74581058E-03

Fitting error of disp. form. σ [1E-6]		
	Visible	Infrared
Power ser. eq.	0.4	5.2
Frac. eq. (ref.)	0.4	5.7

Prod. Freq. (A to D)	C

Similar glass type			
OHARA	-	HOYA	-
CDGM	H-BaF3	SCHOTT	N-BALF4

2022-7-1	StP, AP, SP
2019-4-1	Transmittance
2015-4-1	Color Code, Prod. Freq., Similar glass type

HIKARI GLASS CO., LTD.

J-BAF3

n_d = 1.582670 n_e = 1.585648

ν_d = 46.48 ν_e = 46.19

Glass code (d)
583465
Glass code (e)
586462

Spectral l.	Refractive idx
2.058	1.55565
1.970	1.55686
1.530	1.56243
1.129	1.56755
1.064	1.56851
t	1.56932
s	1.57252
A'	1.574752
r	1.576832
C	1.578929
C'	1.579520
He-Ne	1.580073
D	1.582559
d	1.582670
e	1.585648
F	1.591464
F'	1.592198
g	1.598562
h	1.604624
0.389	1.608407
i	1.615393

Partial dispersion	
F-C	0.012535
F'-C'	0.012678
C-t	0.009605
C-A'	0.004177
d-C	0.003741
e-C	0.006719
g-d	0.015892
g-F	0.007098
h-g	0.006062
i-g	0.016831
C'-t	0.010196
e-C'	0.006128
F'-e	0.006550
i-F'	0.023195

Relative partial dispersion	
C-t／F-C	0.7663
C-A'／F-C	0.3332
d-C／F-C	0.2984
e-C／F-C	0.5360
g-d／F-C	1.2678
g-F／F-C	0.5663
h-g／F-C	0.4836
i-g／F-C	1.3427
C'-t／F'-C'	0.8042
e-C'／F'-C'	0.4834
F'-e／F'-C'	0.5166
i-F'／F'-C'	1.8295

Deviation of relative partial disp.	
ΔPdC	0.0003
ΔPgF	−0.0001

Internal CC (80%/5%)
369/343
Color Code (80%/5%)
375/345

CCI	
B	−
G	−
R	−

Thermal properties	
CTE(−30,70) [1E-7/℃]	85
CTE(100,300) [1E-7/℃]	98
Tg [℃]	558
At [℃]	612
StP [℃]	509
AP [℃]	547
SP [℃]	700
Ht cndct. [W/m·K]	1.097
Sp. heat [kJ/kg·K]	0.723
Ht diffus. [1E-6 m2/sec]	0.554

Chemical properties [class]	
Acid res. (surface)	1
Alkaline detergent res.	1
Climate resistance	1
Water res. (powder)	2
Acid res. (powder)	1

Mechanical properties	
Knoop hardness	483 (5)
Abrasion hardness	134
Young's mod. [GPa]	76.0
Shear mod. [GPa]	30.6
Poisson's ratio	0.244
Stress optical coef. [1E-5 nm/cm／Pa]	2.54

Internal trans. (10mm)	
λ [nm]	τ
280	−
290	−
300	−
310	−
320	−
330	0.01
340	0.03
350	0.19
360	0.58
370	0.82
380	0.917
390	0.960
400	0.977
420	0.989
440	0.991
460	0.992
480	0.994
500	0.994
550	0.996
600	0.994
650	0.993
700	0.993
800	0.996
900	0.998
1000	0.998
1200	0.999
1400	0.992
1600	0.989
1800	0.968
2000	0.946
2200	0.88
2400	0.83

Specific gravity
2.74

Coef. disp. form. (pwr ser.)	
A0	2.45448839E+00
A1	−8.67148963E-03
A2	−1.04715240E-04
A3	1.76039752E-02
A4	1.54610243E-04
A5	5.59918259E-05
A6	−5.01297284E-06
A7	3.17557990E-07
A8	0.00000000E+00

Relative Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90 (ref.)	0.6	0.6	0.8	1.0	1.1	1.2	1.3	1.3	1.5	1.7	2.2	2.3	2.9	3.5	4.0
60 to 80 (ref.)	0.5	0.6	0.8	0.9	1.0	1.1	1.2	1.2	1.4	1.6	2.1	2.2	2.7	3.4	3.8
40 to 60	0.4	0.5	0.6	0.8	0.9	1.0	1.1	1.1	1.3	1.5	1.9	2.0	2.6	3.2	3.6
20 to 40	0.3	0.4	0.5	0.7	0.8	0.9	1.0	1.0	1.2	1.4	1.8	1.9	2.4	3.0	3.4
0 to 20	0.3	0.3	0.5	0.6	0.7	0.9	0.9	0.9	1.1	1.3	1.7	1.8	2.3	2.8	3.2
−20 to 0	0.3	0.4	0.5	0.6	0.7	0.8	0.9	0.9	1.1	1.3	1.7	1.7	2.2	2.8	3.1
−40 to −20	0.4	0.4	0.6	0.7	0.8	0.9	0.9	1.0	1.1	1.3	1.7	1.7	2.2	2.7	3.1
−60 to −40 (ref.)	0.5	0.6	0.7	0.8	0.9	1.0	1.1	1.1	1.2	1.4	1.8	1.8	2.3	2.8	3.1
−70 to −60 (ref.)	0.7	0.8	0.9	1.0	1.1	1.2	1.3	1.3	1.4	1.6	1.9	2.0	2.4	2.9	3.3

Absolute Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90	−0.4	−0.3	−0.1	0.0	0.1	0.3	0.3	0.3	0.5	0.8	1.2	1.3	1.9	2.5	3.0
60 to 80	−0.5	−0.5	−0.3	−0.2	−0.1	0.1	0.1	0.1	0.3	0.5	1.0	1.1	1.6	2.3	2.7
40 to 60	−0.8	−0.7	−0.6	−0.4	−0.3	−0.2	−0.2	−0.1	0.1	0.3	0.7	0.8	1.3	1.9	2.3
20 to 40	−1.0	−1.0	−0.8	−0.7	−0.6	−0.5	−0.4	−0.4	−0.2	0.0	0.4	0.5	1.0	1.6	2.0
0 to 20	−1.3	−1.2	−1.1	−0.9	−0.8	−0.7	−0.7	−0.7	−0.5	−0.3	0.1	0.2	0.7	1.2	1.6
−20 to 0	−1.5	−1.4	−1.3	−1.2	−1.1	−1.0	−0.9	−0.9	−0.8	−0.6	−0.2	−0.2	0.3	0.9	1.2
−40 to −20	−1.7	−1.7	−1.6	−1.4	−1.3	−1.2	−1.2	−1.2	−1.0	−0.9	−0.5	−0.5	0.0	0.5	0.9
−60 to −40	−2.0	−1.9	−1.8	−1.7	−1.6	−1.5	−1.5	−1.4	−1.3	−1.1	−0.8	−0.8	−0.3	0.2	0.5
−70 to −60	−2.1	−2.1	−2.0	−1.9	−1.8	−1.7	−1.7	−1.6	−1.5	−1.4	−1.0	−1.0	−0.6	−0.1	0.2

Coef. disp. form. (frac. eq.)(ref.)	
P1	1.15657985E-01
Q1	8.68803305E+01
P2	9.88427417E-03
Q2	5.11274577E-02
P3	3.16699166E-01
Q3	6.63914300E-03

Fitting error of disp. form. σ [1E-6]		
	Visible	Infrared
Power ser. eq.	0.6	7.9
Frac. eq. (ref.)	0.8	6.7

Prod. Freq. (A to D)	D

Similar glass type			
OHARA	−	HOYA	−
CDGM	H-BaF4	SCHOTT	−

2022-7-1	StP, AP, SP, Prod. Freq.
2020-4-1	Similar glass type
2019-4-1	Transmittance

HIKARI GLASS CO., LTD.

J-BAF4

n_d = 1.605620 n_e = 1.608924

ν_d = 43.49 ν_e = 43.20

Glass code (d)
606435
Glass code (e)
609432

Spectral l.	Refractive idx
2.058	1.57560
1.970	1.57696
1.530	1.58321
1.129	1.58891
1.064	1.58998
t	1.59088
s	1.59440
A'	1.596870
r	1.599166
C	1.601481
C'	1.602134
He-Ne	1.602745
D	1.605498
d	1.605620
e	1.608924
F	1.615408
F'	1.616230
g	1.623384
h	1.630262
0.389	1.634595
i	1.642691

Coef. disp. form. (pwr ser.)	
A0	2.52175840E+00
A1	-9.79498428E-03
A2	-1.34973275E-04
A3	1.97297837E-02
A4	7.13034071E-05
A5	1.03716753E-04
A6	-1.06452623E-05
A7	6.63899530E-07
A8	0.00000000E+00

Partial dispersion	
F-C	0.013927
F'-C'	0.014096
C-t	0.010604
C-A'	0.004611
d-C	0.004139
e-C	0.007443
g-d	0.017764
g-F	0.007976
h-g	0.006878
i-g	0.019307
C'-t	0.011257
e-C'	0.006790
F'-e	0.007306
i-F'	0.026461

Relative partial dispersion	
C-t／F-C	0.7614
C-A'／F-C	0.3311
d-C／F-C	0.2972
e-C／F-C	0.5344
g-d／F-C	1.2755
g-F／F-C	0.5727
h-g／F-C	0.4939
i-g／F-C	1.3863
C'-t／F'-C'	0.7986
e-C'／F'-C'	0.4817
F'-e／F'-C'	0.5183
i-F'／F'-C'	1.8772

Deviation of relative partial disp.	
ΔPdC	0.0004
ΔPgF	0.0013

Internal CC (80%/5%)
377/352
Color Code (80%/5%)
390/350

CCI	
B	–
G	–
R	–

Thermal properties	
CTE(-30,70) [1E-7/℃]	62
CTE(100,300) [1E-7/℃]	76
Tg [℃]	598
At [℃]	651
StP [℃]	–
AP [℃]	–
SP [℃]	–
Ht cndct. [W/m·K]	1.058
Sp. heat [kJ/kg·K]	0.697
Ht diffus. [1E-6 m2/sec]	0.525

Chemical properties [class]	
Acid res. (surface)	1
Alkaline detergent res.	1
Climate resistance	1
Water res. (powder)	2
Acid res. (powder)	1

Mechanical properties	
Knoop hardness	482 (5)
Abrasion hardness	108
Young's mod. [GPa]	84.6
Shear mod. [GPa]	34.2
Poisson's ratio	0.236
Stress optical coef. [1E-5 nm/cm／Pa]	3.11

Internal trans. (10mm)	
λ [nm]	τ
280	–
290	–
300	–
310	–
320	–
330	–
340	–
350	0.02
360	0.29
370	0.66
380	0.84
390	0.916
400	0.950
420	0.973
440	0.978
460	0.983
480	0.986
500	0.989
550	0.992
600	0.993
650	0.992
700	0.992
800	0.994
900	0.996
1000	0.996
1200	0.997
1400	0.982
1600	0.990
1800	0.982
2000	0.971
2200	0.901
2400	0.87

Specific gravity
2.89

Relative Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90 (ref.)	4.2	4.3	4.5	4.7	4.8	5.0	5.0	5.1	5.3	5.6	6.2	6.3	7.0	7.8	8.4
60 to 80 (ref.)	4.1	4.2	4.4	4.5	4.7	4.8	4.9	4.9	5.1	5.4	6.0	6.1	6.8	7.6	8.1
40 to 60	3.9	4.0	4.2	4.3	4.5	4.7	4.7	4.7	4.9	5.2	5.7	5.8	6.5	7.3	7.8
20 to 40	3.8	3.9	4.1	4.2	4.3	4.5	4.5	4.6	4.8	5.0	5.5	5.6	6.3	7.0	7.5
0 to 20	3.7	3.8	4.0	4.1	4.2	4.4	4.4	4.4	4.6	4.9	5.4	5.4	6.0	6.7	7.2
-20 to 0	3.7	3.7	3.9	4.0	4.2	4.3	4.3	4.4	4.5	4.8	5.2	5.3	5.9	6.5	7.0
-40 to -20	3.7	3.7	3.9	4.0	4.2	4.3	4.3	4.4	4.5	4.7	5.2	5.2	5.8	6.4	6.9
-60 to -40 (ref.)	3.8	3.9	4.0	4.1	4.2	4.4	4.4	4.4	4.6	4.8	5.2	5.3	5.8	6.4	6.8
-70 to -60 (ref.)	4.0	4.0	4.2	4.3	4.4	4.5	4.5	4.6	4.7	4.9	5.3	5.4	5.9	6.5	6.9

Absolute Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90	3.3	3.3	3.5	3.7	3.8	4.0	4.0	4.1	4.3	4.6	5.2	5.2	6.0	6.8	7.3
60 to 80	3.0	3.1	3.3	3.4	3.6	3.8	3.8	3.8	4.1	4.3	4.9	4.9	5.7	6.4	7.0
40 to 60	2.7	2.8	3.0	3.1	3.3	3.4	3.5	3.5	3.7	4.0	4.5	4.6	5.2	6.0	6.5
20 to 40	2.4	2.5	2.7	2.8	3.0	3.1	3.1	3.2	3.4	3.6	4.1	4.2	4.8	5.5	6.0
0 to 20	2.2	2.2	2.4	2.5	2.6	2.8	2.8	2.9	3.0	3.3	3.7	3.8	4.4	5.1	5.6
-20 to 0	1.9	1.9	2.1	2.2	2.3	2.4	2.5	2.5	2.7	2.9	3.3	3.4	4.0	4.6	5.1
-40 to -20	1.6	1.6	1.8	1.9	2.0	2.1	2.2	2.2	2.3	2.5	3.0	3.0	3.6	4.2	4.6
-60 to -40	1.3	1.3	1.5	1.6	1.7	1.8	1.8	1.9	2.0	2.2	2.6	2.6	3.1	3.7	4.1
-70 to -60	1.1	1.1	1.2	1.3	1.4	1.5	1.6	1.6	1.8	1.9	2.3	2.4	2.8	3.4	3.8

Coef. disp. form. (frac. eq.)(ref.)	
P1	1.10004273E-01
Q1	7.52194401E+01
P2	9.42216527E-03
Q2	5.73632071E-02
P3	3.27207024E-01
Q3	6.92180568E-03

Fitting error of disp. form. σ [1E-6]		
	Visible	Infrared
Power ser. eq.	0.7	8.9
Frac. eq. (ref.)	1.5	8.6

Prod. Freq. (A to D)	D

Similar glass type			
OHARA	S-BAM4	HOYA	–
CDGM	H-BaF5	SCHOTT	N-BAF4

2019-4-1	Transmittance
2018-4-1	Prod. Freq.
2015-4-1	Color Code, Similar glass type

HIKARI GLASS CO., LTD.

J-BAF8

n_d = 1.623740 n_e = 1.626893

ν_d = 47.01 ν_e = 46.72

Glass code (d)
624470
Glass code (e)
627467

Spectral l.	Refractive idx
2.058	1.59462
1.970	1.59595
1.530	1.60207
1.129	1.60764
1.064	1.60867
t	1.60954
s	1.61296
A'	1.615339
r	1.617550
C	1.619775
C'	1.620402
He-Ne	1.620988
D	1.623623
d	1.623740
e	1.626893
F	1.633044
F'	1.633820
g	1.640541
h	1.646936
0.389	1.650926
i	1.658287

Partial dispersion	
F-C	0.013269
F'-C'	0.013418
C-t	0.010231
C-A'	0.004436
d-C	0.003965
e-C	0.007118
g-d	0.016801
g-F	0.007497
h-g	0.006395
i-g	0.017746
C'-t	0.010858
e-C'	0.006491
F'-e	0.006927
i-F'	0.024467

Relative partial dispersion	
C-t／F-C	0.7710
C-A'／F-C	0.3343
d-C／F-C	0.2988
e-C／F-C	0.5364
g-d／F-C	1.2662
g-F／F-C	0.5650
h-g／F-C	0.4820
i-g／F-C	1.3374
C'-t／F'-C'	0.8092
e-C'／F'-C'	0.4838
F'-e／F'-C'	0.5162
i-F'／F'-C'	1.8234

Deviation of relative partial disp.	
ΔPdC	0.0004
ΔPgF	−0.0005

Internal CC (80%/5%)
373/343
Color Code (80%/5%)
385/345

CCI	
B	0.00
G	0.67
R	0.64

Thermal properties	
CTE(−30,70) [1E-7/℃]	67
CTE(100,300) [1E-7/℃]	80
Tg [℃]	589
At [℃]	641
StP [℃]	540
AP [℃]	578
SP [℃]	721
Ht cndct. [W/m·K]	0.960
Sp. heat [kJ/kg·K]	0.663
Ht diffus. [1E-6 m2/sec]	0.461

Chemical properties [class]	
Acid res. (surface)	1
Alkaline detergent res.	2
Climate resistance	1
Water res. (powder)	1
Acid res. (powder)	2

Mechanical properties	
Knoop hardness	511 (5)
Abrasion hardness	124
Young's mod. [GPa]	85.7
Shear mod. [GPa]	34.0
Poisson's ratio	0.261
Stress optical coef. [1E-5 nm/cm／Pa]	2.72

Internal trans. (10mm)	
λ [nm]	τ
280	–
290	–
300	–
310	–
320	–
330	–
340	0.03
350	0.19
360	0.51
370	0.76
380	0.88
390	0.941
400	0.967
420	0.985
440	0.989
460	0.992
480	0.995
500	0.996
550	0.998
600	0.997
650	0.997
700	0.999
800	0.999
900	0.999
1000	0.999
1200	0.999
1400	0.990
1600	0.990
1800	0.979
2000	0.966
2200	0.901
2400	0.82

Specific gravity
3.14

Coef. disp. form. (pwr ser.)	
A0	2.58219095E+00
A1	−9.86301021E−03
A2	−1.16286506E−04
A3	1.89733467E−02
A4	2.19248923E−04
A5	4.98624477E−05
A6	−4.45223153E−06
A7	3.07817299E−07
A8	0.00000000E+00

Relative Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90 (ref.)	3.5	3.6	3.8	4.0	4.1	4.3	4.3	4.4	4.6	4.8	5.4	5.4	6.1	6.8	7.3
60 to 80 (ref.)	3.4	3.5	3.7	3.8	4.0	4.1	4.2	4.2	4.4	4.7	5.2	5.3	5.9	6.6	7.1
40 to 60	3.3	3.3	3.5	3.7	3.8	4.0	4.0	4.1	4.2	4.5	5.0	5.1	5.7	6.3	6.6
20 to 40	3.2	3.2	3.4	3.5	3.7	3.8	3.9	3.9	4.1	4.3	4.8	4.9	5.5	6.1	6.5
0 to 20	3.1	3.2	3.3	3.5	3.6	3.7	3.8	3.8	4.0	4.2	4.7	4.7	5.3	5.9	6.3
−20 to 0	3.1	3.1	3.3	3.4	3.5	3.7	3.7	3.8	3.9	4.1	4.6	4.6	5.2	5.7	6.2
−40 to −20	3.1	3.2	3.3	3.5	3.6	3.7	3.7	3.8	3.9	4.1	4.5	4.6	5.1	5.7	6.1
−60 to −40 (ref.)	3.3	3.3	3.5	3.6	3.7	3.8	3.8	3.9	4.0	4.2	4.6	4.7	5.2	5.7	6.1
−70 to −60 (ref.)	3.4	3.5	3.6	3.7	3.8	4.0	4.0	4.0	4.2	4.4	4.7	4.8	5.3	5.8	6.1

Absolute Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90	2.5	2.6	2.8	3.0	3.1	3.3	3.3	3.4	3.6	3.8	4.3	4.4	5.1	5.8	6.3
60 to 80	2.3	2.4	2.6	2.7	2.9	3.0	3.1	3.1	3.3	3.6	4.1	4.1	4.8	5.5	5.9
40 to 60	2.1	2.1	2.3	2.4	2.6	2.7	2.8	2.8	3.0	3.2	3.7	3.8	4.4	5.0	5.5
20 to 40	1.8	1.8	2.0	2.1	2.3	2.4	2.5	2.5	2.7	2.9	3.4	3.4	4.0	4.6	5.1
0 to 20	1.5	1.6	1.7	1.9	2.0	2.1	2.2	2.2	2.4	2.6	3.0	3.1	3.6	4.2	4.6
−20 to 0	1.2	1.3	1.4	1.6	1.7	1.8	1.8	1.9	2.0	2.2	2.7	2.7	3.2	3.8	4.2
−40 to −20	1.0	1.0	1.2	1.3	1.4	1.5	1.5	1.6	1.7	1.9	2.3	2.4	2.9	3.4	3.8
−60 to −40	0.7	0.7	0.9	1.0	1.1	1.2	1.2	1.3	1.4	1.6	2.0	2.0	2.5	3.0	3.3
−70 to −60	0.5	0.5	0.7	0.8	0.9	1.0	1.0	1.0	1.2	1.3	1.7	1.7	2.2	2.7	3.0

Coef. disp. form. (frac. eq.)(ref.)	
P1	1.10512594E−01
Q1	7.79743638E+01
P2	9.62875752E−03
Q2	5.14298507E−02
P3	3.35700552E−01
Q3	6.49937209E−03

Fitting error of disp. form. σ [1E-6]		
	Visible	Infrared
Power ser. eq.	0.5	7.4
Frac. eq. (ref.)	0.8	7.6

Prod. Freq. (A to D)	D

Similar glass type			
OHARA	–	HOYA	E-BAF8
CDGM	–	SCHOTT	–

2022-7-1	StP, AP, SP
2020-4-1	chemical properties
2019-4-1	Transmittance

J-BAF10

n_d = 1.670030 n_e = 1.673410

ν_d = 47.14 ν_e = 46.86

Glass code (d)
670471
Glass code (e)
673469

Spectral l.	Refractive idx
2.058	1.64083
1.970	1.64204
1.530	1.64770
1.129	1.65310
1.064	1.65414
t	1.65502
s	1.65856
A'	1.661063
r	1.663410
C	1.665785
C'	1.666455
He-Ne	1.667082
D	1.669905
d	1.670030
e	1.673410
F	1.679998
F'	1.680827
g	1.687994
h	1.694772
0.389	1.698973
i	1.706653

Partial dispersion	
F-C	0.014213
F'-C'	0.014372
C-t	0.010760
C-A'	0.004722
d-C	0.004245
e-C	0.007625
g-d	0.017964
g-F	0.007996
h-g	0.006778
i-g	0.018659
C'-t	0.011430
e-C'	0.006955
F'-e	0.007417
i-F'	0.025826

Relative partial dispersion	
C-t／F-C	0.7571
C-A'／F-C	0.3322
d-C／F-C	0.2987
e-C／F-C	0.5365
g-d／F-C	1.2639
g-F／F-C	0.5626
h-g／F-C	0.4769
i-g／F-C	1.3128
C'-t／F'-C'	0.7953
e-C'／F'-C'	0.4839
F'-e／F'-C'	0.5161
i-F'／F'-C'	1.7970

Deviation of relative partial disp.	
ΔPdC	0.0002
ΔPgF	−0.0027

Internal CC (80%/5%)
367/335
Color Code (80%/5%)
380/335

CCI	
B	0.00
G	0.61
R	0.64

Thermal properties	
CTE(−30,70) [1E-7/℃]	67
CTE(100,300) [1E-7/℃]	83
Tg [℃]	581
At [℃]	640
StP [℃]	539
AP [℃]	578
SP [℃]	732
Ht cndct. [W/m·K]	0.985
Sp. heat [kJ/kg·K]	0.564
Ht diffus. [1E-6 m2/sec]	0.489

Chemical properties [class]	
Acid res. (surface)	1
Alkaline detergent res.	1
Climate resistance	1
Water res. (powder)	2
Acid res. (powder)	2

Mechanical properties	
Knoop hardness	534 (5)
Abrasion hardness	133
Young's mod. [GPa]	94.8
Shear mod. [GPa]	37.2
Poisson's ratio	0.274
Stress optical coef. [1E-5 nm/cm／Pa]	2.22

Internal trans. (10mm)	
λ [nm]	τ
280	–
290	–
300	–
310	–
320	–
330	0.01
340	0.13
350	0.41
360	0.69
370	0.85
380	0.922
390	0.956
400	0.973
420	0.985
440	0.988
460	0.991
480	0.995
500	0.996
550	0.999
600	0.998
650	0.999
700	0.999
800	0.999
900	0.998
1000	0.998
1200	0.998
1400	0.999
1600	0.992
1800	0.983
2000	0.973
2200	0.940
2400	0.89

Specific gravity
3.57

Coef. disp. form. (pwr ser.)	
A0	2.72808119E+00
A1	−9.30210914E−03
A2	−7.12221204E−05
A3	2.08031569E−02
A4	4.57311835E−04
A5	−2.96273778E−06
A6	1.63114030E−06
A7	0.00000000E+00
A8	0.00000000E+00

Relative Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90 (ref.)	4.5	4.5	4.7	4.9	5.1	5.3	5.3	5.4	5.6	5.9	6.5	6.6	7.3	8.0	8.5
60 to 80 (ref.)	4.4	4.4	4.7	4.8	5.0	5.2	5.2	5.3	5.5	5.8	6.3	6.4	7.1	7.8	8.3
40 to 60	4.2	4.3	4.5	4.7	4.8	5.0	5.1	5.1	5.3	5.6	6.1	6.2	6.9	7.6	8.0
20 to 40	4.1	4.2	4.4	4.6	4.7	4.9	4.9	5.0	5.2	5.4	6.0	6.0	6.7	7.3	7.8
0 to 20	4.1	4.1	4.3	4.5	4.6	4.8	4.8	4.9	5.1	5.3	5.8	5.9	6.5	7.2	7.6
−20 to 0	4.1	4.1	4.3	4.5	4.6	4.8	4.8	4.8	5.0	5.3	5.8	5.8	6.4	7.0	7.5
−40 to −20	4.1	4.2	4.4	4.5	4.7	4.8	4.8	4.9	5.1	5.3	5.8	5.8	6.4	7.0	7.4
−60 to −40 (ref.)	4.3	4.3	4.5	4.7	4.8	4.9	5.0	5.0	5.2	5.4	5.8	5.9	6.4	7.0	7.4
−70 to −60 (ref.)	4.5	4.5	4.7	4.8	5.0	5.1	5.1	5.2	5.4	5.6	6.0	6.1	6.6	7.1	7.5

Absolute Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90	3.4	3.5	3.7	3.9	4.1	4.3	4.3	4.4	4.6	4.9	5.4	5.5	6.2	7.0	7.5
60 to 80	3.2	3.3	3.5	3.7	3.9	4.0	4.1	4.1	4.4	4.6	5.2	5.2	5.9	6.6	7.1
40 to 60	3.0	3.0	3.3	3.4	3.6	3.7	3.8	3.8	4.0	4.3	4.8	4.9	5.6	6.2	6.7
20 to 40	2.7	2.8	3.0	3.1	3.3	3.4	3.5	3.5	3.7	4.0	4.5	4.6	5.2	5.8	6.3
0 to 20	2.4	2.5	2.7	2.8	3.0	3.1	3.2	3.2	3.4	3.7	4.1	4.2	4.8	5.4	5.9
−20 to 0	2.2	2.2	2.4	2.6	2.7	2.8	2.9	2.9	3.1	3.3	3.8	3.9	4.4	5.0	5.4
−40 to −20	1.9	2.0	2.1	2.3	2.4	2.5	2.6	2.6	2.8	3.0	3.5	3.5	4.1	4.6	5.0
−60 to −40	1.6	1.7	1.9	2.0	2.1	2.2	2.3	2.3	2.5	2.7	3.1	3.2	3.7	4.2	4.6
−70 to −60	1.4	1.5	1.7	1.8	1.9	2.0	2.1	2.1	2.3	2.5	2.9	2.9	3.4	3.9	4.3

Coef. disp. form. (frac. eq.)(ref.)	
P1	1.12167309E−01
Q1	9.09103715E+01
P2	1.25830025E−02
Q2	4.36118239E−02
P3	3.52889109E−01
Q3	6.43290245E−03

Fitting error of disp. form. σ [1E-6]		
	Visible	Infrared
Power ser. eq.	0.7	4.2
Frac. eq. (ref.)	0.6	5.5

Prod. Freq. (A to D)	C

Similar glass type			
OHARA	S-BAH10	HOYA	BAF10
CDGM	H-ZBaF52	SCHOTT	N-BAF10

2022-7-1	StP, AP, SP
2019-4-1	Transmittance
2015-4-1	Color Code, Prod. Freq., Similar glass type

HIKARI GLASS CO., LTD.

J-BAF11

n_d = 1.666720 n_e = 1.670002

ν_d = 48.33 ν_e = 48.04

Glass code (d)
667483
Glass code (e)
670480

Spectral l.	Refractive idx
2.058	1.63817
1.970	1.63935
1.530	1.64491
1.129	1.65021
1.064	1.65123
t	1.65210
s	1.65555
A'	1.657996
r	1.660282
C	1.662593
C'	1.663245
He-Ne	1.663855
D	1.666598
d	1.666720
e	1.670002
F	1.676388
F'	1.677191
g	1.684118
h	1.690647
0.389	1.694683
i	1.702036

Partial dispersion	
F-C	0.013795
F'-C'	0.013946
C-t	0.010494
C-A'	0.004597
d-C	0.004127
e-C	0.007409
g-d	0.017398
g-F	0.007730
h-g	0.006529
i-g	0.017918
C'-t	0.011146
e-C'	0.006757
F'-e	0.007189
i-F'	0.024845

Relative partial dispersion	
C-t／F-C	0.7607
C-A'／F-C	0.3332
d-C／F-C	0.2992
e-C／F-C	0.5371
g-d／F-C	1.2612
g-F／F-C	0.5603
h-g／F-C	0.4733
i-g／F-C	1.2989
C'-t／F'-C'	0.7992
e-C'／F'-C'	0.4845
F'-e／F'-C'	0.5155
i-F'／F'-C'	1.7815

Deviation of relative partial disp.	
ΔPdC	0.0001
ΔPgF	−0.0029

Internal CC (80%/5%)
362/331
Color Code (80%/5%)
375/330

CCI	
B	0.00
G	0.47
R	0.46

Thermal properties	
CTE(−30,70) [1E-7/℃]	67
CTE(100,300) [1E-7/℃]	84
Tg [℃]	573
At [℃]	631
StP [℃]	534
AP [℃]	573
SP [℃]	729
Ht cndct. [W/m·K]	0.895
Sp. heat [kJ/kg·K]	0.563
Ht diffus. [1E-6 m2/sec]	0.442

Chemical properties [class]	
Acid res. (surface)	1
Alkaline detergent res.	1
Climate resistance	1
Water res. (powder)	1
Acid res. (powder)	1

Mechanical properties	
Knoop hardness	544 (5)
Abrasion hardness	124
Young's mod. [GPa]	94.0
Shear mod. [GPa]	36.8
Poisson's ratio	0.277
Stress optical coef. [1E-5 nm/cm／Pa]	2.21

Internal trans. (10mm)	
λ [nm]	τ
280	–
290	–
300	–
310	–
320	–
330	0.04
340	0.22
350	0.52
360	0.76
370	0.89
380	0.941
390	0.967
400	0.979
420	0.987
440	0.989
460	0.991
480	0.994
500	0.996
550	0.998
600	0.997
650	0.997
700	0.997
800	0.997
900	0.997
1000	0.997
1200	0.998
1400	0.997
1600	0.992
1800	0.979
2000	0.970
2200	0.935
2400	0.88

Specific gravity
3.59

Coef. disp. form. (pwr ser.)	
A0	2.71886836E+00
A1	−9.21086428E−03
A2	−5.97080099E−05
A3	2.02512558E−02
A4	4.23467645E−04
A5	−1.03717059E−06
A6	1.22100678E−06
A7	0.00000000E+00
A8	0.00000000E+00

Relative Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90 (ref.)	4.3	4.3	4.5	4.7	4.9	5.0	5.1	5.1	5.4	5.6	6.2	6.3	7.0	7.7	8.1
60 to 80 (ref.)	4.2	4.2	4.4	4.6	4.7	4.9	5.0	5.0	5.2	5.5	6.1	6.1	6.8	7.5	7.9
40 to 60	4.1	4.1	4.3	4.4	4.6	4.8	4.8	4.9	5.1	5.3	5.9	5.9	6.6	7.2	7.6
20 to 40	4.0	4.0	4.2	4.3	4.5	4.6	4.7	4.7	4.9	5.2	5.7	5.8	6.4	7.0	7.4
0 to 20	3.9	3.9	4.1	4.3	4.4	4.6	4.6	4.7	4.8	5.1	5.6	5.6	6.2	6.8	7.2
−20 to 0	3.9	3.9	4.1	4.2	4.4	4.5	4.6	4.6	4.8	5.0	5.5	5.6	6.1	6.7	7.0
−40 to −20	4.0	4.0	4.1	4.3	4.4	4.6	4.6	4.6	4.8	5.0	5.5	5.6	6.1	6.6	6.9
−60 to −40 (ref.)	4.1	4.1	4.3	4.4	4.6	4.7	4.7	4.8	4.9	5.2	5.6	5.6	6.2	6.7	7.0
−70 to −60 (ref.)	4.3	4.3	4.5	4.6	4.7	4.9	4.9	4.9	5.1	5.3	5.7	5.8	6.3	6.8	7.1

Absolute Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90	3.3	3.3	3.5	3.7	3.8	4.0	4.1	4.1	4.3	4.6	5.2	5.2	5.9	6.6	7.0
60 to 80	3.1	3.1	3.3	3.5	3.6	3.8	3.8	3.9	4.1	4.4	4.9	5.0	5.7	6.3	6.7
40 to 60	2.8	2.8	3.0	3.2	3.3	3.5	3.5	3.6	3.8	4.0	4.6	4.6	5.3	5.9	6.3
20 to 40	2.5	2.6	2.7	2.9	3.0	3.2	3.2	3.3	3.5	3.7	4.2	4.3	4.9	5.5	5.9
0 to 20	2.3	2.3	2.5	2.6	2.8	2.9	3.0	3.0	3.2	3.4	3.9	3.9	4.5	5.1	5.4
−20 to 0	2.0	2.0	2.2	2.3	2.5	2.6	2.7	2.7	2.9	3.1	3.5	3.6	4.2	4.7	5.0
−40 to −20	1.7	1.8	1.9	2.0	2.2	2.3	2.4	2.4	2.6	2.8	3.2	3.3	3.8	4.3	4.6
−60 to −40	1.5	1.5	1.6	1.8	1.9	2.0	2.1	2.1	2.3	2.5	2.9	2.9	3.4	3.9	4.2
−70 to −60	1.3	1.3	1.4	1.6	1.7	1.8	1.8	1.9	2.0	2.2	2.6	2.7	3.1	3.6	3.9

Coef. disp. form. (frac. eq.)(ref.)	
P1	1.22633232E−01
Q1	1.00010916E+02
P2	1.54366657E−02
Q2	3.89083675E−02
P3	3.48798360E−01
Q3	6.16825972E−03

Fitting error of disp. form. σ [1E-6]		
	Visible	Infrared
Power ser. eq.	0.5	1.9
Frac. eq. (ref.)	0.5	2.8

Prod. Freq. (A to D)	C

Similar glass type			
OHARA	S-BAH11	HOYA	BAF11
CDGM	H-ZBaF16	SCHOTT	–

2022-7-1	StP, AP, SP
2019-4-1	Transmittance
2018-4-1	Prod. Freq.

J-BAF12

n_d = 1.639300 n_e = 1.642685

ν_d = 44.83 ν_e = 44.54

Glass code (d)
639448
Glass code (e)
643445

Spectral l.	Refractive idx
2.058	1.60880
1.970	1.61017
1.530	1.61644
1.129	1.62220
1.064	1.62329
t	1.62420
s	1.62780
A'	1.630326
r	1.632680
C	1.635055
C'	1.635725
He-Ne	1.636352
D	1.639174
d	1.639300
e	1.642685
F	1.649314
F'	1.650153
g	1.657437
h	1.664407
0.389	1.668777
i	1.676892

Partial dispersion	
F-C	0.014259
F'-C'	0.014428
C-t	0.010856
C-A'	0.004729
d-C	0.004245
e-C	0.007630
g-d	0.018137
g-F	0.008123
h-g	0.006970
i-g	0.019455
C'-t	0.011526
e-C'	0.006960
F'-e	0.007468
i-F'	0.026739

Relative partial dispersion	
C-t／F-C	0.7613
C-A'／F-C	0.3317
d-C／F-C	0.2977
e-C／F-C	0.5351
g-d／F-C	1.2720
g-F／F-C	0.5697
h-g／F-C	0.4888
i-g／F-C	1.3644
C'-t／F'-C'	0.7989
e-C'／F'-C'	0.4824
F'-e／F'-C'	0.5176
i-F'／F'-C'	1.8533

Deviation of relative partial disp.	
ΔPdC	0.0003
ΔPgF	0.0005

Internal CC (80%/5%)
377/346
Color Code (80%/5%)
390/345

CCI	
B	0.00
G	1.02
R	1.06

Thermal properties	
CTE(-30,70) [1E-7/℃]	67
CTE(100,300) [1E-7/℃]	81
Tg [℃]	583
At [℃]	632
StP [℃]	–
AP [℃]	–
SP [℃]	–
Ht cndct. [W/m･K]	0.856
Sp. heat [kJ/kg･K]	0.586
Ht diffus. [1E-6 m2/sec]	0.453

Chemical properties [class]	
Acid res. (surface)	1
Alkaline detergent res.	2
Climate resistance	1
Water res. (powder)	1
Acid res. (powder)	2

Mechanical properties	
Knoop hardness	535 (5)
Abrasion hardness	144
Young's mod. [GPa]	98.2
Shear mod. [GPa]	38.8
Poisson's ratio	0.265
Stress optical coef. [1E-5 nm/cm／Pa]	2.73

Internal trans. (10mm)	
λ [nm]	τ
280	–
290	–
300	–
310	–
320	–
330	–
340	0.01
350	0.11
360	0.39
370	0.67
380	0.83
390	0.909
400	0.947
420	0.976
440	0.985
460	0.989
480	0.992
500	0.995
550	0.997
600	0.997
650	0.998
700	0.998
800	0.998
900	0.999
1000	0.999
1200	0.998
1400	0.990
1600	0.990
1800	0.981
2000	0.968
2200	0.906
2400	0.81

Specific gravity
3.23

Coef. disp. form. (pwr ser.)	
A0	2.62810335E+00
A1	-9.95087731E-03
A2	-1.44740792E-04
A3	2.06473464E-02
A4	1.62531777E-04
A5	7.85240289E-05
A6	-7.45350927E-06
A7	4.83617341E-07
A8	0.00000000E+00

Relative Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90 (ref.)	3.2	3.3	3.4	3.6	3.8	4.0	4.0	4.1	4.3	4.6	5.2	5.3	6.0	6.6	6.9
60 to 80 (ref.)	3.1	3.1	3.3	3.5	3.6	3.8	3.9	3.9	4.1	4.4	5.0	5.1	5.8	6.4	6.6
40 to 60	3.0	3.0	3.2	3.3	3.5	3.6	3.7	3.7	3.9	4.2	4.8	4.8	5.5	6.1	6.3
20 to 40	2.8	2.9	3.0	3.2	3.3	3.5	3.5	3.6	3.8	4.0	4.6	4.6	5.3	5.8	6.0
0 to 20	2.8	2.8	2.9	3.1	3.2	3.4	3.4	3.5	3.7	3.9	4.4	4.5	5.1	5.6	5.8
-20 to 0	2.7	2.7	2.9	3.0	3.2	3.3	3.4	3.4	3.6	3.8	4.3	4.4	4.9	5.4	5.6
-40 to -20	2.8	2.8	2.9	3.0	3.2	3.3	3.4	3.4	3.6	3.8	4.2	4.3	4.9	5.3	5.5
-60 to -40 (ref.)	2.9	2.9	3.0	3.2	3.3	3.4	3.5	3.5	3.7	3.9	4.3	4.4	4.9	5.3	5.5
-70 to -60 (ref.)	3.0	3.1	3.2	3.3	3.4	3.6	3.6	3.6	3.8	4.0	4.4	4.5	5.0	5.4	5.5

Absolute Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90	2.2	2.3	2.4	2.6	2.8	3.0	3.0	3.0	3.3	3.5	4.1	4.2	4.9	5.5	5.8
60 to 80	2.0	2.0	2.2	2.4	2.5	2.7	2.8	2.8	3.0	3.3	3.9	3.9	4.6	5.2	5.5
40 to 60	1.7	1.8	1.9	2.1	2.2	2.4	2.4	2.5	2.7	2.9	3.5	3.6	4.2	4.8	5.0
20 to 40	1.4	1.5	1.6	1.8	1.9	2.1	2.1	2.2	2.3	2.6	3.1	3.2	3.8	4.3	4.5
0 to 20	1.2	1.2	1.3	1.5	1.6	1.7	1.8	1.8	2.0	2.2	2.7	2.8	3.4	3.9	4.1
-20 to 0	0.9	0.9	1.0	1.2	1.3	1.4	1.5	1.5	1.7	1.9	2.4	2.4	3.0	3.5	3.6
-40 to -20	0.6	0.6	0.7	0.8	1.0	1.1	1.1	1.2	1.3	1.5	2.0	2.1	2.6	3.0	3.3
-60 to -40	0.3	0.3	0.4	0.5	0.7	0.8	0.8	0.9	1.0	1.2	1.6	1.7	2.2	2.6	2.7
-70 to -60	0.1	0.1	0.2	0.3	0.4	0.5	0.6	0.6	0.8	0.9	1.3	1.4	1.9	2.3	2.4

Coef. disp. form. (frac. eq.)(ref.)	
P1	1.01418564E-01
Q1	7.16266791E+01
P2	9.76853251E-03
Q2	5.44636973E-02
P3	3.42089890E-01
Q3	6.70566733E-03

Fitting error of disp. form. σ [1E-6]		
	Visible	Infrared
Power ser. eq.	0.4	11.4
Frac. eq. (ref.)	0.9	10.4

Prod. Freq. (A to D)	D

Similar glass type			
OHARA	S-BAM12	HOYA	–
CDGM	–	SCHOTT	–

2019-4-1	Transmittance, CTE(100,300)
2018-4-1	Prod. Freq.
2015-4-1	Color Code, Prod. Freq.

HIKARI GLASS CO., LTD.

J-BASF2

n_d = 1.664460 n_e = 1.668844

ν_d = 35.87 ν_e = 35.60

Glass code (d)
664359
Glass code (e)
669356

Spectral l.	Refractive idx
2.058	1.62927
1.970	1.63062
1.530	1.63707
1.129	1.64339
1.064	1.64464
t	1.64570
s	1.65000
A'	1.653099
r	1.656034
C	1.659032
C'	1.659883
He-Ne	1.660682
D	1.664298
d	1.664460
e	1.668844
F	1.677556
F'	1.678670
g	1.688467
h	1.698048
0.389	1.704168
i	1.715809

Partial dispersion	
F-C	0.018524
F'-C'	0.018787
C-t	0.013329
C-A'	0.005933
d-C	0.005428
e-C	0.009812
g-d	0.024007
g-F	0.010911
h-g	0.009581
i-g	0.027342
C'-t	0.014180
e-C'	0.008961
F'-e	0.009826
i-F'	0.037139

Relative partial dispersion	
C-t／F-C	0.7196
C-A'／F-C	0.3203
d-C／F-C	0.2930
e-C／F-C	0.5297
g-d／F-C	1.2960
g-F／F-C	0.5890
h-g／F-C	0.5172
i-g／F-C	1.4760
C'-t／F'-C'	0.7548
e-C'／F'-C'	0.4770
F'-e／F'-C'	0.5230
i-F'／F'-C'	1.9768

Deviation of relative partial disp.	
ΔPdC	−0.0004
ΔPgF	0.0048

Internal CC (80%/5%)
386/355
Color Code (80%/5%)
400/355

CCI	
B	0.00
G	1.52
R	1.49

Thermal properties	
CTE(−30,70) [1E-7/℃]	84
CTE(100,300) [1E-7/℃]	98
Tg [℃]	572
At [℃]	614
StP [℃]	515
AP [℃]	552
SP [℃]	684
Ht cndct. [W/m·K]	1.060
Sp. heat [kJ/kg·K]	0.657
Ht diffus. [1E-6 m2/sec]	0.523

Chemical properties [class]	
Acid res. (surface)	1
Alkaline detergent res.	1
Climate resistance	1
Water res. (powder)	1
Acid res. (powder)	1

Mechanical properties	
Knoop hardness	503 (5)
Abrasion hardness	175
Young's mod. [GPa]	84.8
Shear mod. [GPa]	33.9
Poisson's ratio	0.252
Stress optical coef. [1E-5 nm/cm／Pa]	2.51

Internal trans. (10mm)	
λ [nm]	τ
280	–
290	–
300	–
310	–
320	–
330	–
340	–
350	0.01
360	0.14
370	0.42
380	0.69
390	0.84
400	0.916
420	0.969
440	0.983
460	0.987
480	0.991
500	0.993
550	0.997
600	0.996
650	0.995
700	0.998
800	0.998
900	0.998
1000	0.998
1200	0.997
1400	0.993
1600	0.988
1800	0.972
2000	0.952
2200	0.89
2400	0.84

Specific gravity
3.08

Coef. disp. form. (pwr ser.)	
A0	2.69527127E+00
A1	−1.09541476E-02
A2	0.00000000E+00
A3	2.34490053E-02
A4	1.90163560E-03
A5	−3.68276327E-04
A6	7.49770823E-05
A7	−7.09432490E-06
A8	3.01058679E-07

Relative Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90 (ref.)	0.8	0.9	1.1	1.3	1.5	1.7	1.8	1.9	2.2	2.6	3.4	3.5	4.6	5.9	6.8
60 to 80 (ref.)	0.7	0.8	1.0	1.2	1.4	1.6	1.7	1.7	2.0	2.4	3.2	3.3	4.4	5.6	6.5
40 to 60	0.6	0.7	0.9	1.1	1.2	1.4	1.5	1.6	1.8	2.2	3.0	3.1	4.1	5.2	6.1
20 to 40	0.5	0.6	0.8	0.9	1.1	1.3	1.4	1.4	1.7	2.0	2.8	2.9	3.8	4.9	5.7
0 to 20	0.5	0.5	0.7	0.9	1.0	1.2	1.3	1.3	1.6	1.9	2.6	2.7	3.6	4.6	5.3
−20 to 0	0.5	0.5	0.7	0.9	1.0	1.2	1.2	1.3	1.5	1.8	2.5	2.6	3.4	4.4	5.0
−40 to −20	0.5	0.6	0.8	0.9	1.0	1.2	1.3	1.3	1.5	1.8	2.4	2.5	3.3	4.2	4.8
−60 to −40 (ref.)	0.7	0.8	0.9	1.0	1.2	1.3	1.4	1.4	1.6	1.9	2.5	2.6	3.3	4.1	4.7
−70 to −60 (ref.)	0.9	0.9	1.1	1.2	1.4	1.5	1.5	1.6	1.8	2.0	2.6	2.7	3.4	4.2	4.7

Absolute Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90	−0.2	−0.1	0.1	0.3	0.5	0.7	0.8	0.8	1.1	1.5	2.3	2.5	3.5	4.8	5.7
60 to 80	−0.4	−0.3	−0.1	0.1	0.3	0.5	0.5	0.6	0.9	1.3	2.1	2.2	3.2	4.4	5.3
40 to 60	−0.6	−0.6	−0.4	−0.2	0.0	0.2	0.2	0.3	0.6	0.9	1.7	1.8	2.8	3.9	4.7
20 to 40	−0.9	−0.8	−0.6	−0.5	−0.3	−0.1	−0.1	0.0	0.2	0.6	1.3	1.4	2.3	3.4	4.2
0 to 20	−1.1	−1.1	−0.9	−0.8	−0.6	−0.4	−0.4	−0.3	−0.1	0.2	0.9	1.0	1.9	2.9	3.6
−20 to 0	−1.4	−1.4	−1.2	−1.0	−0.9	−0.7	−0.7	−0.6	−0.4	−0.1	0.5	0.6	1.4	2.4	3.0
−40 to −20	−1.7	−1.6	−1.5	−1.3	−1.2	−1.0	−1.0	−0.9	−0.7	−0.5	0.1	0.2	1.0	1.8	2.5
−60 to −40	−1.9	−1.9	−1.7	−1.6	−1.5	−1.3	−1.3	−1.3	−1.1	−0.8	−0.3	−0.2	0.5	1.3	1.9
−70 to −60	−2.1	−2.1	−1.9	−1.8	−1.7	−1.6	−1.5	−1.5	−1.3	−1.1	−0.5	−0.5	0.2	0.9	1.5

Coef. disp. form. (frac. eq.)(ref.)	
P1	1.00362810E-01
Q1	7.32458985E+01
P2	1.42101815E-02
Q2	5.95561472E-02
P3	3.46573289E-01
Q3	7.65094042E-03

Fitting error of disp. form. σ [1E-6]		
	Visible	Infrared
Power ser. eq.	0.8	6.2
Frac. eq. (ref.)	2.3	10.7

Prod. Freq. (A to D)	C

Similar glass type			
OHARA	–	HOYA	–
CDGM	–	SCHOTT	N-BASF2

2022-7-1	StP, AP, SP
2019-4-1	Transmittance
2018-4-1	Prod. Freq.

J-BASF6

n_d = 1.667550 n_e = 1.671331

ν_d = 41.87 ν_e = 41.60

Glass code (d)
668419
Glass code (e)
671416

Spectral l.	Refractive idx
2.058	1.63334
1.970	1.63489
1.530	1.64203
1.129	1.64851
1.064	1.64972
t	1.65074
s	1.65475
A'	1.657562
r	1.660179
C	1.662821
C'	1.663567
He-Ne	1.664265
D	1.667410
d	1.667550
e	1.671331
F	1.678763
F'	1.679706
g	1.687932
h	1.695862
0.389	1.700870
i	1.710252

Coef. disp. form. (pwr ser.)	
A0	2.71408053E+00
A1	-1.14438690E-02
A2	-1.85062065E-04
A3	2.32439131E-02
A4	1.30291556E-04
A5	1.18143460E-04
A6	-1.18586652E-05
A7	7.68022789E-07
A8	0.00000000E+00

Partial dispersion	
F-C	0.015942
F'-C'	0.016139
C-t	0.012079
C-A'	0.005259
d-C	0.004729
e-C	0.008510
g-d	0.020382
g-F	0.009169
h-g	0.007930
i-g	0.022320
C'-t	0.012825
e-C'	0.007764
F'-e	0.008375
i-F'	0.030546

Relative partial dispersion	
C-t／F-C	0.7577
C-A'／F-C	0.3299
d-C／F-C	0.2966
e-C／F-C	0.5338
g-d／F-C	1.2785
g-F／F-C	0.5751
h-g／F-C	0.4974
i-g／F-C	1.4001
C'-t／F'-C'	0.7947
e-C'／F'-C'	0.4811
F'-e／F'-C'	0.5189
i-F'／F'-C'	1.8927

Deviation of relative partial disp.	
ΔPdC	0.0005
ΔPgF	0.0010

Internal CC (80%/5%)
389/352
Color Code (80%/5%)
405/350
CCI

B	0.00
G	2.06
R	2.13

Thermal properties	
CTE(-30,70) [1E-7/℃]	66
CTE(100,300) [1E-7/℃]	81
Tg [℃]	600
At [℃]	644
StP [℃]	551
AP [℃]	586
SP [℃]	710
Ht cndct. [W/m･K]	0.899
Sp. heat [kJ/kg･K]	0.653
Ht diffus. [1E-6 m2/sec]	0.429

Chemical properties [class]	
Acid res. (surface)	7
Alkaline detergent res.	2
Climate resistance	2
Water res. (powder)	1
Acid res. (powder)	4

Mechanical properties	
Knoop hardness	510 (5)
Abrasion hardness	128
Young's mod. [GPa]	88.7
Shear mod. [GPa]	35.0
Poisson's ratio	0.268
Stress optical coef. [1E-5 nm/cm／Pa]	2.73

Internal trans. (10mm)	
λ [nm]	τ
280	–
290	–
300	–
310	–
320	–
330	–
340	–
350	0.03
360	0.20
370	0.48
380	0.70
390	0.82
400	0.89
420	0.949
440	0.969
460	0.979
480	0.985
500	0.990
550	0.995
600	0.996
650	0.996
700	0.997
800	0.998
900	0.999
1000	0.999
1200	0.998
1400	0.992
1600	0.990
1800	0.979
2000	0.962
2200	0.89
2400	0.73

Specific gravity
3.21

Relative Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90 (ref.)	2.4	2.5	2.6	2.8	3.0	3.2	3.2	3.3	3.5	3.8	4.4	4.5	5.4	6.2	6.8
60 to 80 (ref.)	2.3	2.3	2.5	2.7	2.9	3.0	3.1	3.1	3.4	3.6	4.2	4.3	5.1	6.0	6.5
40 to 60	2.2	2.2	2.4	2.5	2.7	2.9	2.9	2.9	3.2	3.4	4.0	4.1	4.9	5.7	6.2
20 to 40	2.1	2.1	2.2	2.4	2.5	2.7	2.8	2.8	3.0	3.3	3.8	3.9	4.6	5.4	5.9
0 to 20	2.0	2.0	2.2	2.3	2.4	2.6	2.6	2.7	2.9	3.1	3.7	3.7	4.4	5.2	5.6
-20 to 0	2.0	2.0	2.1	2.3	2.4	2.5	2.6	2.6	2.8	3.0	3.5	3.6	4.3	5.0	5.4
-40 to -20	2.0	2.0	2.2	2.3	2.4	2.6	2.6	2.6	2.8	3.0	3.5	3.6	4.2	4.9	5.3
-60 to -40 (ref.)	2.2	2.2	2.3	2.4	2.5	2.7	2.7	2.7	2.9	3.1	3.6	3.6	4.2	4.9	5.3
-70 to -60 (ref.)	2.3	2.3	2.5	2.6	2.7	2.8	2.9	2.9	3.1	3.3	3.7	3.8	4.3	5.0	5.3

Absolute Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90	1.4	1.4	1.6	1.8	2.0	2.1	2.2	2.2	2.5	2.8	3.4	3.5	4.3	5.2	5.7
60 to 80	1.2	1.2	1.4	1.6	1.7	1.9	2.0	2.0	2.2	2.5	3.1	3.2	4.0	4.8	5.4
40 to 60	0.9	0.9	1.1	1.3	1.4	1.6	1.6	1.7	1.9	2.1	2.7	2.8	3.6	4.4	4.9
20 to 40	0.6	0.7	0.8	1.0	1.1	1.3	1.3	1.4	1.6	1.8	2.3	2.4	3.1	3.9	4.4
0 to 20	0.4	0.4	0.5	0.7	0.8	0.9	1.0	1.0	1.2	1.5	2.0	2.0	2.7	3.5	3.9
-20 to 0	0.1	0.1	0.2	0.4	0.5	0.6	0.7	0.7	0.9	1.1	1.6	1.7	2.3	3.0	3.4
-40 to -20	-0.2	-0.2	-0.1	0.1	0.2	0.3	0.3	0.4	0.6	0.8	1.2	1.3	1.9	2.5	2.9
-60 to -40	-0.5	-0.5	-0.4	-0.3	-0.1	0.0	0.0	0.1	0.2	0.4	0.8	0.9	1.5	2.1	2.5
-70 to -60	-0.7	-0.7	-0.6	-0.5	-0.4	-0.2	-0.2	-0.2	0.0	0.1	0.6	0.6	1.2	1.7	2.1

Coef. disp. form. (frac. eq.)(ref.)	
P1	1.01508388E-01
Q1	6.45319879E+01
P2	1.08815270E-02
Q2	5.72169663E-02
P3	3.52821748E-01
Q3	6.86732413E-03

Fitting error of disp. form. σ [1E-6]		
	Visible	Infrared
Power ser. eq.	0.7	10.4
Frac. eq. (ref.)	1.4	9.7

Prod. Freq. (A to D)	C

Similar glass type			
OHARA	-	HOYA	-
CDGM	-	SCHOTT	-

2022-7-1	StP, AP, SP
2019-4-1	Transmittance
2018-4-1	Prod. Freq.

J-BASF7

n_d = 1.701540 n_e = 1.705598

ν_d = 41.02 ν_e = 40.73

Glass code (d)
702410
Glass code (e)
706407

Spectral l.	Refractive idx
2.058	1.66819
1.970	1.66950
1.530	1.67568
1.129	1.68171
1.064	1.68290
t	1.68391
s	1.68799
A'	1.690915
r	1.693675
C	1.696483
C'	1.697278
He-Ne	1.698024
D	1.701390
d	1.701540
e	1.705598
F	1.713586
F'	1.714600
g	1.723434
h	1.731926
0.389	1.737268
i	–

Partial dispersion	
F-C	0.017103
F'-C'	0.017322
C-t	0.012575
C-A'	0.005568
d-C	0.005057
e-C	0.009115
g-d	0.021894
g-F	0.009848
h-g	0.008492
i-g	–
C'-t	0.013370
e-C'	0.008320
F'-e	0.009002
i-F'	–

Internal CC (80%/5%)
377/346
Color Code (80%/5%)
395/345

CCI	
B	0.00
G	1.12
R	1.19

Thermal properties	
CTE(-30,70) [1E-7/℃]	67
CTE(100,300) [1E-7/℃]	82
Tg [℃]	579
At [℃]	639
StP [℃]	534
AP [℃]	572
SP [℃]	718
Ht cndct. [W/m·K]	0.985
Sp. heat [kJ/kg·K]	0.583
Ht diffus. [1E-6 m2/sec]	0.464

Internal trans. (10mm)	
λ [nm]	τ
280	–
290	–
300	–
310	–
320	–
330	–
340	–
350	0.11
360	0.40
370	0.68
380	0.84
390	0.909
400	0.944
420	0.972
440	0.980
460	0.985
480	0.989
500	0.992
550	0.996
600	0.997
650	0.997
700	0.997
800	0.997
900	0.996
1000	0.996
1200	0.997
1400	0.996
1600	0.991
1800	0.982
2000	0.973
2200	0.938
2400	0.88

Coef. disp. form. (pwr ser.)	
A0	2.82115391E+00
A1	-1.00514408E-02
A2	-9.24350756E-05
A3	2.49821665E-02
A4	5.23468025E-04
A5	3.70259835E-05
A6	-2.14786963E-06
A7	2.97698375E-07
A8	0.00000000E+00

Relative partial dispersion	
C-t／F-C	0.7353
C-A'／F-C	0.3256
d-C／F-C	0.2957
e-C／F-C	0.5329
g-d／F-C	1.2801
g-F／F-C	0.5758
h-g／F-C	0.4965
i-g／F-C	–
C'-t／F'-C'	0.7719
e-C'／F'-C'	0.4803
F'-e／F'-C'	0.5197
i-F'／F'-C'	–

Deviation of relative partial disp.	
ΔPdC	0.0000
ΔPgF	0.0003

Chemical properties [class]	
Acid res. (surface)	1
Alkaline detergent res.	1
Climate resistance	1
Water res. (powder)	1
Acid res. (powder)	1

Mechanical properties	
Knoop hardness	531 (5)
Abrasion hardness	115
Young's mod. [GPa]	97.2
Shear mod. [GPa]	38.2
Poisson's ratio	0.272
Stress optical coef. [1E-5 nm/cm／Pa]	2.37

Specific gravity
3.63

Relative Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90 (ref.)	4.5	4.5	4.7	5.0	5.2	5.4	5.4	5.5	5.8	6.1	6.9	7.0	7.9	8.9	9.6
60 to 80 (ref.)	4.4	4.4	4.7	4.8	5.0	5.2	5.3	5.4	5.6	6.0	6.7	6.8	7.7	8.7	9.3
40 to 60	4.2	4.3	4.5	4.7	4.9	5.1	5.1	5.2	5.4	5.8	6.5	6.6	7.4	8.3	8.9
20 to 40	4.1	4.2	4.4	4.5	4.7	4.9	5.0	5.0	5.3	5.6	6.3	6.3	7.2	8.1	8.6
0 to 20	4.1	4.1	4.3	4.5	4.6	4.8	4.9	4.9	5.2	5.5	6.1	6.2	7.0	7.8	8.3
-20 to 0	4.0	4.1	4.3	4.4	4.6	4.8	4.8	4.9	5.1	5.4	6.0	6.1	6.8	7.6	8.1
-40 to -20	4.1	4.1	4.3	4.4	4.6	4.8	4.8	4.9	5.1	5.4	5.9	6.0	6.7	7.5	8.0
-60 to -40 (ref.)	4.2	4.3	4.4	4.6	4.7	4.9	4.9	5.0	5.2	5.5	6.0	6.1	6.8	7.5	7.9
-70 to -60 (ref.)	4.4	4.4	4.6	4.8	4.9	5.1	5.1	5.1	5.3	5.6	6.1	6.2	6.9	7.5	8.0

Absolute Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90	3.4	3.5	3.7	3.9	4.1	4.3	4.4	4.4	4.7	5.1	5.8	5.9	6.8	7.8	8.5
60 to 80	3.2	3.3	3.5	3.7	3.9	4.1	4.1	4.2	4.5	4.8	5.5	5.6	6.5	7.5	8.1
40 to 60	3.0	3.0	3.2	3.4	3.6	3.8	3.8	3.9	4.1	4.5	5.1	5.2	6.1	7.0	7.6
20 to 40	2.7	2.7	2.9	3.1	3.3	3.4	3.5	3.5	3.8	4.1	4.8	4.8	5.7	6.5	7.1
0 to 20	2.4	2.4	2.6	2.8	2.9	3.1	3.2	3.2	3.5	3.7	4.4	4.5	5.2	6.0	6.6
-20 to 0	2.1	2.1	2.3	2.5	2.6	2.8	2.9	2.9	3.1	3.4	4.0	4.1	4.8	5.6	6.1
-40 to -20	1.8	1.9	2.0	2.2	2.3	2.5	2.5	2.6	2.8	3.0	3.6	3.7	4.4	5.1	5.6
-60 to -40	1.5	1.6	1.7	1.9	2.0	2.2	2.2	2.2	2.4	2.7	3.2	3.3	3.9	4.6	5.1
-70 to -60	1.3	1.4	1.5	1.6	1.8	1.9	2.0	2.0	2.2	2.4	2.9	3.0	3.6	4.3	4.7

Coef. disp. form. (frac. eq.)(ref.)	
P1	1.10478239E-01
Q1	8.55560494E+01
P2	1.40861354E-02
Q2	5.16621818E-02
P3	3.63660694E-01
Q3	6.86792659E-03

Fitting error of disp. form. σ [1E-6]		
	Visible	Infrared
Power ser. eq.	0.6	7.5
Frac. eq. (ref.)	0.6	8.8

Prod. Freq. (A to D)	C

Similar glass type			
OHARA	S-BAH27	HOYA	BAFD7
CDGM	H-ZBaF20	SCHOTT	–

2022-7-1	StP, AP, SP
2019-4-1	Transmittance
2018-4-1	Prod. Freq.

J-BASF8

n_d = 1.723420 n_e = 1.727927

ν_d = 38.03 ν_e = 37.75

Glass code (d)
723380
Glass code (e)
728378

Spectral l.	Refractive idx
2.058	1.68732
1.970	1.68870
1.530	1.69523
1.129	1.70167
1.064	1.70296
t	1.70405
s	1.70849
A'	1.711700
r	1.714733
C	1.717827
C'	1.718705
He-Ne	1.719528
D	1.723254
d	1.723420
e	1.727927
F	1.736849
F'	1.737986
g	1.747938
h	1.757590
0.389	1.763711
i	1.775229

Partial dispersion	
F-C	0.019022
F'-C'	0.019281
C-t	0.013775
C-A'	0.006127
d-C	0.005593
e-C	0.010100
g-d	0.024518
g-F	0.011089
h-g	0.009652
i-g	0.027291
C'-t	0.014653
e-C'	0.009222
F'-e	0.010059
i-F'	0.037243

Relative partial dispersion	
C-t／F-C	0.7242
C-A'／F-C	0.3221
d-C／F-C	0.2940
e-C／F-C	0.5310
g-d／F-C	1.2889
g-F／F-C	0.5830
h-g／F-C	0.5074
i-g／F-C	1.4347
C'-t／F'-C'	0.7600
e-C'／F'-C'	0.4783
F'-e／F'-C'	0.5217
i-F'／F'-C'	1.9316

Deviation of relative partial disp.	
ΔPdC	−0.0003
ΔPgF	0.0024

Internal CC (80%/5%)
385/351
Color Code (80%/5%)
410/350
CCI

B	0.00
G	1.90
R	2.00

Thermal properties	
CTE(−30,70) [1E-7/℃]	69
CTE(100,300) [1E-7/℃]	84
Tg [℃]	600
At [℃]	653
StP [℃]	561
AP [℃]	599
SP [℃]	744
Ht cndct. [W/m·K]	0.921
Sp. heat [kJ/kg·K]	0.580
Ht diffus. [1E-6 m2/sec]	0.440

Chemical properties [class]	
Acid res. (surface)	1
Alkaline detergent res.	1
Climate resistance	1
Water res. (powder)	2
Acid res. (powder)	1

Mechanical properties	
Knoop hardness	519 (5)
Abrasion hardness	121
Young's mod. [GPa]	99.7
Shear mod. [GPa]	39.2
Poisson's ratio	0.271
Stress optical coef. [1E-5 nm/cm／Pa]	2.21

Internal trans. (10mm)	
λ [nm]	τ
280	–
290	–
300	–
310	–
320	–
330	–
340	–
350	0.04
360	0.23
370	0.53
380	0.74
390	0.84
400	0.901
420	0.951
440	0.969
460	0.977
480	0.983
500	0.988
550	0.994
600	0.996
650	0.996
700	0.997
800	0.996
900	0.996
1000	0.997
1200	0.998
1400	0.996
1600	0.991
1800	0.982
2000	0.971
2200	0.934
2400	0.87

Specific gravity
3.61

Coef. disp. form. (pwr ser.)	
A0	2.88696022E+00
A1	−1.05560202E-02
A2	−1.02521932E-04
A3	2.80905311E-02
A4	3.99098561E-04
A5	1.15091109E-04
A6	−1.16375905E-05
A7	8.75066077E-07
A8	0.00000000E+00

Relative Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90 (ref.)	3.8	3.9	4.1	4.3	4.6	4.8	4.9	4.9	5.3	5.6	6.5	6.6	7.7	8.9	9.7
60 to 80 (ref.)	3.7	3.8	4.0	4.2	4.4	4.6	4.7	4.8	5.1	5.5	6.3	6.4	7.4	8.6	9.4
40 to 60	3.5	3.6	3.9	4.0	4.2	4.5	4.5	4.6	4.9	5.2	6.0	6.1	7.1	8.2	9.0
20 to 40	3.4	3.5	3.7	3.9	4.1	4.3	4.4	4.4	4.7	5.1	5.8	5.9	6.8	7.9	8.6
0 to 20	3.4	3.4	3.6	3.8	4.0	4.2	4.2	4.3	4.6	4.9	5.6	5.7	6.6	7.6	8.2
−20 to 0	3.3	3.4	3.6	3.8	3.9	4.1	4.2	4.2	4.5	4.8	5.5	5.6	6.4	7.3	7.9
−40 to −20	3.4	3.4	3.6	3.8	4.0	4.1	4.2	4.2	4.5	4.8	5.4	5.5	6.3	7.1	7.7
−60 to −40 (ref.)	3.5	3.6	3.8	3.9	4.1	4.2	4.3	4.3	4.6	4.8	5.4	5.5	6.3	7.1	7.6
−70 to −60 (ref.)	3.7	3.8	4.0	4.1	4.2	4.4	4.5	4.5	4.7	5.0	5.6	5.6	6.3	7.1	7.6

Absolute Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90	2.7	2.8	3.1	3.3	3.5	3.7	3.8	3.9	4.2	4.6	5.4	5.5	6.6	7.8	8.6
60 to 80	2.5	2.6	2.9	3.1	3.3	3.5	3.5	3.6	3.9	4.3	5.1	5.2	6.2	7.4	8.2
40 to 60	2.2	2.3	2.6	2.7	2.9	3.1	3.2	3.3	3.6	3.9	4.7	4.8	5.8	6.8	7.6
20 to 40	2.0	2.0	2.2	2.4	2.6	2.8	2.9	2.9	3.2	3.5	4.3	4.4	5.3	6.3	7.0
0 to 20	1.7	1.7	1.9	2.1	2.3	2.5	2.5	2.6	2.8	3.2	3.9	4.0	4.8	5.8	6.4
−20 to 0	1.4	1.4	1.6	1.8	2.0	2.1	2.2	2.2	2.5	2.8	3.4	3.5	4.4	5.2	5.9
−40 to −20	1.1	1.2	1.3	1.5	1.6	1.8	1.9	1.9	2.1	2.4	3.0	3.1	3.9	4.7	5.3
−60 to −40	0.8	0.9	1.0	1.2	1.3	1.5	1.5	1.6	1.8	2.1	2.6	2.7	3.4	4.2	4.7
−70 to −60	0.6	0.6	0.8	0.9	1.1	1.2	1.3	1.3	1.5	1.8	2.3	2.4	3.1	3.8	4.3

Coef. disp. form. (frac. eq.)(ref.)	
P1	1.04773433E-01
Q1	7.92701952E+01
P2	1.39007302E-02
Q2	5.65058214E-02
P3	3.72250971E-01
Q3	7.25055966E-03

Fitting error of disp. form. σ [1E-6]		
	Visible	Infrared
Power ser. eq.	0.6	5.4
Frac. eq. (ref.)	2.0	10.1

Prod. Freq. (A to D)	C

Similar glass type			
OHARA	S-BAH28	HOYA	BAFD8
CDGM	H-ZBaF21	SCHOTT	–

2022-7-1	StP, AP, SP
2019-4-1	Transmittance
2015-4-1	Color Code

HIKARI GLASS CO., LTD.

J-SK2

n_d = 1.607380 n_e = 1.609932

ν_d = 56.74 ν_e = 56.46

Glass code (d)
607567
Glass code (e)
610565

Spectral l.	Refractive idx
2.058	1.58249
1.970	1.58367
1.530	1.58909
1.129	1.59394
1.064	1.59484
t	1.59558
s	1.59847
A'	1.600467
r	1.602303
C	1.604139
C'	1.604653
He-Ne	1.605134
D	1.607285
d	1.607380
e	1.609932
F	1.614843
F'	1.615456
g	1.620704
h	1.625584
0.389	1.628565
i	1.633926

Coef. disp. form. (pwr ser.)	
A0	2.53980653E+00
A1	-8.90433248E-03
A2	-8.40740070E-05
A3	1.55288703E-02
A4	2.21892881E-04
A5	3.98552039E-06
A6	1.13655993E-07
A7	0.00000000E+00
A8	0.00000000E+00

Partial dispersion	
F-C	0.010704
F'-C'	0.010803
C-t	0.008558
C-A'	0.003672
d-C	0.003241
e-C	0.005793
g-d	0.013324
g-F	0.005861
h-g	0.004880
i-g	0.013222
C'-t	0.009072
e-C'	0.005279
F'-e	0.005524
i-F'	0.018470

Relative partial dispersion	
C-t／F-C	0.7995
C-A'／F-C	0.3430
d-C／F-C	0.3028
e-C／F-C	0.5412
g-d／F-C	1.2448
g-F／F-C	0.5476
h-g／F-C	0.4559
i-g／F-C	1.2352
C'-t／F'-C'	0.8398
e-C'／F'-C'	0.4887
F'-e／F'-C'	0.5113
i-F'／F'-C'	1.7097

Deviation of relative partial disp.	
ΔPdC	0.0000
ΔPgF	−0.0016

Internal CC (80%/5%)
336/292
Color Code (80%/5%)
350/295
CCI
B −
G −
R −

Thermal properties	
CTE(−30,70) [1E-7/℃]	57
CTE(100,300) [1E-7/℃]	69
Tg [℃]	654
At [℃]	702
StP [℃]	604
AP [℃]	645
SP [℃]	804
Ht cndct. [W/m·K]	0.961
Sp. heat [kJ/kg·K]	0.548
Ht diffus. [1E-6 m2/sec]	0.496

Chemical properties [class]	
Acid res. (surface)	2
Alkaline detergent res.	2
Climate resistance	1
Water res. (powder)	1
Acid res. (powder)	3

Mechanical properties	
Knoop hardness	512 (5)
Abrasion hardness	164
Young's mod. [GPa]	77.6
Shear mod. [GPa]	30.6
Poisson's ratio	0.266
Stress optical coef. [1E-5 nm/cm／Pa]	2.50

Internal trans. (10mm)	
λ [nm]	τ
280	−
290	0.04
300	0.14
310	0.33
320	0.54
330	0.72
340	0.84
350	0.910
360	0.951
370	0.972
380	0.983
390	0.988
400	0.992
420	0.994
440	0.994
460	0.995
480	0.995
500	0.996
550	0.996
600	0.995
650	0.995
700	0.994
800	0.995
900	0.995
1000	0.996
1200	0.998
1400	0.989
1600	0.991
1800	0.982
2000	0.972
2200	0.917
2400	0.87

Specific gravity
3.53

Relative Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90 (ref.)	4.3	4.3	4.4	4.6	4.7	4.9	4.9	4.9	5.1	5.3	5.7	5.7	6.2	6.7	7.0
60 to 80 (ref.)	4.1	4.2	4.3	4.4	4.6	4.7	4.7	4.8	4.9	5.1	5.5	5.6	6.0	6.5	6.7
40 to 60	4.0	4.0	4.1	4.3	4.4	4.5	4.5	4.6	4.7	4.9	5.3	5.3	5.8	6.2	6.4
20 to 40	3.8	3.8	4.0	4.1	4.2	4.3	4.3	4.4	4.5	4.7	5.1	5.1	5.5	5.9	6.2
0 to 20	3.7	3.7	3.9	4.0	4.1	4.2	4.2	4.2	4.4	4.5	4.9	4.9	5.3	5.7	5.9
−20 to 0	3.6	3.7	3.8	3.9	4.0	4.1	4.1	4.1	4.3	4.4	4.8	4.8	5.2	5.6	5.8
−40 to −20	3.6	3.7	3.8	3.9	4.0	4.1	4.1	4.1	4.2	4.4	4.7	4.8	5.1	5.5	5.7
−60 to −40 (ref.)	3.7	3.7	3.8	3.9	4.0	4.1	4.2	4.2	4.3	4.4	4.8	4.8	5.1	5.5	5.7
−70 to −60 (ref.)	3.9	3.9	4.0	4.1	4.2	4.3	4.3	4.3	4.4	4.6	4.9	4.9	5.2	5.6	5.7

Absolute Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90	3.3	3.3	3.5	3.6	3.7	3.9	3.9	3.9	4.1	4.3	4.7	4.7	5.2	5.7	5.9
60 to 80	3.1	3.1	3.2	3.4	3.5	3.6	3.6	3.7	3.8	4.0	4.4	4.5	4.9	5.3	5.6
40 to 60	2.8	2.8	2.9	3.0	3.1	3.3	3.3	3.3	3.5	3.7	4.0	4.1	4.5	4.9	5.2
20 to 40	2.4	2.5	2.6	2.7	2.8	2.9	3.0	3.0	3.1	3.3	3.6	3.7	4.1	4.5	4.7
0 to 20	2.1	2.1	2.3	2.4	2.5	2.6	2.6	2.6	2.8	2.9	3.3	3.3	3.7	4.1	4.3
−20 to 0	1.8	1.8	1.9	2.0	2.1	2.2	2.3	2.3	2.4	2.6	2.9	2.9	3.3	3.7	3.8
−40 to −20	1.5	1.5	1.6	1.7	1.8	1.9	1.9	1.9	2.1	2.2	2.5	2.5	2.9	3.2	3.4
−60 to −40	1.2	1.2	1.3	1.4	1.5	1.5	1.6	1.6	1.7	1.8	2.1	2.2	2.5	2.8	3.0
−70 to −60	0.9	0.9	1.0	1.1	1.2	1.3	1.3	1.3	1.4	1.6	1.8	1.9	2.2	2.5	2.7

Coef. disp. form. (frac. eq.)(ref.)	
P1	1.21503006E-01
Q1	9.35640895E+01
P2	5.14196139E-02
Q2	1.93145621E-02
P3	2.87770878E-01
Q3	4.39985459E-03

Fitting error of disp. form. σ [1E-6]	Visible	Infrared
Power ser. eq.	0.3	4.2
Frac. eq. (ref.)	0.3	4.2

Prod. Freq. (A to D)	C

Similar glass type			
OHARA	S-BSM2	HOYA	BACD2
CDGM	H-ZK50	SCHOTT	N-SK2

2022-7-1	StP, AP, SP
2019-4-1	Transmittance
2016-4-1	Similar glass type

HIKARI GLASS CO., LTD.

J-SK4

n_d = 1.612720 n_e = 1.615216

ν_d = 58.54 ν_e = 58.27

Glass code (d)
613585
Glass code (e)
615583

Spectral l.	Refractive idx
2.058	1.58718
1.970	1.58846
1.530	1.59426
1.129	1.59934
1.064	1.60026
t	1.60101
s	1.60393
A'	1.605913
r	1.607730
C	1.609539
C'	1.610045
He-Ne	1.610518
D	1.612627
d	1.612720
e	1.615216
F	1.620006
F'	1.620603
g	1.625707
h	1.630445
0.389	1.633337
i	1.638532

Coef. disp. form. (pwr ser.)	
A0	2.55820861E+00
A1	-9.63062190E-03
A2	-1.05056878E-04
A3	1.52842971E-02
A4	1.88241434E-04
A5	5.74199467E-06
A6	3.67306869E-08
A7	0.00000000E+00
A8	0.00000000E+00

Partial dispersion	
F-C	0.010467
F'-C'	0.010558
C-t	0.008525
C-A'	0.003626
d-C	0.003181
e-C	0.005677
g-d	0.012987
g-F	0.005701
h-g	0.004738
i-g	0.012825
C'-t	0.009031
e-C'	0.005171
F'-e	0.005387
i-F'	0.017929

Relative partial dispersion	
C-t／F-C	0.8145
C-A'／F-C	0.3464
d-C／F-C	0.3039
e-C／F-C	0.5424
g-d／F-C	1.2408
g-F／F-C	0.5447
h-g／F-C	0.4527
i-g／F-C	1.2253
C'-t／F'-C'	0.8554
e-C'／F'-C'	0.4898
F'-e／F'-C'	0.5102
i-F'／F'-C'	1.6981

Deviation of relative partial disp.	
ΔPdC	0.0003
ΔPgF	−0.0015

Internal CC (80%/5%)
352/315
Color Code (80%/5%)
360/315

CCI	
B	0.00
G	0.21
R	0.18

Thermal properties	
CTE(-30,70) [1E-7/℃]	62
CTE(100,300) [1E-7/℃]	75
Tg [℃]	652
At [℃]	694
StP [℃]	602
AP [℃]	639
SP [℃]	775
Ht cndct. [W/m･K]	0.884
Sp. heat [kJ/kg･K]	0.538
Ht diffus. [1E-6 m2/sec]	0.460

Chemical properties [class]	
Acid res. (surface)	4
Alkaline detergent res.	2
Climate resistance	2
Water res. (powder)	2
Acid res. (powder)	3

Mechanical properties	
Knoop hardness	485 (5)
Abrasion hardness	106
Young's mod. [GPa]	82.4
Shear mod. [GPa]	32.5
Poisson's ratio	0.266
Stress optical coef. [1E-5 nm/cm／Pa]	2.14

Internal trans. (10mm)	
λ [nm]	τ
280	–
290	–
300	–
310	0.02
320	0.12
330	0.35
340	0.60
350	0.78
360	0.89
370	0.941
380	0.967
390	0.980
400	0.988
420	0.994
440	0.995
460	0.996
480	0.997
500	0.998
550	0.998
600	0.998
650	0.997
700	0.999
800	0.998
900	0.998
1000	0.998
1200	0.997
1400	0.986
1600	0.990
1800	0.978
2000	0.961
2200	0.88
2400	0.79

Specific gravity
3.53

Relative Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90 (ref.)	2.7	2.7	2.7	2.9	3.0	3.1	3.2	3.2	3.3	3.5	3.8	3.9	4.3	4.7	4.9
60 to 80 (ref.)	2.5	2.5	2.7	2.8	2.9	3.0	3.0	3.0	3.2	3.3	3.7	3.7	4.1	4.5	4.7
40 to 60	2.4	2.4	2.5	2.6	2.7	2.8	2.8	2.9	3.0	3.1	3.5	3.5	3.9	4.3	4.4
20 to 40	2.3	2.3	2.4	2.5	2.6	2.7	2.7	2.7	2.8	3.0	3.3	3.3	3.7	4.1	4.2
0 to 20	2.2	2.2	2.3	2.4	2.5	2.6	2.6	2.6	2.7	2.9	3.2	3.2	3.6	3.9	4.1
-20 to 0	2.1	2.1	2.2	2.3	2.4	2.5	2.5	2.6	2.7	2.8	3.1	3.1	3.5	3.8	4.0
-40 to -20	2.2	2.2	2.3	2.4	2.4	2.5	2.6	2.6	2.7	2.8	3.1	3.1	3.5	3.8	3.9
-60 to -40 (ref.)	2.3	2.3	2.4	2.5	2.6	2.6	2.7	2.7	2.8	2.9	3.2	3.2	3.5	3.8	4.0
-70 to -60 (ref.)	2.4	2.5	2.5	2.6	2.7	2.8	2.8	2.8	2.9	3.0	3.3	3.3	3.7	3.9	4.1

Absolute Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90	1.7	1.7	1.8	1.9	2.0	2.1	2.2	2.2	2.3	2.5	2.8	2.8	3.3	3.6	3.8
60 to 80	1.4	1.5	1.6	1.7	1.8	1.9	1.9	1.9	2.1	2.2	2.5	2.6	3.0	3.4	3.5
40 to 60	1.2	1.2	1.3	1.4	1.5	1.6	1.6	1.6	1.8	1.9	2.2	2.2	2.6	3.0	3.2
20 to 40	0.9	0.9	1.0	1.1	1.2	1.3	1.3	1.3	1.4	1.6	1.9	1.9	2.3	2.6	2.8
0 to 20	0.6	0.6	0.7	0.8	0.9	1.0	1.0	1.0	1.1	1.3	1.5	1.6	1.9	2.3	2.4
-20 to 0	0.3	0.3	0.4	0.5	0.6	0.7	0.7	0.7	0.8	0.9	1.2	1.2	1.6	1.9	2.0
-40 to -20	0.0	0.0	0.1	0.2	0.3	0.4	0.4	0.4	0.5	0.6	0.9	0.9	1.2	1.5	1.6
-60 to -40	-0.3	-0.3	-0.2	-0.1	0.0	0.0	0.1	0.1	0.2	0.3	0.5	0.6	0.9	1.1	1.3
-70 to -60	-0.5	-0.5	-0.4	-0.3	-0.3	-0.2	-0.2	-0.1	-0.1	0.0	0.3	0.3	0.6	0.9	1.0

Coef. disp. form. (frac. eq.)(ref.)	
P1	1.20597544E-01
Q1	8.62245013E+01
P2	2.08228775E-02
Q2	2.54136407E-02
P3	3.21046137E-01
Q3	5.20024979E-03

Fitting error of disp. form. σ [1E-6]		
	Visible	Infrared
Power ser. eq.	0.5	3.7
Frac. eq. (ref.)	0.5	3.5

Prod. Freq. (A to D)	C

Similar glass type			
OHARA	S-BSM4	HOYA	BACD4
CDGM	H-ZK6	SCHOTT	N-SK4

2022-7-1	StP, AP, SP
2019-4-1	Transmittance
2015-4-1	Color Code, Prod. Freq.

HIKARI GLASS CO., LTD.

J-SK5

n_d = 1.589130 n_e = 1.591426

ν_d = 61.22 ν_e = 60.98

Glass code (d)
589612
Glass code (e)
591610

Spectral l.	Refractive idx
2.058	1.56405
1.970	1.56537
1.530	1.57138
1.129	1.57650
1.064	1.57740
t	1.57814
s	1.58094
A'	1.582810
r	1.584509
C	1.586191
C'	1.586660
He-Ne	1.587097
D	1.589044
d	1.589130
e	1.591426
F	1.595814
F'	1.596359
g	1.601011
h	1.605313
0.389	1.607932
i	1.612622

Partial dispersion	
F-C	0.009623
F'-C'	0.009699
C-t	0.008051
C-A'	0.003381
d-C	0.002939
e-C	0.005235
g-d	0.011881
g-F	0.005197
h-g	0.004302
i-g	0.011611
C'-t	0.008520
e-C'	0.004766
F'-e	0.004933
i-F'	0.016263

Relative partial dispersion	
C-t／F-C	0.8366
C-A'／F-C	0.3513
d-C／F-C	0.3054
e-C／F-C	0.5440
g-d／F-C	1.2346
g-F／F-C	0.5401
h-g／F-C	0.4471
i-g／F-C	1.2066
C'-t／F'-C'	0.8784
e-C'／F'-C'	0.4914
F'-e／F'-C'	0.5086
i-F'／F'-C'	1.6768

Deviation of relative partial disp.	
ΔPdC	0.0006
ΔPgF	−0.0016

Internal CC (80%/5%)
339/298
Color Code (80%/5%)
350/300
CCI

B	0.00
G	0.12
R	0.13

Thermal properties	
CTE(−30,70) [1E-7/℃]	55
CTE(100,300) [1E-7/℃]	67
Tg [℃]	613
At [℃]	658
StP [℃]	561
AP [℃]	599
SP [℃]	743
Ht cndct. [W/m･K]	1.092
Sp. heat [kJ/kg･K]	0.614
Ht diffus. [1E-6 m2/sec]	0.542

Chemical properties [class]	
Acid res. (surface)	1
Alkaline detergent res.	1
Climate resistance	2
Water res. (powder)	2
Acid res. (powder)	3

Mechanical properties	
Knoop hardness	523 (5)
Abrasion hardness	85
Young's mod. [GPa]	86.1
Shear mod. [GPa]	34.4
Poisson's ratio	0.252
Stress optical coef. [1E-5 nm/cm／Pa]	2.29

Internal trans. (10mm)	
λ [nm]	τ
280	–
290	0.02
300	0.07
310	0.24
320	0.48
330	0.69
340	0.82
350	0.905
360	0.950
370	0.973
380	0.984
390	0.991
400	0.994
420	0.996
440	0.997
460	0.997
480	0.998
500	0.999
550	0.999
600	0.999
650	0.999
700	0.999
800	0.998
900	0.997
1000	0.997
1200	0.997
1400	0.979
1600	0.989
1800	0.979
2000	0.962
2200	0.87
2400	0.79

Specific gravity
3.26

Coef. disp. form. (pwr ser.)	
A0	2.48748280E+00
A1	−1.01006793E-02
A2	−9.51075480E-05
A3	1.37290228E-02
A4	1.82268499E-04
A5	1.87989450E-06
A6	9.76616911E-08
A7	0.00000000E+00
A8	0.00000000E+00

Relative Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90 (ref.)	3.8	3.8	3.9	4.0	4.1	4.2	4.2	4.2	4.3	4.5	4.8	4.8	5.1	5.4	5.6
60 to 80 (ref.)	3.6	3.7	3.8	3.9	3.9	4.0	4.1	4.1	4.2	4.3	4.6	4.6	5.0	5.2	5.5
40 to 60	3.5	3.5	3.6	3.7	3.8	3.8	3.9	3.9	4.0	4.2	4.4	4.4	4.8	5.0	5.2
20 to 40	3.3	3.4	3.5	3.6	3.6	3.7	3.7	3.7	3.9	4.0	4.3	4.3	4.6	4.8	5.0
0 to 20	3.2	3.3	3.4	3.4	3.5	3.6	3.6	3.6	3.7	3.9	4.1	4.1	4.4	4.7	4.9
−20 to 0	3.2	3.2	3.3	3.4	3.4	3.5	3.5	3.6	3.7	3.8	4.1	4.1	4.4	4.6	4.8
−40 to −20	3.2	3.2	3.3	3.4	3.5	3.5	3.5	3.6	3.7	3.8	4.0	4.1	4.3	4.6	4.8
−60 to −40 (ref.)	3.3	3.3	3.4	3.5	3.6	3.6	3.6	3.7	3.8	3.9	4.1	4.1	4.4	4.6	4.8
−70 to −60 (ref.)	3.4	3.5	3.6	3.6	3.7	3.8	3.8	3.8	3.9	4.0	4.3	4.3	4.5	4.8	4.9

Absolute Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90	2.8	2.8	3.0	3.0	3.1	3.2	3.2	3.2	3.4	3.5	3.8	3.8	4.1	4.4	4.6
60 to 80	2.6	2.6	2.7	2.8	2.9	2.9	3.0	3.0	3.1	3.3	3.5	3.5	3.9	4.1	4.3
40 to 60	2.3	2.3	2.4	2.5	2.6	2.6	2.7	2.7	2.8	2.9	3.2	3.2	3.5	3.8	4.0
20 to 40	2.0	2.0	2.1	2.2	2.2	2.3	2.3	2.4	2.5	2.6	2.9	2.9	3.2	3.4	3.6
0 to 20	1.7	1.7	1.8	1.9	1.9	2.0	2.0	2.0	2.2	2.3	2.5	2.5	2.8	3.1	3.2
−20 to 0	1.4	1.4	1.5	1.6	1.6	1.7	1.7	1.7	1.8	2.0	2.2	2.2	2.5	2.7	2.9
−40 to −20	1.1	1.1	1.2	1.3	1.3	1.4	1.4	1.4	1.5	1.6	1.9	1.9	2.1	2.4	2.5
−60 to −40	0.8	0.8	0.9	0.9	1.0	1.1	1.1	1.1	1.2	1.3	1.5	1.5	1.8	2.0	2.2
−70 to −60	0.5	0.6	0.7	0.7	0.8	0.8	0.8	0.9	0.9	1.1	1.3	1.3	1.5	1.7	1.9

Coef. disp. form. (frac. eq.)(ref.)	
P1	1.32946901E-01
Q1	8.83791979E+01
P2	7.83138637E-02
Q2	1.47105353E-02
P3	2.53166689E-01
Q3	3.53720032E-03

Fitting error of disp. form. σ [1E-6]		
	Visible	Infrared
Power ser. eq.	0.3	3.7
Frac. eq. (ref.)	0.3	4.1

Prod. Freq. (A to D)	A

Similar glass type			
OHARA	S-BAL35	HOYA	BACD5
CDGM	H-ZK3	SCHOTT	N-SK5

2022-7-1	StP, AP, SP
2019-4-1	Transmittance
2015-4-1	Color Code, Prod. Freq.

HIKARI GLASS CO., LTD.

J-SK10

n_d = 1.622800 n_e = 1.625400

ν_d = 57.10 ν_e = 56.83

Glass code (d)
623571
Glass code (e)
625568

Spectral l.	Refractive idx
2.058	1.59692
1.970	1.59817
1.530	1.60391
1.129	1.60900
1.064	1.60993
t	1.61070
s	1.61369
A'	1.615735
r	1.617616
C	1.619492
C'	1.620018
He-Ne	1.620509
D	1.622703
d	1.622800
e	1.625400
F	1.630399
F'	1.631023
g	1.636358
h	1.641315
0.389	1.644342
i	1.649783

Coef. disp. form. (pwr ser.)	
A0	2.58848328E+00
A1	-9.52709742E-03
A2	-9.90298068E-05
A3	1.60216897E-02
A4	2.07026667E-04
A5	6.19900432E-06
A6	1.17812844E-08
A7	0.00000000E+00
A8	0.00000000E+00

Partial dispersion	
F-C	0.010907
F'-C'	0.011005
C-t	0.008788
C-A'	0.003757
d-C	0.003308
e-C	0.005908
g-d	0.013558
g-F	0.005959
h-g	0.004957
i-g	0.013425
C'-t	0.009314
e-C'	0.005382
F'-e	0.005623
i-F'	0.018760

Relative partial dispersion	
C-t／F-C	0.8057
C-A'／F-C	0.3445
d-C／F-C	0.3033
e-C／F-C	0.5417
g-d／F-C	1.2431
g-F／F-C	0.5463
h-g／F-C	0.4545
i-g／F-C	1.2309
C'-t／F'-C'	0.8463
e-C'／F'-C'	0.4891
F'-e／F'-C'	0.5109
i-F'／F'-C'	1.7047

Deviation of relative partial disp.	
ΔPdC	0.0003
ΔPgF	−0.0022

Internal CC (80%/5%)
342/292
Color Code (80%/5%)
355/295
CCI

B	0.00
G	0.21
R	0.20

Thermal properties	
CTE(-30,70) [1E-7/℃]	68
CTE(100,300) [1E-7/℃]	80
Tg [℃]	623
At [℃]	671
StP [℃]	572
AP [℃]	609
SP [℃]	746
Ht cndct. [W/m･K]	0.822
Sp. heat [kJ/kg･K]	0.521
Ht diffus. [1E-6 m2/sec]	0.440

Chemical properties [class]	
Acid res. (surface)	7
Alkaline detergent res.	3
Climate resistance	3
Water res. (powder)	2
Acid res. (powder)	4

Mechanical properties	
Knoop hardness	547 (5)
Abrasion hardness	167
Young's mod. [GPa]	82.7
Shear mod. [GPa]	32.5
Poisson's ratio	0.273
Stress optical coef. [1E-5 nm/cm／Pa]	2.16

Internal trans. (10mm)	
λ [nm]	τ
280	–
290	0.04
300	0.11
310	0.25
320	0.45
330	0.63
340	0.77
350	0.87
360	0.928
370	0.962
380	0.978
390	0.987
400	0.992
420	0.995
440	0.995
460	0.995
480	0.998
500	0.998
550	0.999
600	0.999
650	0.998
700	0.999
800	0.998
900	0.996
1000	0.996
1200	0.997
1400	0.989
1600	0.989
1800	0.976
2000	0.959
2200	0.89
2400	0.78

Specific gravity
3.58

Relative Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90 (ref.)	2.0	2.0	2.1	2.3	2.4	2.5	2.5	2.6	2.7	2.9	3.3	3.3	3.7	4.1	4.3
60 to 80 (ref.)	1.9	1.9	2.1	2.2	2.3	2.4	2.4	2.4	2.6	2.7	3.1	3.1	3.6	3.9	4.1
40 to 60	1.7	1.8	1.9	2.0	2.1	2.2	2.2	2.3	2.4	2.6	2.9	2.9	3.3	3.7	3.9
20 to 40	1.6	1.7	1.8	1.9	2.0	2.1	2.1	2.1	2.3	2.4	2.7	2.8	3.2	3.5	3.7
0 to 20	1.6	1.6	1.7	1.8	1.9	2.0	2.0	2.0	2.2	2.3	2.6	2.7	3.0	3.4	3.5
−20 to 0	1.5	1.5	1.6	1.7	1.8	1.9	1.9	2.0	2.1	2.2	2.5	2.6	2.9	3.3	3.4
−40 to −20	1.6	1.6	1.7	1.8	1.8	1.9	2.0	2.0	2.1	2.2	2.5	2.6	2.9	3.2	3.4
−60 to −40 (ref.)	1.7	1.7	1.8	1.9	2.0	2.0	2.1	2.1	2.2	2.3	2.6	2.6	3.0	3.3	3.4
−70 to −60 (ref.)	1.8	1.9	1.9	2.0	2.1	2.2	2.2	2.3	2.4	2.5	2.8	2.8	3.1	3.4	3.5

Absolute Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90	1.0	1.0	1.2	1.3	1.4	1.5	1.5	1.6	1.7	1.9	2.2	2.3	2.7	3.1	3.3
60 to 80	0.8	0.8	1.0	1.1	1.2	1.3	1.3	1.3	1.5	1.6	2.0	2.0	2.4	2.8	3.0
40 to 60	0.5	0.5	0.7	0.8	0.9	1.0	1.0	1.0	1.2	1.3	1.6	1.7	2.1	2.4	2.6
20 to 40	0.2	0.3	0.4	0.5	0.6	0.7	0.7	0.7	0.8	1.0	1.3	1.3	1.7	2.1	2.2
0 to 20	0.0	0.0	0.1	0.2	0.3	0.4	0.4	0.4	0.5	0.7	1.0	1.0	1.4	1.7	1.9
−20 to 0	−0.3	−0.3	−0.2	−0.1	0.0	0.1	0.1	0.1	0.2	0.3	0.6	0.7	1.0	1.3	1.5
−40 to −20	−0.6	−0.6	−0.5	−0.4	−0.3	−0.3	−0.2	−0.2	−0.1	0.0	0.3	0.3	0.7	0.9	1.1
−60 to −40	−0.9	−0.9	−0.8	−0.7	−0.6	−0.6	−0.5	−0.5	−0.4	−0.3	0.0	0.0	0.3	0.6	0.7
−70 to −60	−1.1	−1.1	−1.0	−0.9	−0.9	−0.8	−0.8	−0.7	−0.7	−0.5	−0.3	−0.3	0.0	0.3	0.4

Coef. disp. form. (frac. eq.)(ref.)	
P1	1.22567490E-01
Q1	8.97846825E+01
P2	3.82261328E-02
Q2	2.10742317E-02
P3	3.07985247E-01
Q3	4.76996135E-03

Fitting error of disp. form. σ [1E-6]		
	Visible	Infrared
Power ser. eq.	0.3	1.9
Frac. eq. (ref.)	0.4	1.7

Prod. Freq. (A to D)	C

Similar glass type			
OHARA	S-BSM10	HOYA	E-BACD10
CDGM	H-ZK10L	SCHOTT	–

2022-7-1	StP, AP, SP
2019-4-1	Transmittance
2018-4-1	Prod. Freq.

J-SK11

n_d = 1.563840 n_e = 1.566055

ν_d = 60.71 ν_e = 60.46

Glass code (d)
564607
Glass code (e)
566605

Spectral l.	Refractive idx
2.058	1.53995
1.970	1.54120
1.530	1.54686
1.129	1.55171
1.064	1.55257
t	1.55328
s	1.55595
A'	1.557752
r	1.559387
C	1.561006
C'	1.561458
He-Ne	1.561879
D	1.563757
d	1.563840
e	1.566055
F	1.570294
F'	1.570821
g	1.575320
h	1.579485
0.389	1.582022
i	1.586569

Partial dispersion	
F-C	0.009288
F'-C'	0.009363
C-t	0.007729
C-A'	0.003254
d-C	0.002834
e-C	0.005049
g-d	0.011480
g-F	0.005026
h-g	0.004165
i-g	0.011249
C'-t	0.008181
e-C'	0.004597
F'-e	0.004766
i-F'	0.015748

Relative partial dispersion	
C-t／F-C	0.8321
C-A'／F-C	0.3503
d-C／F-C	0.3051
e-C／F-C	0.5436
g-d／F-C	1.2360
g-F／F-C	0.5411
h-g／F-C	0.4484
i-g／F-C	1.2111
C'-t／F'-C'	0.8738
e-C'／F'-C'	0.4910
F'-e／F'-C'	0.5090
i-F'／F'-C'	1.6819

Deviation of relative partial disp.	
ΔPdC	0.0005
ΔPgF	−0.0014

Internal CC (80%/5%)
334/302
Color Code (80%/5%)
340/305

CCI	
B	0.00
G	0.12
R	0.06

Thermal properties	
CTE(−30,70) [1E-7/℃]	64
CTE(100,300) [1E-7/℃]	77
Tg [℃]	603
At [℃]	653
StP [℃]	546
AP [℃]	587
SP [℃]	745
Ht cndct. [W/m·K]	0.873
Sp. heat [kJ/kg·K]	0.550
Ht diffus. [1E-6 m2/sec]	0.444

Chemical properties [class]	
Acid res. (surface)	1
Alkaline detergent res.	1
Climate resistance	1
Water res. (powder)	2
Acid res. (powder)	2

Mechanical properties	
Knoop hardness	508 (5)
Abrasion hardness	112
Young's mod. [GPa]	79.9
Shear mod. [GPa]	32.2
Poisson's ratio	0.241
Stress optical coef. [1E-5 nm/cm／Pa]	2.61

Internal trans. (10mm)	
λ [nm]	τ
280	–
290	–
300	0.03
310	0.20
320	0.50
330	0.74
340	0.87
350	0.938
360	0.969
370	0.982
380	0.988
390	0.993
400	0.995
420	0.996
440	0.996
460	0.996
480	0.997
500	0.998
550	0.998
600	0.998
650	0.997
700	0.998
800	0.998
900	0.999
1000	0.999
1200	0.999
1400	0.982
1600	0.992
1800	0.980
2000	0.962
2200	0.87
2400	0.82

Specific gravity
3.06

Coef. disp. form. (pwr ser.)	
A0	2.40941529E+00
A1	−9.29122990E−03
A2	−9.65092890E−05
A3	1.31170272E−02
A4	1.53988355E−04
A5	4.69136387E−06
A6	−2.59660236E−08
A7	0.00000000E+00
A8	0.00000000E+00

Relative Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90 (ref.)	3.6	3.7	3.7	3.9	3.9	4.0	4.1	4.1	4.2	4.3	4.6	4.6	4.9	5.2	5.4
60 to 80 (ref.)	3.4	3.4	3.6	3.6	3.7	3.8	3.8	3.9	4.0	4.1	4.4	4.4	4.7	5.0	5.2
40 to 60	3.1	3.2	3.3	3.4	3.5	3.5	3.6	3.6	3.7	3.8	4.1	4.1	4.4	4.7	4.9
20 to 40	2.9	2.9	3.0	3.1	3.2	3.3	3.3	3.3	3.4	3.6	3.8	3.9	4.1	4.4	4.6
0 to 20	2.7	2.7	2.8	2.9	3.0	3.1	3.1	3.1	3.2	3.4	3.6	3.6	3.9	4.2	4.4
−20 to 0	2.5	2.6	2.7	2.8	2.8	2.9	3.0	3.0	3.1	3.2	3.4	3.5	3.8	4.0	4.2
−40 to −20	2.4	2.5	2.6	2.7	2.7	2.8	2.9	2.9	3.0	3.1	3.3	3.4	3.7	3.9	4.1
−60 to −40 (ref.)	2.4	2.5	2.6	2.7	2.7	2.8	2.8	2.9	3.0	3.1	3.3	3.4	3.6	3.9	4.1
−70 to −60 (ref.)	2.5	2.5	2.6	2.7	2.8	2.9	2.9	2.9	3.0	3.2	3.4	3.4	3.7	4.0	4.2

Absolute Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90	2.7	2.7	2.8	2.9	3.0	3.1	3.1	3.1	3.2	3.3	3.6	3.6	3.9	4.2	4.4
60 to 80	2.4	2.4	2.5	2.6	2.7	2.8	2.8	2.8	2.9	3.0	3.3	3.3	3.6	3.9	4.1
40 to 60	2.0	2.0	2.1	2.2	2.3	2.3	2.4	2.4	2.5	2.6	2.9	2.9	3.2	3.5	3.6
20 to 40	1.6	1.6	1.7	1.8	1.9	1.9	2.0	2.0	2.1	2.2	2.4	2.5	2.7	3.0	3.2
0 to 20	1.2	1.2	1.3	1.4	1.5	1.5	1.6	1.6	1.7	1.8	2.0	2.1	2.3	2.6	2.8
−20 to 0	0.8	0.8	0.9	1.0	1.0	1.1	1.1	1.2	1.3	1.4	1.6	1.6	1.9	2.2	2.4
−40 to −20	0.4	0.4	0.5	0.6	0.6	0.7	0.7	0.8	0.9	1.0	1.2	1.2	1.5	1.7	1.9
−60 to −40	0.0	0.0	0.1	0.2	0.2	0.3	0.3	0.3	0.4	0.6	0.8	0.8	1.1	1.3	1.5
−70 to −60	−0.3	−0.3	−0.2	−0.1	−0.1	0.0	0.0	0.0	0.1	0.2	0.5	0.5	0.7	1.0	1.2

Coef. disp. form. (frac. eq.)(ref.)	
P1	1.30541326E−01
Q1	9.05077329E+01
P2	4.41635252E−02
Q2	1.83187813E−02
P3	2.75495920E−01
Q3	4.38027483E−03

Fitting error of disp. form. σ [1E-6]		
	Visible	Infrared
Power ser. eq.	0.3	3.4
Frac. eq. (ref.)	0.3	3.6

Prod. Freq. (A to D)	B

Similar glass type			
OHARA	S-BAL41	HOYA	BACD11
CDGM	H-BaK6	SCHOTT	N-SK11

2022-7-1	StP, AP, SP
2019-4-1	Transmittance
2015-4-1	Color Code, Prod. Freq.

HIKARI GLASS CO., LTD.

J-SK12

n_d = 1.583130 n_e = 1.585470

ν_d = 59.42 ν_e = 59.16

Glass code (d)
583594
Glass code (e)
585592

Spectral l.	Refractive idx
2.058	1.55838
1.970	1.55965
1.530	1.56543
1.129	1.57042
1.064	1.57131
t	1.57204
s	1.57483
A'	1.576718
r	1.578436
C	1.580141
C'	1.580617
He-Ne	1.581061
D	1.583043
d	1.583130
e	1.585470
F	1.589954
F'	1.590513
g	1.595281
h	1.599700
0.389	1.602395
i	1.607229

Coef. disp. form. (pwr ser.)	
A0	2.46741191E+00
A1	-9.52788845E-03
A2	-1.02594923E-04
A3	1.40303006E-02
A4	1.69265777E-04
A5	5.39399652E-06
A6	-2.33385875E-08
A7	0.00000000E+00
A8	0.00000000E+00

Partial dispersion	
F-C	0.009813
F'-C'	0.009896
C-t	0.008098
C-A'	0.003423
d-C	0.002989
e-C	0.005329
g-d	0.012151
g-F	0.005327
h-g	0.004419
i-g	0.011948
C'-t	0.008574
e-C'	0.004853
F'-e	0.005043
i-F'	0.016716

Relative partial dispersion	
C-t／F-C	0.8252
C-A'／F-C	0.3488
d-C／F-C	0.3046
e-C／F-C	0.5431
g-d／F-C	1.2383
g-F／F-C	0.5429
h-g／F-C	0.4503
i-g／F-C	1.2176
C'-t／F'-C'	0.8664
e-C'／F'-C'	0.4904
F'-e／F'-C'	0.5096
i-F'／F'-C'	1.6892

Deviation of relative partial disp.	
ΔPdC	0.0006
ΔPgF	-0.0018

Internal CC (80%/5%)
335/288
Color Code (80%/5%)
345/290

CCI	
B	0.00
G	0.15
R	0.13

Thermal properties	
CTE(-30,70) [1E-7/℃]	60
CTE(100,300) [1E-7/℃]	73
Tg [℃]	604
At [℃]	650
StP [℃]	554
AP [℃]	593
SP [℃]	744
Ht cndct. [W/m·K]	0.869
Sp. heat [kJ/kg·K]	0.558
Ht diffus. [1E-6 m2/sec]	0.479

Chemical properties [class]	
Acid res. (surface)	2
Alkaline detergent res.	2
Climate resistance	1
Water res. (powder)	2
Acid res. (powder)	4

Mechanical properties	
Knoop hardness	483 (5)
Abrasion hardness	112
Young's mod. [GPa]	81.6
Shear mod. [GPa]	32.6
Poisson's ratio	0.252
Stress optical coef. [1E-5 nm/cm／Pa]	2.61

Internal trans. (10mm)	
λ [nm]	τ
280	-
290	0.06
300	0.18
310	0.37
320	0.58
330	0.74
340	0.85
350	0.919
360	0.956
370	0.975
380	0.984
390	0.990
400	0.993
420	0.995
440	0.995
460	0.996
480	0.996
500	0.997
550	0.998
600	0.998
650	0.998
700	0.997
800	0.997
900	0.997
1000	0.998
1200	0.999
1400	0.985
1600	0.990
1800	0.976
2000	0.962
2200	0.88
2400	0.80

Specific gravity
3.23

Relative Δn/ΔT [1E-6/℃]															
Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90 (ref.)	3.5	3.6	3.7	3.8	3.9	4.0	4.0	4.1	4.2	4.4	4.7	4.8	5.1	5.5	5.8
60 to 80 (ref.)	3.4	3.5	3.6	3.7	3.8	3.9	3.9	3.9	4.1	4.2	4.6	4.6	5.0	5.3	5.6
40 to 60	3.3	3.3	3.4	3.5	3.6	3.7	3.7	3.7	3.9	4.0	4.4	4.4	4.7	5.1	5.3
20 to 40	3.1	3.2	3.3	3.4	3.5	3.5	3.6	3.6	3.7	3.9	4.2	4.2	4.5	4.9	5.1
0 to 20	3.0	3.1	3.2	3.3	3.3	3.4	3.5	3.5	3.6	3.8	4.0	4.1	4.4	4.7	4.9
-20 to 0	3.0	3.0	3.1	3.2	3.3	3.4	3.4	3.4	3.5	3.7	4.0	4.0	4.3	4.6	4.8
-40 to -20	3.0	3.0	3.1	3.2	3.3	3.4	3.4	3.4	3.5	3.7	3.9	4.0	4.3	4.5	4.7
-60 to -40 (ref.)	3.1	3.2	3.2	3.3	3.4	3.5	3.5	3.5	3.6	3.7	4.0	4.0	4.3	4.6	4.8
-70 to -60 (ref.)	3.3	3.3	3.4	3.5	3.5	3.6	3.6	3.7	3.8	3.9	4.1	4.2	4.4	4.7	4.9

Absolute Δn/ΔT [1E-6/℃]															
Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90	2.6	2.6	2.7	2.8	2.9	3.0	3.1	3.1	3.2	3.4	3.7	3.8	4.1	4.5	4.7
60 to 80	2.4	2.4	2.5	2.6	2.7	2.8	2.8	2.9	3.0	3.1	3.5	3.5	3.9	4.2	4.5
40 to 60	2.1	2.1	2.2	2.3	2.4	2.5	2.5	2.5	2.7	2.8	3.1	3.2	3.5	3.8	4.1
20 to 40	1.8	1.8	1.9	2.0	2.1	2.2	2.2	2.2	2.3	2.5	2.8	2.8	3.1	3.5	3.7
0 to 20	1.5	1.5	1.6	1.7	1.8	1.9	1.9	1.9	2.0	2.2	2.4	2.5	2.8	3.1	3.3
-20 to 0	1.2	1.2	1.3	1.4	1.5	1.5	1.6	1.6	1.7	1.8	2.1	2.1	2.4	2.7	2.9
-40 to -20	0.9	0.9	1.0	1.1	1.2	1.2	1.3	1.3	1.4	1.5	1.8	1.8	2.1	2.3	2.5
-60 to -40	0.6	0.6	0.7	0.8	0.9	0.9	0.9	1.0	1.1	1.2	1.4	1.4	1.7	1.9	2.1
-70 to -60	0.4	0.4	0.5	0.6	0.6	0.7	0.7	0.7	0.8	0.9	1.2	1.2	1.4	1.7	1.8

Coef. disp. form. (frac. eq.)(ref.)	
P1	1.27040365E-01
Q1	8.81223287E+01
P2	4.08483065E-02
Q2	1.95227691E-02
P3	2.87645522E-01
Q3	4.52794933E-03

Fitting error of disp. form. σ [1E-6]		
	Visible	Infrared
Power ser. eq.	0.3	2.5
Frac. eq. (ref.)	0.4	3.3

Prod. Freq. (A to D)	C

Similar glass type			
OHARA	S-BAL42	HOYA	-
CDGM	H-ZK2	SCHOTT	-

2022-7-1	StP, AP, SP
2019-4-1	Transmittance
2018-4-1	Prod. Freq.

J-SK14

n_d = 1.603110 n_e = 1.605480

ν_d = 60.69 ν_e = 60.45

Glass code (d)
603607
Glass code (e)
605605

Spectral l.	Refractive idx
2.058	1.57754
1.970	1.57887
1.530	1.58494
1.129	1.59014
1.064	1.59106
t	1.59181
s	1.59467
A'	1.596598
r	1.598346
C	1.600078
C'	1.600562
He-Ne	1.601012
D	1.603021
d	1.603110
e	1.605480
F	1.610015
F'	1.610579
g	1.615392
h	1.619847
0.389	1.622559
i	1.627420

Coef. disp. form. (pwr ser.)	
A0	2.53043945E+00
A1	-1.02567827E-02
A2	-9.79440830E-05
A3	1.42752530E-02
A4	2.00898558E-04
A5	1.18522803E-06
A6	1.46555128E-07
A7	0.00000000E+00
A8	0.00000000E+00

Partial dispersion	
F-C	0.009937
F'-C'	0.010017
C-t	0.008266
C-A'	0.003480
d-C	0.003032
e-C	0.005402
g-d	0.012282
g-F	0.005377
h-g	0.004455
i-g	0.012028
C'-t	0.008750
e-C'	0.004918
F'-e	0.005099
i-F'	0.016841

Relative partial dispersion	
C-t／F-C	0.8318
C-A'／F-C	0.3502
d-C／F-C	0.3051
e-C／F-C	0.5436
g-d／F-C	1.2360
g-F／F-C	0.5411
h-g／F-C	0.4483
i-g／F-C	1.2104
C'-t／F'-C'	0.8735
e-C'／F'-C'	0.4910
F'-e／F'-C'	0.5090
i-F'／F'-C'	1.6812

Deviation of relative partial disp.	
ΔPdC	0.0005
ΔPgF	-0.0014

Internal CC (80%/5%)
342/290
Color Code (80%/5%)
355/290
CCI

B	0.00
G	0.15
R	0.13

Thermal properties	
CTE(-30,70) [1E-7/℃]	58
CTE(100,300) [1E-7/℃]	72
Tg [℃]	646
At [℃]	691
StP [℃]	589
AP [℃]	626
SP [℃]	761
Ht cndct. [W/m･K]	0.979
Sp. heat [kJ/kg･K]	0.567
Ht diffus. [1E-6 m2/sec]	0.501

Chemical properties [class]	
Acid res. (surface)	4
Alkaline detergent res.	2
Climate resistance	3
Water res. (powder)	3
Acid res. (powder)	5

Mechanical properties	
Knoop hardness	503 (5)
Abrasion hardness	142
Young's mod. [GPa]	85.7
Shear mod. [GPa]	34.0
Poisson's ratio	0.260
Stress optical coef. [1E-5 nm/cm／Pa]	2.19

Internal trans. (10mm)	
λ [nm]	τ
280	-
290	0.05
300	0.13
310	0.28
320	0.47
330	0.65
340	0.78
350	0.88
360	0.932
370	0.963
380	0.978
390	0.987
400	0.992
420	0.995
440	0.996
460	0.997
480	0.998
500	0.999
550	0.999
600	0.998
650	0.998
700	0.998
800	0.997
900	0.996
1000	0.997
1200	0.998
1400	0.979
1600	0.988
1800	0.974
2000	0.952
2200	0.84
2400	0.74

Specific gravity
3.43

Relative Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90 (ref.)	2.7	2.7	2.8	2.9	3.0	3.1	3.1	3.2	3.3	3.4	3.7	3.8	4.1	4.5	4.6
60 to 80 (ref.)	2.6	2.6	2.7	2.8	2.9	3.0	3.0	3.0	3.1	3.3	3.6	3.6	4.0	4.3	4.4
40 to 60	2.4	2.4	2.5	2.6	2.7	2.8	2.8	2.8	2.9	3.1	3.4	3.4	3.8	4.1	4.2
20 to 40	2.2	2.3	2.4	2.5	2.5	2.6	2.6	2.7	2.8	2.9	3.2	3.2	3.6	3.9	4.0
0 to 20	2.1	2.1	2.2	2.3	2.4	2.5	2.5	2.5	2.6	2.8	3.1	3.1	3.4	3.7	3.9
-20 to 0	2.1	2.1	2.2	2.3	2.3	2.4	2.4	2.5	2.6	2.7	3.0	3.0	3.3	3.6	3.8
-40 to -20	2.1	2.1	2.2	2.3	2.3	2.4	2.4	2.5	2.6	2.7	3.0	3.0	3.3	3.6	3.8
-60 to -40 (ref.)	2.2	2.2	2.3	2.3	2.4	2.5	2.5	2.5	2.6	2.8	3.0	3.1	3.4	3.7	3.8
-70 to -60 (ref.)	2.3	2.3	2.4	2.5	2.6	2.6	2.7	2.7	2.8	2.9	3.2	3.2	3.5	3.8	3.9

Absolute Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90	1.7	1.7	1.9	1.9	2.0	2.1	2.1	2.2	2.3	2.4	2.7	2.7	3.1	3.4	3.6
60 to 80	1.5	1.5	1.6	1.7	1.8	1.9	1.9	1.9	2.0	2.2	2.4	2.5	2.8	3.2	3.3
40 to 60	1.2	1.2	1.3	1.4	1.5	1.6	1.6	1.6	1.7	1.8	2.1	2.1	2.5	2.8	2.9
20 to 40	0.9	0.9	1.0	1.1	1.1	1.2	1.2	1.3	1.4	1.5	1.8	1.8	2.1	2.4	2.6
0 to 20	0.6	0.6	0.7	0.7	0.8	0.9	0.9	0.9	1.0	1.2	1.4	1.5	1.8	2.1	2.2
-20 to 0	0.2	0.3	0.3	0.4	0.5	0.6	0.6	0.6	0.7	0.8	1.1	1.1	1.5	1.7	1.9
-40 to -20	-0.1	-0.1	0.0	0.1	0.2	0.3	0.3	0.3	0.4	0.5	0.7	0.8	1.1	1.4	1.5
-60 to -40	-0.4	-0.4	-0.3	-0.2	-0.1	-0.1	-0.1	0.0	0.1	0.2	0.4	0.4	0.8	1.0	1.1
-70 to -60	-0.6	-0.6	-0.5	-0.5	-0.4	-0.3	-0.3	-0.3	-0.2	-0.1	0.2	0.2	0.5	0.8	0.9

Coef. disp. form. (frac. eq.)(ref.)	
P1	1.29162449E-01
Q1	8.62734299E+01
P2	9.62415853E-02
Q2	1.39736344E-02
P3	2.41574459E-01
Q3	3.09089297E-03

Fitting error of disp. form. σ [1E-6]		
	Visible	Infrared
Power ser. eq.	0.6	5.3
Frac. eq. (ref.)	0.6	5.6

Prod. Freq. (A to D)	B

Similar glass type			
OHARA	S-BSM14	HOYA	BACD14
CDGM	H-ZK14	SCHOTT	N-SK14

2022-7-1	StP, AP, SP
2019-4-1	Transmittance
2016-4-1	Prod. Freq.

HIKARI GLASS CO., LTD.

J-SK15

n_d = 1.622990 n_e = 1.625546

ν_d = 58.12 ν_e = 57.87

Glass code (d)
623581
Glass code (e)
626579

Spectral l.	Refractive idx
2.058	1.59635
1.970	1.59771
1.530	1.60386
1.129	1.60920
1.064	1.61015
t	1.61094
s	1.61396
A'	1.616004
r	1.617872
C	1.619729
C'	1.620248
He-Ne	1.620733
D	1.622895
d	1.622990
e	1.625546
F	1.630448
F'	1.631058
g	1.636277
h	1.641119
0.389	1.644073
i	1.649378

Partial dispersion	
F-C	0.010719
F'-C'	0.010810
C-t	0.008788
C-A'	0.003725
d-C	0.003261
e-C	0.005817
g-d	0.013287
g-F	0.005829
h-g	0.004842
i-g	0.013101
C'-t	0.009307
e-C'	0.005298
F'-e	0.005512
i-F'	0.018320

Relative partial dispersion	
C-t／F-C	0.8199
C-A'／F-C	0.3475
d-C／F-C	0.3042
e-C／F-C	0.5427
g-d／F-C	1.2396
g-F／F-C	0.5438
h-g／F-C	0.4517
i-g／F-C	1.2222
C'-t／F'-C'	0.8610
e-C'／F'-C'	0.4901
F'-e／F'-C'	0.5099
i-F'／F'-C'	1.6947

Deviation of relative partial disp.	
ΔPdC	0.0008
ΔPgF	−0.0030

Internal CC (80%/5%)
347/307
Color Code (80%/5%)
360/310

CCI	
B	0.00
G	0.21
R	0.19

Thermal properties	
CTE(−30,70) [1E-7/℃]	60
CTE(100,300) [1E-7/℃]	70
Tg [℃]	651
At [℃]	696
StP [℃]	604
AP [℃]	640
SP [℃]	772
Ht cndct. [W/m·K]	0.975
Sp. heat [kJ/kg·K]	0.614
Ht diffus. [1E-6 m2/sec]	0.517

Chemical properties [class]	
Acid res. (surface)	7
Alkaline detergent res.	3
Climate resistance	2
Water res. (powder)	2
Acid res. (powder)	4

Mechanical properties	
Knoop hardness	507 (5)
Abrasion hardness	124
Young's mod. [GPa]	85.6
Shear mod. [GPa]	33.9
Poisson's ratio	0.264
Stress optical coef. [1E-5 nm/cm／Pa]	2.22

Internal trans. (10mm)	
λ [nm]	τ
280	–
290	–
300	–
310	0.08
320	0.29
330	0.53
340	0.73
350	0.85
360	0.915
370	0.954
380	0.973
390	0.984
400	0.990
420	0.995
440	0.995
460	0.996
480	0.998
500	0.998
550	0.999
600	0.999
650	0.998
700	0.999
800	0.998
900	0.996
1000	0.997
1200	0.998
1400	0.985
1600	0.988
1800	0.974
2000	0.952
2200	0.85
2400	0.73

Specific gravity
3.58

Coef. disp. form. (pwr ser.)	
A0	2.59035665E+00
A1	−1.02907579E-02
A2	−1.19847148E-04
A3	1.57254882E-02
A4	1.90519844E-04
A5	6.52864472E-06
A6	−1.78313721E-08
A7	0.00000000E+00
A8	0.00000000E+00

Relative Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90 (ref.)	2.8	2.8	2.9	3.1	3.2	3.3	3.3	3.3	3.4	3.6	3.9	3.9	4.3	4.7	4.9
60 to 80 (ref.)	2.6	2.7	2.8	2.9	3.0	3.1	3.1	3.2	3.3	3.4	3.7	3.8	4.1	4.5	4.7
40 to 60	2.5	2.5	2.7	2.7	2.8	2.9	3.0	3.0	3.1	3.3	3.6	3.6	3.9	4.3	4.5
20 to 40	2.4	2.4	2.5	2.6	2.7	2.8	2.8	2.8	3.0	3.1	3.4	3.4	3.8	4.1	4.3
0 to 20	2.3	2.3	2.4	2.5	2.6	2.7	2.7	2.7	2.9	3.0	3.3	3.3	3.6	3.9	4.2
−20 to 0	2.2	2.3	2.4	2.5	2.5	2.6	2.7	2.7	2.8	2.9	3.2	3.2	3.5	3.9	4.1
−40 to −20	2.2	2.3	2.4	2.5	2.6	2.6	2.7	2.7	2.8	2.9	3.2	3.2	3.5	3.8	4.0
−60 to −40 (ref.)	2.4	2.4	2.5	2.6	2.7	2.7	2.8	2.8	2.9	3.0	3.3	3.3	3.6	3.9	4.1
−70 to −60 (ref.)	2.5	2.5	2.7	2.7	2.8	2.9	2.9	2.9	3.0	3.2	3.4	3.4	3.7	4.0	4.2

Absolute Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90	1.8	1.8	2.0	2.1	2.1	2.2	2.3	2.3	2.4	2.6	2.9	2.9	3.3	3.6	3.9
60 to 80	1.6	1.6	1.7	1.8	1.9	2.0	2.0	2.1	2.2	2.3	2.6	2.7	3.0	3.4	3.6
40 to 60	1.3	1.3	1.4	1.5	1.6	1.7	1.7	1.8	1.9	2.0	2.3	2.3	2.7	3.0	3.2
20 to 40	1.0	1.0	1.1	1.2	1.3	1.4	1.4	1.4	1.6	1.7	2.0	2.0	2.3	2.6	2.8
0 to 20	0.7	0.7	0.8	0.9	1.0	1.1	1.1	1.1	1.2	1.4	1.6	1.7	2.0	2.3	2.5
−20 to 0	0.4	0.4	0.5	0.6	0.7	0.8	0.8	0.8	0.9	1.0	1.3	1.3	1.6	1.9	2.1
−40 to −20	0.1	0.1	0.2	0.3	0.4	0.4	0.5	0.5	0.6	0.7	1.0	1.0	1.3	1.6	1.7
−60 to −40	−0.2	−0.2	−0.1	0.0	0.1	0.1	0.2	0.2	0.3	0.4	0.6	0.6	0.9	1.2	1.4
−70 to −60	−0.4	−0.4	−0.3	−0.2	−0.2	−0.1	−0.1	−0.1	0.0	0.1	0.4	0.4	0.7	0.9	1.1

Coef. disp. form. (frac. eq.)(ref.)	
P1	1.23469308E-01
Q1	8.35768084E+01
P2	3.22374048E-02
Q2	2.17575456E-02
P3	3.14247196E-01
Q3	4.85654114E-03

Fitting error of disp. form. σ [1E-6]		
	Visible	Infrared
Power ser. eq.	0.4	4.9
Frac. eq. (ref.)	0.4	5.4

Prod. Freq. (A to D)	B

Similar glass type			
OHARA	S-BSM15	HOYA	BACD15
CDGM	H-ZK21	SCHOTT	–

2022-7-1	StP, AP, SP
2020-4-1	chemical properties
2019-4-1	Transmittance

HIKARI GLASS CO., LTD.

J-SK16

n_d = 1.620410 n_e = 1.622866

ν_d = 60.25 ν_e = 60.01

Glass code (d)
620603
Glass code (e)
623600

Spectral l.	Refractive idx
2.058	1.59326
1.970	1.59473
1.530	1.60130
1.129	1.60686
1.064	1.60783
t	1.60862
s	1.61163
A'	1.613642
r	1.615463
C	1.617264
C'	1.617766
He-Ne	1.618234
D	1.620318
d	1.620410
e	1.622866
F	1.627562
F'	1.628145
g	1.633125
h	1.637732
0.389	1.640539
i	1.645569

Partial dispersion	
F-C	0.010298
F'-C'	0.010379
C-t	0.008640
C-A'	0.003622
d-C	0.003146
e-C	0.005602
g-d	0.012715
g-F	0.005563
h-g	0.004607
i-g	0.012444
C'-t	0.009142
e-C'	0.005100
F'-e	0.005279
i-F'	0.017424

Relative partial dispersion	
C-t／F-C	0.8390
C-A'／F-C	0.3517
d-C／F-C	0.3055
e-C／F-C	0.5440
g-d／F-C	1.2347
g-F／F-C	0.5402
h-g／F-C	0.4474
i-g／F-C	1.2084
C'-t／F'-C'	0.8808
e-C'／F'-C'	0.4914
F'-e／F'-C'	0.5086
i-F'／F'-C'	1.6788

Deviation of relative partial disp.	
ΔPdC	0.0011
ΔPgF	−0.0031

Internal CC (80%/5%)
347/303
Color Code (80%/5%)
360/305
CCI

B	0.00
G	0.20
R	0.16

Thermal properties	
CTE(−30,70) [1E-7/℃]	60
CTE(100,300) [1E-7/℃]	70
Tg [℃]	653
At [℃]	693
StP [℃]	601
AP [℃]	637
SP [℃]	761
Ht cndct. [W/m·K]	0.834
Sp. heat [kJ/kg·K]	0.515
Ht diffus. [1E-6 m2/sec]	0.456

Chemical properties [class]	
Acid res. (surface)	6
Alkaline detergent res.	4
Climate resistance	5
Water res. (powder)	3
Acid res. (powder)	5

Mechanical properties	
Knoop hardness	500 (5)
Abrasion hardness	124
Young's mod. [GPa]	87.2
Shear mod. [GPa]	34.6
Poisson's ratio	0.262
Stress optical coef. [1E-5 nm/cm／Pa]	2.27

Internal trans. (10mm)	
λ [nm]	τ
280	–
290	–
300	0.03
310	0.13
320	0.33
330	0.55
340	0.72
350	0.84
360	0.913
370	0.952
380	0.972
390	0.983
400	0.990
420	0.994
440	0.995
460	0.995
480	0.997
500	0.998
550	0.998
600	0.997
650	0.997
700	0.997
800	0.998
900	0.998
1000	0.998
1200	0.998
1400	0.979
1600	0.986
1800	0.971
2000	0.947
2200	0.83
2400	0.67

Specific gravity
3.56

Coef. disp. form. (pwr ser.)	
A0	2.58448044E+00
A1	−1.11132665E-02
A2	−1.37540448E-04
A3	1.49921982E-02
A4	1.88581834E-04
A5	3.56240422E-06
A6	7.76507396E-08
A7	0.00000000E+00
A8	0.00000000E+00

Relative Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90 (ref.)	2.2	2.2	2.3	2.5	2.6	2.7	2.7	2.7	2.9	3.0	3.3	3.3	3.7	4.0	4.2
60 to 80 (ref.)	2.2	2.2	2.3	2.4	2.5	2.6	2.6	2.7	2.8	2.9	3.2	3.3	3.6	3.9	4.1
40 to 60	2.1	2.2	2.3	2.4	2.5	2.5	2.6	2.6	2.7	2.9	3.1	3.2	3.5	3.8	4.0
20 to 40	2.1	2.1	2.3	2.3	2.4	2.5	2.5	2.6	2.7	2.8	3.1	3.1	3.4	3.7	3.9
0 to 20	2.1	2.2	2.3	2.4	2.4	2.5	2.5	2.6	2.7	2.8	3.0	3.1	3.4	3.7	3.8
−20 to 0	2.2	2.2	2.3	2.4	2.5	2.6	2.6	2.6	2.7	2.8	3.1	3.1	3.4	3.7	3.8
−40 to −20	2.3	2.4	2.5	2.5	2.6	2.7	2.7	2.7	2.8	2.9	3.2	3.2	3.5	3.7	3.9
−60 to −40 (ref.)	2.6	2.6	2.7	2.8	2.8	2.9	2.9	2.9	3.0	3.1	3.3	3.4	3.6	3.9	4.1
−70 to −60 (ref.)	2.8	2.8	2.9	3.0	3.1	3.1	3.1	3.2	3.3	3.4	3.6	3.6	3.8	4.1	4.2

Absolute Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90	1.2	1.3	1.4	1.5	1.6	1.7	1.7	1.7	1.8	2.0	2.3	2.3	2.7	3.0	3.2
60 to 80	1.1	1.1	1.2	1.3	1.4	1.5	1.5	1.6	1.7	1.8	2.1	2.1	2.5	2.8	3.0
40 to 60	0.9	0.9	1.0	1.1	1.2	1.3	1.3	1.4	1.5	1.6	1.9	1.9	2.2	2.5	2.7
20 to 40	0.7	0.7	0.9	0.9	1.0	1.1	1.1	1.2	1.3	1.4	1.6	1.7	2.0	2.3	2.4
0 to 20	0.5	0.6	0.7	0.7	0.8	0.9	0.9	0.9	1.0	1.2	1.4	1.4	1.7	2.0	2.2
−20 to 0	0.4	0.4	0.5	0.6	0.6	0.7	0.7	0.7	0.8	0.9	1.2	1.2	1.5	1.7	1.9
−40 to −20	0.2	0.2	0.3	0.4	0.4	0.5	0.5	0.5	0.6	0.7	0.9	1.0	1.2	1.5	1.6
−60 to −40	0.0	0.0	0.1	0.2	0.2	0.3	0.3	0.3	0.4	0.5	0.7	0.7	1.0	1.2	1.3
−70 to −60	−0.1	−0.1	0.0	0.0	0.1	0.1	0.2	0.2	0.2	0.3	0.5	0.5	0.8	1.0	1.1

Coef. disp. form. (frac. eq.)(ref.)	
P1	1.17133032E-01
Q1	7.35971696E+01
P2	3.13502706E-02
Q2	2.07201986E-02
P3	3.14284226E-01
Q3	4.73371033E-03

Fitting error of disp. form. σ [1E-6]		
	Visible	Infrared
Power ser. eq.	0.3	7.6
Frac. eq. (ref.)	0.3	7.8

Prod. Freq. (A to D)	B

Similar glass type			
OHARA	S-BSM16	HOYA	BACD16
CDGM	H-ZK9B	SCHOTT	N-SK16

2022-7-1	StP, AP, SP
2019-4-1	Transmittance, Tg
2016-4-1	Prod. Freq.

HIKARI GLASS CO., LTD.

J-SK18

n_d = 1.638540 n_e = 1.641289

ν_d = 55.34 ν_e = 55.07

Glass code (d)
639553
Glass code (e)
641551

Spectral l.	Refractive idx
2.058	1.61110
1.970	1.61245
1.530	1.61859
1.129	1.62400
1.064	1.62498
t	1.62579
s	1.62894
A'	1.631094
r	1.633073
C	1.635050
C'	1.635605
He-Ne	1.636122
D	1.638438
d	1.638540
e	1.641289
F	1.646589
F'	1.647251
g	1.652938
h	1.658254
0.389	1.661518
i	1.667427

Coef. disp. form. (pwr ser.)	
A0	2.63738575E+00
A1	-1.03287558E-02
A2	-1.09091934E-04
A3	1.67282181E-02
A4	3.03233685E-04
A5	-2.03256494E-06
A6	7.96743025E-07
A7	0.00000000E+00
A8	0.00000000E+00

Partial dispersion	
F-C	0.011539
F'-C'	0.011646
C-t	0.009256
C-A'	0.003956
d-C	0.003490
e-C	0.006239
g-d	0.014398
g-F	0.006349
h-g	0.005316
i-g	0.014489
C'-t	0.009811
e-C'	0.005684
F'-e	0.005962
i-F'	0.020176

Relative partial dispersion	
C-t／F-C	0.8021
C-A'／F-C	0.3428
d-C／F-C	0.3025
e-C／F-C	0.5407
g-d／F-C	1.2478
g-F／F-C	0.5502
h-g／F-C	0.4607
i-g／F-C	1.2557
C'-t／F'-C'	0.8424
e-C'／F'-C'	0.4881
F'-e／F'-C'	0.5119
i-F'／F'-C'	1.7324

Deviation of relative partial disp.	
ΔPdC	0.0003
ΔPgF	-0.0013

Internal CC (80%/5%)
364/330
Color Code (80%/5%)
375/330

CCI	
B	0.00
G	0.48
R	0.45

Thermal properties	
CTE(-30,70) [1E-7/℃]	67
CTE(100,300) [1E-7/℃]	81
Tg [℃]	645
At [℃]	684
StP [℃]	596
AP [℃]	631
SP [℃]	754
Ht cndct. [W/m･K]	0.831
Sp. heat [kJ/kg･K]	0.526
Ht diffus. [1E-6 m2/sec]	0.429

Chemical properties [class]	
Acid res. (surface)	6
Alkaline detergent res.	3
Climate resistance	3
Water res. (powder)	3
Acid res. (powder)	5

Mechanical properties	
Knoop hardness	499 (5)
Abrasion hardness	157
Young's mod. [GPa]	87.0
Shear mod. [GPa]	34.2
Poisson's ratio	0.271
Stress optical coef. [1E-5 nm/cm／Pa]	1.92

Internal trans. (10mm)	
λ [nm]	τ
280	–
290	–
300	–
310	–
320	–
330	0.04
340	0.22
350	0.51
360	0.74
370	0.86
380	0.927
390	0.958
400	0.974
420	0.987
440	0.991
460	0.992
480	0.994
500	0.996
550	0.997
600	0.996
650	0.996
700	0.997
800	0.995
900	0.993
1000	0.994
1200	0.997
1400	0.989
1600	0.987
1800	0.969
2000	0.946
2200	0.85
2400	0.73

Specific gravity
3.67

Relative Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90 (ref.)	1.7	1.7	1.8	1.9	2.0	2.2	2.2	2.2	2.4	2.6	2.9	3.0	3.5	3.9	4.2
60 to 80 (ref.)	1.5	1.6	1.7	1.8	1.9	2.0	2.1	2.1	2.3	2.4	2.8	2.8	3.3	3.7	4.0
40 to 60	1.4	1.4	1.6	1.7	1.8	1.9	1.9	2.0	2.1	2.3	2.6	2.7	3.1	3.5	3.7
20 to 40	1.3	1.3	1.5	1.6	1.7	1.8	1.8	1.8	2.0	2.1	2.5	2.5	2.9	3.3	3.6
0 to 20	1.3	1.3	1.4	1.5	1.6	1.7	1.7	1.8	1.9	2.0	2.4	2.4	2.8	3.2	3.4
-20 to 0	1.3	1.3	1.4	1.5	1.6	1.7	1.7	1.7	1.9	2.0	2.3	2.4	2.7	3.1	3.3
-40 to -20	1.3	1.3	1.4	1.5	1.6	1.7	1.7	1.8	1.9	2.0	2.3	2.4	2.7	3.1	3.3
-60 to -40 (ref.)	1.5	1.5	1.6	1.7	1.8	1.9	1.9	1.9	2.0	2.1	2.4	2.5	2.8	3.1	3.3
-70 to -60 (ref.)	1.7	1.7	1.8	1.9	1.9	2.0	2.1	2.1	2.2	2.3	2.6	2.6	3.0	3.3	3.5

Absolute Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90	0.7	0.7	0.8	0.9	1.0	1.2	1.2	1.2	1.4	1.5	1.9	2.0	2.4	2.8	3.1
60 to 80	0.5	0.5	0.6	0.7	0.8	0.9	1.0	1.0	1.1	1.3	1.7	1.7	2.2	2.6	2.8
40 to 60	0.2	0.2	0.3	0.4	0.5	0.7	0.7	0.7	0.8	1.0	1.4	1.4	1.8	2.2	2.4
20 to 40	-0.1	-0.1	0.1	0.2	0.3	0.4	0.4	0.4	0.6	0.7	1.0	1.1	1.5	1.9	2.1
0 to 20	-0.3	-0.3	-0.2	-0.1	0.0	0.1	0.1	0.1	0.3	0.4	0.7	0.8	1.1	1.5	1.7
-20 to 0	-0.6	-0.6	-0.5	-0.4	-0.3	-0.2	-0.2	-0.2	0.0	0.1	0.4	0.4	0.8	1.1	1.3
-40 to -20	-0.9	-0.8	-0.8	-0.7	-0.6	-0.5	-0.5	-0.4	-0.3	-0.2	0.1	0.1	0.5	0.8	1.0
-60 to -40	-1.1	-1.1	-1.0	-0.9	-0.8	-0.8	-0.8	-0.7	-0.6	-0.5	-0.2	-0.2	0.1	0.4	0.6
-70 to -60	-1.3	-1.3	-1.2	-1.2	-1.1	-1.0	-1.0	-0.9	-0.8	-0.7	-0.5	-0.5	-0.1	0.1	0.3

Coef. disp. form. (frac. eq.)(ref.)	
P1	1.05284203E-01
Q1	7.37088855E+01
P2	1.09317433E-02
Q2	3.78284051E-02
P3	3.42135739E-01
Q3	5.67258954E-03

Fitting error of disp. form. σ [1E-6]		
	Visible	Infrared
Power ser. eq.	0.5	3.7
Frac. eq. (ref.)	0.5	5.4

Prod. Freq. (A to D)	C

Similar glass type			
OHARA	S-BSM18	HOYA	BACD18
CDGM	H-ZK11	SCHOTT	–

2022-7-1	StP, AP, SP
2019-4-1	Transmittance
2015-4-1	Color Code

HIKARI GLASS CO., LTD.

J-SSK1

n_d = 1.617200 n_e = 1.619924

ν_d = 53.97 ν_e = 53.71

Glass code (d)
617540
Glass code (e)
620537

Spectral l.	Refractive idx
2.058	1.58946
1.970	1.59085
1.530	1.59717
1.129	1.60268
1.064	1.60368
t	1.60450
s	1.60765
A'	1.609804
r	1.611774
C	1.613738
C'	1.614288
He-Ne	1.614802
D	1.617098
d	1.617200
e	1.619924
F	1.625175
F'	1.625831
g	1.631468
h	1.636742
0.389	1.639984
i	1.645856

Coef. disp. form. (pwr ser.)	
A0	2.56917001E+00
A1	-1.05347050E-02
A2	-1.14820760E-04
A3	1.63890732E-02
A4	2.66043325E-04
A5	2.86703318E-06
A6	5.89038637E-07
A7	0.00000000E+00
A8	0.00000000E+00

Partial dispersion	
F-C	0.011437
F'-C'	0.011543
C-t	0.009240
C-A'	0.003934
d-C	0.003462
e-C	0.006186
g-d	0.014268
g-F	0.006293
h-g	0.005274
i-g	0.014388
C'-t	0.009790
e-C'	0.005636
F'-e	0.005907
i-F'	0.020025

Relative partial dispersion	
C-t／F-C	0.8079
C-A'／F-C	0.3440
d-C／F-C	0.3027
e-C／F-C	0.5409
g-d／F-C	1.2475
g-F／F-C	0.5502
h-g／F-C	0.4611
i-g／F-C	1.2580
C'-t／F'-C'	0.8481
e-C'／F'-C'	0.4883
F'-e／F'-C'	0.5117
i-F'／F'-C'	1.7348

Deviation of relative partial disp.	
ΔPdC	0.0011
ΔPgF	-0.0036

Internal CC (80%/5%)
359/329
Color Code (80%/5%)
370/330
CCI

B	0.00
G	0.33
R	0.32

Thermal properties	
CTE(-30,70) [1E-7/℃]	59
CTE(100,300) [1E-7/℃]	74
Tg [℃]	600
At [℃]	649
StP [℃]	552
AP [℃]	589
SP [℃]	725
Ht cndct. [W/m･K]	0.865
Sp. heat [kJ/kg･K]	0.592
Ht diffus. [1E-6 m2/sec]	0.442

Chemical properties [class]	
Acid res. (surface)	6
Alkaline detergent res.	3
Climate resistance	1
Water res. (powder)	2
Acid res. (powder)	4

Mechanical properties	
Knoop hardness	539 (5)
Abrasion hardness	136
Young's mod. [GPa]	86.2
Shear mod. [GPa]	34.1
Poisson's ratio	0.265
Stress optical coef. [1E-5 nm/cm／Pa]	2.75

Internal trans. (10mm)	
λ [nm]	τ
280	–
290	–
300	–
310	–
320	–
330	0.07
340	0.29
350	0.60
360	0.81
370	0.913
380	0.956
390	0.976
400	0.984
420	0.990
440	0.992
460	0.993
480	0.995
500	0.997
550	0.997
600	0.997
650	0.997
700	0.998
800	0.998
900	0.997
1000	0.997
1200	0.998
1400	0.987
1600	0.989
1800	0.978
2000	0.960
2200	0.87
2400	0.75

Specific gravity
3.3

Relative Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90 (ref.)	3.9	3.9	4.0	4.2	4.3	4.4	4.5	4.5	4.6	4.8	5.3	5.3	5.8	6.3	6.6
60 to 80 (ref.)	3.8	3.8	4.0	4.1	4.2	4.3	4.3	4.3	4.5	4.7	5.1	5.1	5.6	6.1	6.3
40 to 60	3.6	3.6	3.8	3.9	4.0	4.1	4.1	4.1	4.3	4.5	4.9	4.9	5.4	5.8	6.1
20 to 40	3.4	3.5	3.6	3.7	3.8	3.9	4.0	4.0	4.1	4.3	4.7	4.7	5.2	5.6	5.9
0 to 20	3.3	3.4	3.5	3.6	3.7	3.8	3.8	3.9	4.0	4.2	4.5	4.6	5.0	5.4	5.7
-20 to 0	3.3	3.3	3.4	3.5	3.6	3.7	3.8	3.8	3.9	4.1	4.4	4.5	4.9	5.3	5.5
-40 to -20	3.3	3.3	3.5	3.5	3.6	3.7	3.7	3.8	3.9	4.1	4.4	4.4	4.9	5.3	5.5
-60 to -40 (ref.)	3.4	3.4	3.5	3.6	3.7	3.8	3.8	3.9	4.0	4.1	4.5	4.5	4.9	5.3	5.5
-70 to -60 (ref.)	3.5	3.6	3.7	3.8	3.9	3.9	4.0	4.0	4.1	4.3	4.6	4.6	5.0	5.4	5.6

Absolute Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90	2.9	3.0	3.1	3.2	3.3	3.4	3.5	3.5	3.6	3.8	4.2	4.3	4.8	5.2	5.5
60 to 80	2.7	2.7	2.9	3.0	3.1	3.2	3.2	3.2	3.4	3.6	4.0	4.0	4.5	4.9	5.2
40 to 60	2.4	2.4	2.5	2.6	2.7	2.8	2.9	2.9	3.0	3.2	3.6	3.7	4.1	4.6	4.8
20 to 40	2.1	2.1	2.2	2.3	2.4	2.5	2.5	2.6	2.7	2.9	3.3	3.3	3.7	4.2	4.4
0 to 20	1.8	1.8	1.9	2.0	2.1	2.2	2.2	2.2	2.4	2.5	2.9	2.9	3.4	3.8	4.0
-20 to 0	1.4	1.5	1.6	1.7	1.8	1.9	1.9	1.9	2.0	2.2	2.5	2.6	3.0	3.4	3.6
-40 to -20	1.1	1.2	1.3	1.4	1.4	1.5	1.6	1.6	1.7	1.9	2.2	2.2	2.6	3.0	3.2
-60 to -40	0.8	0.9	1.0	1.1	1.1	1.2	1.2	1.3	1.4	1.5	1.8	1.9	2.2	2.6	2.8
-70 to -60	0.6	0.6	0.7	0.8	0.9	1.0	1.0	1.0	1.1	1.3	1.6	1.6	2.0	2.3	2.5

Coef. disp. form. (frac. eq.)(ref.)	
P1	1.21623796E-01
Q1	8.02644402E+01
P2	1.09215263E-02
Q2	3.87083928E-02
P3	3.32513362E-01
Q3	5.82267405E-03

Fitting error of disp. form. σ [1E-6]		
	Visible	Infrared
Power ser. eq.	0.5	4.9
Frac. eq. (ref.)	0.4	5.3

Prod. Freq. (A to D)	C

Similar glass type			
OHARA	–	HOYA	–
CDGM	H-ZK20	SCHOTT	–

2022-7-1	StP, AP, SP
2020-4-1	Similar glass type
2019-4-1	Transmittance

HIKARI GLASS CO., LTD.

J-SSK5

n_d = 1.658440 n_e = 1.661522

ν_d = 50.84 ν_e = 50.54

Glass code (d)
658508
Glass code (e)
662505

Spectral l.	Refractive idx
2.058	1.63030
1.970	1.63156
1.530	1.63735
1.129	1.64268
1.064	1.64369
t	1.64453
s	1.64786
A'	1.650196
r	1.652367
C	1.654552
C'	1.655167
He-Ne	1.655742
D	1.658325
d	1.658440
e	1.661522
F	1.667504
F'	1.668256
g	1.674728
h	1.680821
0.389	1.684584
i	1.691437

Partial dispersion	
F-C	0.012952
F'-C'	0.013089
C-t	0.010022
C-A'	0.004356
d-C	0.003888
e-C	0.006970
g-d	0.016288
g-F	0.007224
h-g	0.006093
i-g	0.016709
C'-t	0.010637
e-C'	0.006355
F'-e	0.006734
i-F'	0.023181

Relative partial dispersion	
C-t／F-C	0.7738
C-A'／F-C	0.3363
d-C／F-C	0.3002
e-C／F-C	0.5381
g-d／F-C	1.2576
g-F／F-C	0.5578
h-g／F-C	0.4704
i-g／F-C	1.2901
C'-t／F'-C'	0.8127
e-C'／F'-C'	0.4855
F'-e／F'-C'	0.5145
i-F'／F'-C'	1.7710

Deviation of relative partial disp.	
ΔPdC	0.0000
ΔPgF	−0.0013

Internal CC (80%/5%)
370/337
Color Code (80%/5%)
385/335

CCI	
B	0.00
G	0.71
R	0.71

Thermal properties	
CTE(−30,70) [1E-7/℃]	70
CTE(100,300) [1E-7/℃]	84
Tg [℃]	641
At [℃]	681
StP [℃]	592
AP [℃]	628
SP [℃]	759
Ht cndct. [W/m·K]	0.759
Sp. heat [kJ/kg·K]	0.531
Ht diffus. [1E-6 m2/sec]	0.382

Chemical properties [class]	
Acid res. (surface)	1
Alkaline detergent res.	3
Climate resistance	2
Water res. (powder)	1
Acid res. (powder)	4

Mechanical properties	
Knoop hardness	483 (5)
Abrasion hardness	163
Young's mod. [GPa]	83.4
Shear mod. [GPa]	32.6
Poisson's ratio	0.280
Stress optical coef. [1E-5 nm/cm／Pa]	2.03

Internal trans. (10mm)	
λ [nm]	τ
280	–
290	–
300	–
310	–
320	–
330	0.01
340	0.10
350	0.34
360	0.62
370	0.80
380	0.89
390	0.939
400	0.963
420	0.983
440	0.988
460	0.991
480	0.993
500	0.995
550	0.998
600	0.998
650	0.998
700	0.997
800	0.997
900	0.997
1000	0.997
1200	0.997
1400	0.992
1600	0.989
1800	0.976
2000	0.959
2200	0.900
2400	0.80

Specific gravity
3.75

Coef. disp. form. (pwr ser.)	
A0	2.69546608E+00
A1	−9.46960473E−03
A2	−1.10686762E−04
A3	1.90535266E−02
A4	3.49767067E−04
A5	1.61235917E−06
A6	1.06076791E−06
A7	0.00000000E+00
A8	0.00000000E+00

Relative Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90 (ref.)	1.9	2.0	2.1	2.2	2.4	2.5	2.5	2.6	2.8	3.0	3.4	3.5	4.0	4.6	5.0
60 to 80 (ref.)	1.8	1.9	2.0	2.1	2.2	2.4	2.4	2.4	2.6	2.8	3.3	3.4	3.9	4.4	4.8
40 to 60	1.7	1.7	1.9	2.0	2.1	2.2	2.3	2.3	2.5	2.7	3.1	3.2	3.7	4.2	4.5
20 to 40	1.6	1.6	1.8	1.9	2.0	2.1	2.1	2.2	2.3	2.5	3.0	3.0	3.5	4.0	4.3
0 to 20	1.5	1.6	1.7	1.8	1.9	2.0	2.1	2.1	2.2	2.4	2.9	2.9	3.4	3.9	4.2
−20 to 0	1.5	1.5	1.7	1.8	1.9	2.0	2.0	2.1	2.2	2.4	2.8	2.8	3.3	3.8	4.1
−40 to −20	1.5	1.6	1.7	1.8	1.9	2.0	2.1	2.1	2.2	2.4	2.8	2.8	3.3	3.7	4.0
−60 to −40 (ref.)	1.7	1.7	1.9	2.0	2.0	2.2	2.2	2.2	2.4	2.5	2.9	3.0	3.4	3.8	4.1
−70 to −60 (ref.)	1.9	1.9	2.0	2.1	2.2	2.3	2.4	2.4	2.5	2.7	3.1	3.1	3.5	3.9	4.2

Absolute Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90	0.9	0.9	1.1	1.2	1.3	1.5	1.5	1.5	1.7	1.9	2.4	2.5	3.0	3.5	3.9
60 to 80	0.7	0.7	0.9	1.0	1.1	1.3	1.3	1.3	1.5	1.7	2.2	2.2	2.7	3.2	3.6
40 to 60	0.4	0.5	0.6	0.7	0.8	1.0	1.0	1.0	1.2	1.4	1.8	1.9	2.4	2.9	3.2
20 to 40	0.1	0.2	0.3	0.4	0.5	0.7	0.7	0.7	0.9	1.1	1.5	1.5	2.0	2.5	2.8
0 to 20	−0.1	−0.1	0.1	0.2	0.3	0.4	0.4	0.4	0.6	0.8	1.2	1.2	1.7	2.1	2.5
−20 to 0	−0.4	−0.3	−0.2	−0.1	0.0	0.1	0.1	0.1	0.3	0.5	0.8	0.9	1.3	1.8	2.1
−40 to −20	−0.7	−0.6	−0.5	−0.4	−0.3	−0.2	−0.2	−0.2	0.0	0.2	0.5	0.6	1.0	1.4	1.7
−60 to −40	−0.9	−0.9	−0.8	−0.7	−0.6	−0.5	−0.5	−0.5	−0.3	−0.2	0.2	0.2	0.6	1.0	1.3
−70 to −60	−1.1	−1.1	−1.0	−0.9	−0.8	−0.7	−0.7	−0.7	−0.6	−0.4	−0.1	0.0	0.4	0.8	1.0

Coef. disp. form. (frac. eq.)(ref.)	
P1	9.83663348E−02
Q1	7.63945327E+01
P2	1.03186784E−02
Q2	4.32605569E−02
P3	3.50770304E−01
Q3	6.14483385E−03

Fitting error of disp. form. σ [1E-6]		
	Visible	Infrared
Power ser. eq.	0.7	8.3
Frac. eq. (ref.)	0.6	9.0

Prod. Freq. (A to D)	C

Similar glass type			
OHARA	S-BSM25	HOYA	BACED5
CDGM	H-ZBaF50	SCHOTT	N-SSK5

2022-7-1	StP, AP, SP
2019-4-1	Transmittance
2015-4-1	Color Code, Prod. Freq.

HIKARI GLASS CO., LTD.

J-SSK8

n_d = 1.617720 n_e = 1.620669

ν_d = 49.81 ν_e = 49.53

Glass code (d)
618498
Glass code (e)
621495

Spectral l.	Refractive idx
2.058	1.58991
1.970	1.59120
1.530	1.59714
1.129	1.60250
1.064	1.60349
t	1.60432
s	1.60756
A'	1.609817
r	1.611903
C	1.613998
C'	1.614587
He-Ne	1.615138
D	1.617610
d	1.617720
e	1.620669
F	1.626399
F'	1.627119
g	1.633338
h	1.639220
0.389	1.642869
i	1.649551

Coef. disp. form. (pwr ser.)	
A0	2.56658096E+00
A1	-9.72847347E-03
A2	-9.45439785E-05
A3	1.74935076E-02
A4	3.71433240E-04
A5	-4.00752907E-06
A6	1.64198401E-06
A7	0.00000000E+00
A8	0.00000000E+00

Partial dispersion	
F-C	0.012401
F'-C'	0.012532
C-t	0.009678
C-A'	0.004181
d-C	0.003722
e-C	0.006671
g-d	0.015618
g-F	0.006939
h-g	0.005882
i-g	0.016213
C'-t	0.010267
e-C'	0.006082
F'-e	0.006450
i-F'	0.022432

Relative partial dispersion	
C-t／F-C	0.7804
C-A'／F-C	0.3372
d-C／F-C	0.3001
e-C／F-C	0.5379
g-d／F-C	1.2594
g-F／F-C	0.5596
h-g／F-C	0.4743
i-g／F-C	1.3074
C'-t／F'-C'	0.8193
e-C'／F'-C'	0.4853
F'-e／F'-C'	0.5147
i-F'／F'-C'	1.7900

Deviation of relative partial disp.	
ΔPdC	0.0004
ΔPgF	−0.0012

Internal CC (80%/5%)
372/340
Color Code (80%/5%)
385/340
CCI

B	0.00
G	0.78
R	0.75

Thermal properties	
CTE(-30,70) [1E-7/℃]	74
CTE(100,300) [1E-7/℃]	89
Tg [℃]	593
At [℃]	639
StP [℃]	542
AP [℃]	579
SP [℃]	720
Ht cndct. [W/m·K]	0.979
Sp. heat [kJ/kg·K]	0.626
Ht diffus. [1E-6 m2/sec]	0.492

Chemical properties [class]	
Acid res. (surface)	6
Alkaline detergent res.	3
Climate resistance	2
Water res. (powder)	2
Acid res. (powder)	3

Mechanical properties	
Knoop hardness	493 (5)
Abrasion hardness	129
Young's mod. [GPa]	85.6
Shear mod. [GPa]	34.0
Poisson's ratio	0.260
Stress optical coef. [1E-5 nm/cm／Pa]	2.37

Internal trans. (10mm)	
λ [nm]	τ
280	–
290	–
300	–
310	–
320	–
330	–
340	0.05
350	0.25
360	0.54
370	0.76
380	0.88
390	0.935
400	0.962
420	0.982
440	0.987
460	0.990
480	0.993
500	0.995
550	0.998
600	0.998
650	0.997
700	0.997
800	0.997
900	0.997
1000	0.997
1200	0.997
1400	0.989
1600	0.989
1800	0.977
2000	0.961
2200	0.902
2400	0.83

Specific gravity
3.18

Relative Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90 (ref.)	2.1	2.1	2.2	2.4	2.5	2.7	2.7	2.7	2.9	3.1	3.6	3.6	4.1	4.7	5.0
60 to 80 (ref.)	1.9	2.0	2.2	2.3	2.4	2.5	2.6	2.6	2.8	3.0	3.4	3.5	4.0	4.5	4.8
40 to 60	1.8	1.8	2.0	2.1	2.2	2.3	2.4	2.4	2.6	2.8	3.2	3.2	3.7	4.2	4.6
20 to 40	1.6	1.7	1.8	1.9	2.1	2.2	2.2	2.2	2.4	2.6	3.0	3.1	3.5	4.0	4.4
0 to 20	1.5	1.6	1.7	1.8	1.9	2.1	2.1	2.1	2.3	2.5	2.9	2.9	3.4	3.9	4.2
-20 to 0	1.5	1.5	1.7	1.8	1.9	2.0	2.0	2.1	2.2	2.4	2.8	2.8	3.3	3.7	4.1
-40 to -20	1.5	1.6	1.7	1.8	1.9	2.0	2.0	2.1	2.2	2.4	2.8	2.8	3.2	3.7	4.0
-60 to -40 (ref.)	1.6	1.7	1.8	1.9	2.0	2.1	2.1	2.1	2.3	2.5	2.8	2.9	3.3	3.7	4.0
-70 to -60 (ref.)	1.8	1.8	1.9	2.0	2.1	2.2	2.3	2.3	2.4	2.6	3.0	3.0	3.4	3.9	4.2

Absolute Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90	1.1	1.1	1.3	1.4	1.5	1.7	1.7	1.7	1.9	2.1	2.5	2.6	3.1	3.6	4.0
60 to 80	0.9	0.9	1.1	1.2	1.3	1.4	1.5	1.5	1.7	1.9	2.3	2.3	2.8	3.3	3.7
40 to 60	0.6	0.6	0.8	0.9	1.0	1.1	1.1	1.2	1.3	1.5	1.9	2.0	2.5	3.0	3.3
20 to 40	0.3	0.3	0.4	0.6	0.7	0.8	0.8	0.8	1.0	1.2	1.6	1.6	2.1	2.6	2.9
0 to 20	0.0	0.0	0.1	0.2	0.3	0.5	0.5	0.5	0.7	0.9	1.2	1.3	1.7	2.2	2.5
-20 to 0	-0.3	-0.3	-0.2	-0.1	0.0	0.1	0.2	0.2	0.3	0.5	0.9	0.9	1.4	1.8	2.1
-40 to -20	-0.6	-0.6	-0.5	-0.4	-0.3	-0.2	-0.2	-0.1	0.0	0.2	0.5	0.6	1.0	1.4	1.7
-60 to -40	-0.9	-0.9	-0.8	-0.7	-0.6	-0.5	-0.5	-0.5	-0.3	-0.2	0.2	0.2	0.6	1.0	1.3
-70 to -60	-1.2	-1.1	-1.0	-0.9	-0.8	-0.8	-0.7	-0.7	-0.6	-0.4	-0.1	0.0	0.4	0.8	1.0

Coef. disp. form. (frac. eq.)(ref.)	
P1	1.14440812E-01
Q1	8.22577070E+01
P2	8.67672536E-03
Q2	4.88531477E-02
P3	3.34364724E-01
Q3	6.32531622E-03

Fitting error of disp. form. σ [1E-6]		
	Visible	Infrared
Power ser. eq.	0.9	6.8
Frac. eq. (ref.)	0.7	7.6

Prod. Freq. (A to D)	C

Similar glass type			
OHARA	S-BSM28	HOYA	–
CDGM	–	SCHOTT	N-SSK8

2022-7-1	StP, AP, SP
2019-4-1	Transmittance
2018-4-1	Prod. Freq.

HIKARI GLASS CO., LTD.

J-LLF1

n_d = 1.548140 n_e = 1.551000

ν_d = 45.51 ν_e = 45.22

Glass code (d)
548455
Glass code (e)
551452

Spectral l.	Refractive idx
2.058	1.52182
1.970	1.52302
1.530	1.52855
1.129	1.53359
1.064	1.53453
t	1.53532
s	1.53840
A'	1.540544
r	1.542539
C	1.544550
C'	1.545117
He-Ne	1.545647
D	1.548034
d	1.548140
e	1.551000
F	1.556594
F'	1.557301
g	1.563441
h	1.569310
0.389	1.572986
i	1.579793

Partial dispersion	
F-C	0.012044
F'-C'	0.012184
C-t	0.009232
C-A'	0.004006
d-C	0.003590
e-C	0.006450
g-d	0.015301
g-F	0.006847
h-g	0.005869
i-g	0.016352
C'-t	0.009799
e-C'	0.005883
F'-e	0.006301
i-F'	0.022492

Relative partial dispersion	
C-t／F-C	0.7665
C-A'／F-C	0.3326
d-C／F-C	0.2981
e-C／F-C	0.5355
g-d／F-C	1.2704
g-F／F-C	0.5685
h-g／F-C	0.4873
i-g／F-C	1.3577
C'-t／F'-C'	0.8043
e-C'／F'-C'	0.4828
F'-e／F'-C'	0.5172
i-F'／F'-C'	1.8460

Deviation of relative partial disp.	
ΔPdC	0.0003
ΔPgF	0.0005

Internal CC (80%/5%)
364/338
Color Code (80%/5%)
370/340

CCI	
B	0.00
G	0.30
R	0.28

Thermal properties	
CTE(-30,70) [1E-7/℃]	87
CTE(100,300) [1E-7/℃]	105
Tg [℃]	471
At [℃]	529
StP [℃]	416
AP [℃]	456
SP [℃]	628
Ht cndct. [W/m･K]	1.050
Sp. heat [kJ/kg･K]	0.770
Ht diffus. [1E-6 m2/sec]	0.534

Chemical properties [class]	
Acid res. (surface)	1
Alkaline detergent res.	1
Climate resistance	1
Water res. (powder)	3
Acid res. (powder)	1

Mechanical properties	
Knoop hardness	455 (5)
Abrasion hardness	109
Young's mod. [GPa]	71.0
Shear mod. [GPa]	29.2
Poisson's ratio	0.216
Stress optical coef. [1E-5 nm/cm／Pa]	3.16

Internal trans. (10mm)	
λ [nm]	τ
280	–
290	–
300	–
310	–
320	–
330	–
340	0.08
350	0.36
360	0.70
370	0.88
380	0.948
390	0.975
400	0.986
420	0.994
440	0.995
460	0.996
480	0.997
500	0.998
550	0.999
600	0.999
650	0.999
700	0.999
800	0.998
900	0.997
1000	0.997
1200	0.998
1400	0.993
1600	0.990
1800	0.962
2000	0.920
2200	0.84
2400	0.79

Specific gravity
2.55

Coef. disp. form. (pwr ser.)	
A0	2.35082049E+00
A1	-8.90815763E-03
A2	-4.67960548E-05
A3	1.55575823E-02
A4	4.97642954E-04
A5	-1.81687973E-05
A6	2.83408723E-06
A7	0.00000000E+00
A8	0.00000000E+00

Relative Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90 (ref.)	0.9	1.0	1.1	1.3	1.4	1.6	1.6	1.6	1.8	2.1	2.6	2.7	3.3	4.0	4.4
60 to 80 (ref.)	0.9	0.9	1.1	1.2	1.4	1.5	1.5	1.6	1.8	2.0	2.5	2.6	3.2	3.8	4.3
40 to 60	0.8	0.9	1.0	1.2	1.3	1.4	1.5	1.5	1.7	1.9	2.4	2.4	3.0	3.7	4.1
20 to 40	0.8	0.9	1.0	1.1	1.2	1.4	1.4	1.5	1.6	1.8	2.3	2.4	2.9	3.5	4.0
0 to 20	0.8	0.9	1.0	1.1	1.2	1.4	1.4	1.4	1.6	1.8	2.3	2.3	2.9	3.4	3.8
-20 to 0	0.9	0.9	1.1	1.2	1.3	1.4	1.4	1.5	1.6	1.8	2.3	2.3	2.8	3.4	3.8
-40 to -20	1.0	1.1	1.2	1.3	1.4	1.5	1.5	1.6	1.7	1.9	2.3	2.4	2.9	3.4	3.8
-60 to -40 (ref.)	1.2	1.3	1.4	1.5	1.6	1.7	1.7	1.8	1.9	2.1	2.5	2.5	3.0	3.5	3.9
-70 to -60 (ref.)	1.5	1.5	1.6	1.7	1.8	1.9	2.0	2.0	2.1	2.3	2.7	2.7	3.2	3.7	4.0

Absolute Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90	0.0	0.0	0.2	0.3	0.5	0.6	0.6	0.7	0.9	1.1	1.6	1.7	2.3	3.0	3.4
60 to 80	-0.1	-0.1	0.1	0.2	0.3	0.4	0.5	0.5	0.7	0.9	1.4	1.5	2.1	2.8	3.2
40 to 60	-0.3	-0.3	-0.1	0.0	0.1	0.2	0.3	0.3	0.5	0.7	1.2	1.2	1.8	2.5	2.9
20 to 40	-0.5	-0.5	-0.3	-0.2	-0.1	0.0	0.1	0.1	0.3	0.5	0.9	1.0	1.6	2.2	2.6
0 to 20	-0.7	-0.6	-0.5	-0.4	-0.3	-0.2	-0.1	-0.1	0.1	0.3	0.7	0.7	1.3	1.8	2.2
-20 to 0	-0.9	-0.8	-0.7	-0.6	-0.5	-0.4	-0.3	-0.3	-0.2	0.0	0.4	0.5	1.0	1.5	1.9
-40 to -20	-1.0	-1.0	-0.9	-0.8	-0.7	-0.6	-0.5	-0.5	-0.4	-0.2	0.2	0.2	0.7	1.2	1.6
-60 to -40	-1.2	-1.2	-1.1	-1.0	-0.9	-0.8	-0.8	-0.7	-0.6	-0.4	0.0	0.0	0.5	0.9	1.3
-70 to -60	-1.4	-1.3	-1.2	-1.1	-1.0	-0.9	-0.9	-0.9	-0.7	-0.6	-0.2	-0.2	0.3	0.7	1.0

Coef. disp. form. (frac. eq.)(ref.)	
P1	1.14272540E-01
Q1	8.36598442E+01
P2	1.16097513E-02
Q2	5.03232551E-02
P3	2.98780426E-01
Q3	6.54971242E-03

Fitting error of disp. form. σ [1E-6]		
	Visible	Infrared
Power ser. eq.	0.8	5.0
Frac. eq. (ref.)	0.9	4.7

Prod. Freq. (A to D)	C

Similar glass type			
OHARA	S-TIL1	HOYA	E-FEL1
CDGM	H-QF1	SCHOTT	–

2022-7-1	StP, AP, SP
2019-4-1	Transmittance
2018-4-1	Prod. Freq.

J-LLF2

n_d = 1.540720 n_e = 1.543455

ν_d = 46.97 ν_e = 46.68

Glass code (d)
541470
Glass code (e)
543467

Spectral l.	Refractive idx
2.058	1.51518
1.970	1.51636
1.530	1.52179
1.129	1.52671
1.064	1.52762
t	1.52838
s	1.53136
A'	1.533429
r	1.535348
C	1.537280
C'	1.537824
He-Ne	1.538332
D	1.540618
d	1.540720
e	1.543455
F	1.548793
F'	1.549466
g	1.555303
h	1.560866
0.389	1.564340
i	1.570753

Partial dispersion	
F-C	0.011513
F'-C'	0.011642
C-t	0.008899
C-A'	0.003851
d-C	0.003440
e-C	0.006175
g-d	0.014583
g-F	0.006510
h-g	0.005563
i-g	0.015450
C'-t	0.009443
e-C'	0.005631
F'-e	0.006011
i-F'	0.021287

Relative partial dispersion	
C-t／F-C	0.7730
C-A'／F-C	0.3345
d-C／F-C	0.2988
e-C／F-C	0.5364
g-d／F-C	1.2667
g-F／F-C	0.5654
h-g／F-C	0.4832
i-g／F-C	1.3420
C'-t／F'-C'	0.8111
e-C'／F'-C'	0.4837
F'-e／F'-C'	0.5163
i-F'／F'-C'	1.8285

Deviation of relative partial disp.	
ΔPdC	0.0004
ΔPgF	−0.0001

Internal CC (80%/5%)
365/337
Color Code (80%/5%)
370/340

CCI	
B	0.00
G	0.34
R	0.33

Thermal properties	
CTE(−30,70) [1E-7/℃]	88
CTE(100,300) [1E-7/℃]	107
Tg [℃]	460
At [℃]	522
StP [℃]	414
AP [℃]	454
SP [℃]	629
Ht cndct. [W/m·K]	1.129
Sp. heat [kJ/kg·K]	0.771
Ht diffus. [1E-6 m2/sec]	0.577

Chemical properties [class]	
Acid res. (surface)	1
Alkaline detergent res.	1
Climate resistance	1
Water res. (powder)	3
Acid res. (powder)	1

Mechanical properties	
Knoop hardness	455 (5)
Abrasion hardness	120
Young's mod. [GPa]	69.8
Shear mod. [GPa]	28.4
Poisson's ratio	0.227
Stress optical coef. [1E-5 nm/cm／Pa]	2.95

Internal trans. (10mm)	
λ [nm]	τ
280	–
290	–
300	–
310	–
320	–
330	–
340	0.09
350	0.37
360	0.70
370	0.87
380	0.940
390	0.970
400	0.984
420	0.993
440	0.995
460	0.996
480	0.997
500	0.998
550	0.999
600	0.999
650	0.998
700	0.999
800	0.998
900	0.997
1000	0.998
1200	0.999
1400	0.999
1600	0.990
1800	0.964
2000	0.920
2200	0.84
2400	0.79

Specific gravity
2.53

Coef. disp. form. (pwr ser.)	
A0	2.32991556E+00
A1	−8.66190637E-03
A2	−5.64810656E-05
A3	1.50203800E-02
A4	4.20176461E-04
A5	−1.21206332E-05
A6	2.27699343E-06
A7	0.00000000E+00
A8	0.00000000E+00

Relative Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90 (ref.)	0.5	0.6	0.7	0.9	1.0	1.1	1.2	1.2	1.4	1.6	2.0	2.1	2.7	3.3	3.7
60 to 80 (ref.)	0.5	0.5	0.7	0.8	0.9	1.1	1.1	1.1	1.3	1.5	2.0	2.0	2.6	3.2	3.6
40 to 60	0.4	0.5	0.7	0.8	0.9	1.0	1.1	1.1	1.3	1.5	1.9	2.0	2.5	3.1	3.5
20 to 40	0.4	0.5	0.6	0.8	0.9	1.0	1.0	1.1	1.2	1.4	1.9	1.9	2.4	3.0	3.4
0 to 20	0.5	0.5	0.7	0.8	0.9	1.0	1.1	1.1	1.3	1.4	1.8	1.9	2.4	2.9	3.3
−20 to 0	0.6	0.6	0.8	0.9	1.0	1.1	1.1	1.2	1.3	1.5	1.9	1.9	2.4	2.9	3.3
−40 to −20	0.7	0.8	0.9	1.0	1.1	1.2	1.3	1.3	1.4	1.6	2.0	2.0	2.5	3.0	3.4
−60 to −40 (ref.)	0.9	1.0	1.1	1.2	1.3	1.4	1.5	1.5	1.6	1.8	2.2	2.2	2.7	3.2	3.5
−70 to −60 (ref.)	1.2	1.2	1.4	1.5	1.6	1.7	1.7	1.7	1.9	2.0	2.4	2.4	2.9	3.3	3.7

Absolute Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90	−0.4	−0.4	−0.2	−0.1	0.0	0.2	0.2	0.2	0.4	0.6	1.1	1.1	1.7	2.3	2.8
60 to 80	−0.6	−0.5	−0.3	−0.2	−0.1	0.0	0.1	0.1	0.3	0.5	0.9	1.0	1.5	2.1	2.5
40 to 60	−0.7	−0.7	−0.5	−0.4	−0.3	−0.2	−0.1	−0.1	0.1	0.3	0.7	0.8	1.3	1.9	2.3
20 to 40	−0.9	−0.8	−0.7	−0.6	−0.4	−0.3	−0.3	−0.3	−0.1	0.1	0.5	0.5	1.1	1.6	2.0
0 to 20	−1.0	−1.0	−0.8	−0.7	−0.6	−0.5	−0.5	−0.4	−0.3	−0.1	0.3	0.3	0.8	1.4	1.7
−20 to 0	−1.2	−1.1	−1.0	−0.9	−0.8	−0.7	−0.7	−0.6	−0.5	−0.3	0.1	0.1	0.6	1.1	1.5
−40 to −20	−1.3	−1.3	−1.2	−1.1	−1.0	−0.9	−0.8	−0.8	−0.7	−0.5	−0.1	−0.1	0.4	0.8	1.2
−60 to −40	−1.5	−1.5	−1.3	−1.2	−1.1	−1.0	−1.0	−1.0	−0.8	−0.7	−0.4	−0.3	0.1	0.6	0.9
−70 to −60	−1.6	−1.6	−1.5	−1.4	−1.3	−1.2	−1.1	−1.1	−1.0	−0.8	−0.5	−0.5	−0.1	0.4	0.7

Coef. disp. form. (frac. eq.)(ref.)	
P1	1.13935561E-01
Q1	8.42051318E+01
P2	1.02232092E-02
Q2	5.03254636E-02
P3	2.96865573E-01
Q3	6.54412936E-03

Fitting error of disp. form. σ [1E-6]		
	Visible	Infrared
Power ser. eq.	0.8	3.9
Frac. eq. (ref.)	0.6	3.8

Prod. Freq. (A to D)	C

Similar glass type			
OHARA	S-TIL2	HOYA	E-FEL2
CDGM	H-QF8	SCHOTT	–

2022-7-1	StP, AP, SP
2019-4-1	Transmittance
2018-4-1	Prod. Freq.

J-LLF6

n_d = 1.531720 n_e = 1.534311

ν_d = 48.78 ν_e = 48.49

Glass code (d)
532488
Glass code (e)
534485

Spectral l.	Refractive idx
2.058	1.50694
1.970	1.50811
1.530	1.51350
1.129	1.51831
1.064	1.51920
t	1.51993
s	1.52280
A'	1.524781
r	1.526614
C	1.528453
C'	1.528970
He-Ne	1.529453
D	1.531624
d	1.531720
e	1.534311
F	1.539353
F'	1.539988
g	1.545481
h	1.550696
0.389	1.553942
i	1.559910

Partial dispersion	
F-C	0.010900
F'-C'	0.011018
C-t	0.008520
C-A'	0.003672
d-C	0.003267
e-C	0.005858
g-d	0.013761
g-F	0.006128
h-g	0.005215
i-g	0.014429
C'-t	0.009037
e-C'	0.005341
F'-e	0.005677
i-F'	0.019922

Internal CC (80%/5%)
362/336
Color Code (80%/5%)
365/335

CCI	
B	0.00
G	0.23
R	0.21

Thermal properties	
CTE(-30,70) [1E-7/℃]	82
CTE(100,300) [1E-7/℃]	90
Tg [℃]	511
At [℃]	581
StP [℃]	463
AP [℃]	506
SP [℃]	684
Ht cndct. [W/m·K]	0.965
Sp. heat [kJ/kg·K]	0.716
Ht diffus. [1E-6 m2/sec]	0.536

Internal trans. (10mm)	
λ [nm]	τ
280	–
290	–
300	–
310	–
320	–
330	–
340	0.11
350	0.44
360	0.77
370	0.923
380	0.968
390	0.984
400	0.991
420	0.993
440	0.994
460	0.994
480	0.996
500	0.996
550	0.998
600	0.997
650	0.997
700	0.998
800	0.997
900	0.996
1000	0.996
1200	0.997
1400	0.993
1600	0.989
1800	0.959
2000	0.914
2200	0.83
2400	0.77

Coef. disp. form. (pwr ser.)	
A0	2.30465477E+00
A1	-8.42372028E-03
A2	-8.53219261E-05
A3	1.43763145E-02
A4	3.30848944E-04
A5	-4.10026783E-06
A6	1.57001947E-06
A7	0.00000000E+00
A8	0.00000000E+00

Relative partial dispersion	
C-t／F-C	0.7817
C-A'／F-C	0.3369
d-C／F-C	0.2997
e-C／F-C	0.5374
g-d／F-C	1.2625
g-F／F-C	0.5622
h-g／F-C	0.4784
i-g／F-C	1.3238
C'-t／F'-C'	0.8202
e-C'／F'-C'	0.4848
F'-e／F'-C'	0.5152
i-F'／F'-C'	1.8081

Deviation of relative partial disp.	
ΔPdC	0.0005
ΔPgF	-0.0003

Chemical properties [class]	
Acid res. (surface)	1
Alkaline detergent res.	1
Climate resistance	1
Water res. (powder)	1
Acid res. (powder)	1

Mechanical properties	
Knoop hardness	443 (4)
Abrasion hardness	140
Young's mod. [GPa]	65.0
Shear mod. [GPa]	26.3
Poisson's ratio	0.235
Stress optical coef. [1E-5 nm/cm／Pa]	3.25

Specific gravity
2.51

Relative Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90 (ref.)	0.5	0.5	0.6	0.8	0.9	1.0	1.0	1.1	1.2	1.5	1.9	1.9	2.4	3.0	3.4
60 to 80 (ref.)	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.0	1.2	1.4	1.8	1.8	2.3	2.9	3.3
40 to 60	0.4	0.4	0.5	0.6	0.7	0.8	0.9	0.9	1.1	1.3	1.7	1.7	2.2	2.7	3.1
20 to 40	0.3	0.4	0.5	0.6	0.7	0.8	0.8	0.9	1.0	1.2	1.6	1.6	2.1	2.6	3.0
0 to 20	0.3	0.4	0.5	0.6	0.7	0.8	0.8	0.8	1.0	1.2	1.5	1.6	2.0	2.5	2.9
-20 to 0	0.4	0.4	0.5	0.6	0.7	0.8	0.8	0.9	1.0	1.2	1.6	1.6	2.0	2.5	2.8
-40 to -20	0.5	0.5	0.6	0.7	0.8	0.9	0.9	1.0	1.1	1.3	1.6	1.7	2.0	2.5	2.8
-60 to -40 (ref.)	0.7	0.7	0.8	0.9	1.0	1.1	1.1	1.1	1.3	1.4	1.8	1.8	2.2	2.6	2.9
-70 to -60 (ref.)	0.9	1.0	1.1	1.1	1.2	1.3	1.3	1.4	1.5	1.6	2.0	2.0	2.4	2.8	3.1

Absolute Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90	-0.5	-0.4	-0.3	-0.2	-0.1	0.0	0.1	0.1	0.3	0.5	0.9	1.0	1.5	2.0	2.4
60 to 80	-0.6	-0.5	-0.4	-0.3	-0.2	-0.1	-0.1	0.0	0.1	0.3	0.7	0.8	1.3	1.8	2.2
40 to 60	-0.8	-0.7	-0.6	-0.5	-0.4	-0.3	-0.3	-0.3	-0.1	0.1	0.5	0.5	1.0	1.5	1.9
20 to 40	-1.0	-0.9	-0.8	-0.7	-0.6	-0.5	-0.5	-0.5	-0.3	-0.1	0.2	0.3	0.7	1.2	1.6
0 to 20	-1.2	-1.1	-1.0	-0.9	-0.8	-0.7	-0.7	-0.7	-0.5	-0.4	0.0	0.0	0.5	0.9	1.3
-20 to 0	-1.3	-1.3	-1.2	-1.1	-1.0	-1.0	-0.9	-0.9	-0.8	-0.6	-0.2	-0.2	0.2	0.6	1.0
-40 to -20	-1.5	-1.5	-1.4	-1.3	-1.3	-1.2	-1.1	-1.1	-1.0	-0.8	-0.5	-0.5	-0.1	0.3	0.7
-60 to -40	-1.7	-1.7	-1.6	-1.5	-1.5	-1.4	-1.3	-1.3	-1.2	-1.0	-0.7	-0.7	-0.4	0.0	0.4
-70 to -60	-1.9	-1.8	-1.7	-1.7	-1.6	-1.5	-1.5	-1.5	-1.4	-1.2	-0.9	-0.9	-0.6	-0.2	0.1

Coef. disp. form. (frac. eq.)(ref.)	
P1	1.07557274E-01
Q1	7.94538219E+01
P2	9.79586899E-03
Q2	4.86675152E-02
P3	2.93267192E-01
Q3	6.39526758E-03

Fitting error of disp. form. σ [1E-6]		
	Visible	Infrared
Power ser. eq.	0.7	5.3
Frac. eq. (ref.)	0.5	5.9

Prod. Freq. (A to D)	C

Similar glass type			
OHARA	S-TIL6	HOYA	E-FEL6
CDGM	H-QF6A	SCHOTT	–

2022-7-1	StP, AP, SP
2019-4-1	Transmittance
2018-4-1	Prod. Freq.

J-LF5

n_d = 1.581440 n_e = 1.584805

ν_d = 40.98 ν_e = 40.70

Glass code (d)
581410
Glass code (e)
585407

Spectral l.	Refractive idx
2.058	1.55179
1.970	1.55308
1.530	1.55908
1.129	1.56464
1.064	1.56570
t	1.56659
s	1.57010
A'	1.572581
r	1.574895
C	1.577238
C'	1.577900
He-Ne	1.578520
D	1.581315
d	1.581440
e	1.584805
F	1.591428
F'	1.592268
g	1.599606
h	1.606684
0.389	1.611153
i	1.619523

Partial dispersion	
F-C	0.014190
F'-C'	0.014368
C-t	0.010652
C-A'	0.004657
d-C	0.004202
e-C	0.007567
g-d	0.018166
g-F	0.008178
h-g	0.007078
i-g	0.019917
C'-t	0.011314
e-C'	0.006905
F'-e	0.007463
i-F'	0.027255

Internal CC (80%/5%)
376/348
Color Code (80%/5%)
385/350

CCI	
B	0.00
G	0.68
R	0.70

Thermal properties	
CTE(-30,70) [1E-7/℃]	75
CTE(100,300) [1E-7/℃]	90
Tg [℃]	576
At [℃]	623
StP [℃]	516
AP [℃]	557
SP [℃]	720
Ht cndct. [W/m·K]	1.127
Sp. heat [kJ/kg·K]	0.822
Ht diffus. [1E-6 m2/sec]	0.531

Internal trans. (10mm)	
λ [nm]	τ
280	–
290	–
300	–
310	–
320	–
330	–
340	–
350	0.08
360	0.35
370	0.68
380	0.86
390	0.934
400	0.966
420	0.987
440	0.990
460	0.993
480	0.995
500	0.996
550	0.998
600	0.998
650	0.998
700	0.998
800	0.996
900	0.995
1000	0.996
1200	0.997
1400	0.992
1600	0.991
1800	0.972
2000	0.949
2200	0.89
2400	0.86

Coef. disp. form. (pwr ser.)	
A0	2.44484793E+00
A1	-9.36437503E-03
A2	-9.46881204E-05
A3	1.93135291E-02
A4	2.36834809E-04
A5	7.55993911E-05
A6	-7.53407578E-06
A7	5.41756865E-07
A8	0.00000000E+00

Relative partial dispersion	
C-t／F-C	0.7507
C-A'／F-C	0.3282
d-C／F-C	0.2961
e-C／F-C	0.5333
g-d／F-C	1.2802
g-F／F-C	0.5763
h-g／F-C	0.4988
i-g／F-C	1.4036
C'-t／F'-C'	0.7874
e-C'／F'-C'	0.4806
F'-e／F'-C'	0.5194
i-F'／F'-C'	1.8969

Deviation of relative partial disp.	
ΔPdC	0.0004
ΔPgF	0.0007

Chemical properties [class]	
Acid res. (surface)	1
Alkaline detergent res.	1
Climate resistance	1
Water res. (powder)	3
Acid res. (powder)	1

Mechanical properties	
Knoop hardness	477 (5)
Abrasion hardness	105
Young's mod. [GPa]	75.6
Shear mod. [GPa]	30.9
Poisson's ratio	0.223
Stress optical coef. [1E-5 nm/cm／Pa]	3.17

Specific gravity
2.58

Relative Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90 (ref.)	2.4	2.4	2.5	2.7	2.9	3.1	3.1	3.2	3.4	3.7	4.3	4.4	5.2	6.0	6.6
60 to 80 (ref.)	2.3	2.3	2.5	2.6	2.8	3.0	3.0	3.1	3.3	3.6	4.2	4.2	5.0	5.8	6.4
40 to 60	2.2	2.2	2.4	2.5	2.7	2.9	2.9	3.0	3.2	3.4	4.0	4.1	4.8	5.6	6.1
20 to 40	2.1	2.2	2.3	2.5	2.6	2.8	2.8	2.9	3.1	3.3	3.9	3.9	4.6	5.4	5.9
0 to 20	2.1	2.1	2.3	2.4	2.6	2.7	2.8	2.8	3.0	3.2	3.8	3.8	4.5	5.2	5.7
-20 to 0	2.1	2.1	2.3	2.4	2.5	2.7	2.7	2.8	3.0	3.2	3.7	3.8	4.4	5.1	5.6
-40 to -20	2.2	2.2	2.3	2.5	2.6	2.8	2.8	2.8	3.0	3.2	3.7	3.8	4.4	5.1	5.5
-60 to -40 (ref.)	2.4	2.4	2.5	2.6	2.8	2.9	2.9	3.0	3.1	3.4	3.8	3.9	4.5	5.1	5.5
-70 to -60 (ref.)	2.6	2.6	2.7	2.8	2.9	3.1	3.1	3.2	3.3	3.5	4.0	4.0	4.6	5.2	5.6

Absolute Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90	1.4	1.4	1.6	1.8	1.9	2.1	2.2	2.2	2.4	2.7	3.3	3.4	4.2	5.0	5.6
60 to 80	1.2	1.3	1.4	1.6	1.7	1.9	2.0	2.0	2.2	2.5	3.1	3.2	3.9	4.7	5.3
40 to 60	1.0	1.0	1.2	1.3	1.5	1.7	1.7	1.7	2.0	2.2	2.8	2.8	3.6	4.4	4.9
20 to 40	0.8	0.8	0.9	1.1	1.2	1.4	1.4	1.5	1.7	1.9	2.5	2.5	3.2	4.0	4.5
0 to 20	0.6	0.6	0.7	0.8	1.0	1.1	1.2	1.2	1.4	1.6	2.2	2.2	2.9	3.6	4.1
-20 to 0	0.3	0.3	0.5	0.6	0.7	0.9	0.9	1.0	1.1	1.4	1.8	1.9	2.6	3.2	3.7
-40 to -20	0.1	0.1	0.2	0.4	0.5	0.6	0.7	0.7	0.9	1.1	1.5	1.6	2.2	2.9	3.3
-60 to -40	-0.1	-0.1	0.0	0.1	0.2	0.4	0.4	0.4	0.6	0.8	1.2	1.3	1.9	2.5	2.9
-70 to -60	-0.3	-0.3	-0.2	-0.1	0.0	0.2	0.2	0.2	0.4	0.6	1.0	1.1	1.6	2.2	2.6

Coef. disp. form. (frac. eq.)(ref.)	
P1	1.12159838E-01
Q1	7.90009989E+01
P2	1.17641971E-02
Q2	5.54494399E-02
P3	3.13327895E-01
Q3	7.14680751E-03

Fitting error of disp. form. σ [1E-6]		
	Visible	Infrared
Power ser. eq.	0.5	8.2
Frac. eq. (ref.)	1.3	11.1

Prod. Freq. (A to D)	C

Similar glass type			
OHARA	S-TIL25	HOYA	E-FL5
CDGM	H-QF50A	SCHOTT	–

2022-7-1	StP, AP, SP
2019-4-1	Transmittance
2016-4-1	Prod. Freq., Similar glass type

HIKARI GLASS CO., LTD.

J-LF6

n_d = 1.567320 n_e = 1.570480

ν_d = 42.58 ν_e = 42.29

Glass code (d)
567426
Glass code (e)
570423

Spectral l.	Refractive idx
2.058	1.53950
1.970	1.54071
1.530	1.54633
1.129	1.55153
1.064	1.55252
t	1.55336
s	1.55666
A'	1.558991
r	1.561168
C	1.563371
C'	1.563993
He-Ne	1.564576
D	1.567203
d	1.567320
e	1.570480
F	1.576695
F'	1.577484
g	1.584361
h	1.590985
0.389	1.595163
i	1.602977

Partial dispersion	
F-C	0.013324
F'-C'	0.013491
C-t	0.010016
C-A'	0.004380
d-C	0.003949
e-C	0.007109
g-d	0.017041
g-F	0.007666
h-g	0.006624
i-g	0.018616
C'-t	0.010638
e-C'	0.006487
F'-e	0.007004
i-F'	0.025493

Relative partial dispersion	
C-t／F-C	0.7517
C-A'／F-C	0.3287
d-C／F-C	0.2964
e-C／F-C	0.5335
g-d／F-C	1.2790
g-F／F-C	0.5754
h-g／F-C	0.4971
i-g／F-C	1.3972
C'-t／F'-C'	0.7885
e-C'／F'-C'	0.4808
F'-e／F'-C'	0.5192
i-F'／F'-C'	1.8896

Deviation of relative partial disp.	
ΔPdC	0.0000
ΔPgF	0.0024

Internal CC (80%/5%)
368/343
Color Code (80%/5%)
375/345

CCI	
B	0.00
G	0.33
R	0.33

Thermal properties	
CTE(-30,70) [1E-7/℃]	91
CTE(100,300) [1E-7/℃]	106
Tg [℃]	499
At [℃]	557
StP [℃]	443
AP [℃]	481
SP [℃]	641
Ht cndct. [W/m･K]	1.070
Sp. heat [kJ/kg･K]	0.784
Ht diffus. [1E-6 m2/sec]	0.524

Chemical properties [class]	
Acid res. (surface)	1
Alkaline detergent res.	1
Climate resistance	1
Water res. (powder)	1
Acid res. (powder)	1

Mechanical properties	
Knoop hardness	476 (5)
Abrasion hardness	119
Young's mod. [GPa]	73.4
Shear mod. [GPa]	29.8
Poisson's ratio	0.232
Stress optical coef. [1E-5 nm/cm／Pa]	2.69

Internal trans. (10mm)	
λ [nm]	τ
280	–
290	–
300	–
310	–
320	–
330	–
340	–
350	0.19
360	0.56
370	0.83
380	0.934
390	0.971
400	0.986
420	0.994
440	0.995
460	0.997
480	0.998
500	0.998
550	0.999
600	0.999
650	0.999
700	0.999
800	0.998
900	0.996
1000	0.996
1200	0.997
1400	0.993
1600	0.987
1800	0.963
2000	0.933
2200	0.86
2400	0.82

Specific gravity
2.61

Coef. disp. form. (pwr ser.)	
A0	2.40368894E+00
A1	-8.44989386E-03
A2	-1.22270670E-04
A3	1.83786358E-02
A4	9.28895588E-05
A5	9.23801901E-05
A6	-9.14295770E-06
A7	5.77555194E-07
A8	0.00000000E+00

Relative Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90 (ref.)	0.6	0.6	0.8	1.0	1.1	1.3	1.3	1.3	1.6	1.8	2.4	2.4	3.2	4.0	4.5
60 to 80 (ref.)	0.5	0.6	0.8	0.9	1.0	1.2	1.2	1.3	1.5	1.7	2.3	2.3	3.0	3.8	4.4
40 to 60	0.4	0.5	0.7	0.8	1.0	1.1	1.1	1.2	1.4	1.6	2.1	2.2	2.9	3.6	4.1
20 to 40	0.4	0.5	0.6	0.8	0.9	1.0	1.1	1.1	1.3	1.5	2.0	2.1	2.7	3.5	4.0
0 to 20	0.4	0.5	0.6	0.8	0.9	1.0	1.1	1.1	1.3	1.5	2.0	2.0	2.6	3.3	3.8
-20 to 0	0.5	0.5	0.7	0.8	0.9	1.1	1.1	1.1	1.3	1.5	2.0	2.0	2.6	3.2	3.7
-40 to -20	0.6	0.6	0.8	0.9	1.0	1.1	1.2	1.2	1.4	1.6	2.0	2.1	2.6	3.2	3.7
-60 to -40 (ref.)	0.8	0.8	1.0	1.1	1.2	1.3	1.4	1.4	1.6	1.7	2.2	2.2	2.7	3.3	3.7
-70 to -60 (ref.)	1.0	1.1	1.2	1.3	1.4	1.5	1.6	1.6	1.8	1.9	2.3	2.4	2.9	3.4	3.8

Absolute Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90	-0.4	-0.3	-0.2	0.0	0.1	0.3	0.3	0.4	0.6	0.8	1.4	1.5	2.2	3.0	3.5
60 to 80	-0.5	-0.5	-0.3	-0.2	0.0	0.1	0.2	0.2	0.4	0.7	1.2	1.3	1.9	2.7	3.3
40 to 60	-0.7	-0.7	-0.5	-0.4	-0.2	-0.1	-0.1	0.0	0.2	0.4	0.9	1.0	1.6	2.4	2.9
20 to 40	-0.9	-0.9	-0.7	-0.6	-0.4	-0.3	-0.3	-0.2	-0.1	0.2	0.7	0.7	1.3	2.0	2.5
0 to 20	-1.1	-1.1	-0.9	-0.8	-0.7	-0.5	-0.5	-0.5	-0.3	-0.1	0.4	0.4	1.0	1.7	2.2
-20 to 0	-1.3	-1.3	-1.1	-1.0	-0.9	-0.7	-0.7	-0.7	-0.5	-0.3	0.1	0.2	0.7	1.4	1.8
-40 to -20	-1.5	-1.4	-1.3	-1.2	-1.1	-1.0	-0.9	-0.9	-0.7	-0.6	-0.1	-0.1	0.4	1.0	1.5
-60 to -40	-1.7	-1.6	-1.5	-1.4	-1.3	-1.2	-1.2	-1.1	-1.0	-0.8	-0.4	-0.4	0.1	0.7	1.1
-70 to -60	-1.8	-1.8	-1.7	-1.6	-1.5	-1.3	-1.3	-1.3	-1.2	-1.0	-0.6	-0.6	-0.1	0.4	0.8

Coef. disp. form. (frac. eq.)(ref.)	
P1	9.96589303E-02
Q1	7.47533697E+01
P2	1.06620520E-02
Q2	5.58428365E-02
P3	3.08177533E-01
Q3	7.01297392E-03

Fitting error of disp. form. σ [1E-6]		
	Visible	Infrared
Power ser. eq.	0.5	10.1
Frac. eq. (ref.)	1.2	9.1

Prod. Freq. (A to D)	D

Similar glass type			
OHARA	S-TIL26	HOYA	E-FL6
CDGM	H-QF56	SCHOTT	–

2022-7-1	StP, AP, SP
2019-4-1	Transmittance
2018-4-1	Prod. Freq.

J-LF7

n_d = 1.575010 n_e = 1.578295

ν_d = 41.51 ν_e = 41.23

Glass code (d)
575415
Glass code (e)
578412

Spectral l.	Refractive idx
2.058	1.54615
1.970	1.54740
1.530	1.55322
1.129	1.55862
1.064	1.55965
t	1.56051
s	1.56394
A'	1.566362
r	1.568621
C	1.570908
C'	1.571555
He-Ne	1.572160
D	1.574888
d	1.575010
e	1.578295
F	1.584760
F'	1.585581
g	1.592745
h	1.599656
0.389	1.604022
i	1.612203

Partial dispersion	
F-C	0.013852
F'-C'	0.014026
C-t	0.010395
C-A'	0.004546
d-C	0.004102
e-C	0.007387
g-d	0.017735
g-F	0.007985
h-g	0.006911
i-g	0.019458
C'-t	0.011042
e-C'	0.006740
F'-e	0.007286
i-F'	0.026622

Relative partial dispersion	
C-t／F-C	0.7504
C-A'／F-C	0.3282
d-C／F-C	0.2961
e-C／F-C	0.5333
g-d／F-C	1.2803
g-F／F-C	0.5765
h-g／F-C	0.4989
i-g／F-C	1.4047
C'-t／F'-C'	0.7873
e-C'／F'-C'	0.4805
F'-e／F'-C'	0.5195
i-F'／F'-C'	1.8980

Deviation of relative partial disp.	
ΔPdC	0.0002
ΔPgF	0.0017

Internal CC (80%/5%)
375/347
Color Code (80%/5%)
385/345

CCI	
B	0.00
G	0.73
R	0.72

Thermal properties	
CTE(-30,70) [1E-7/℃]	80
CTE(100,300) [1E-7/℃]	98
Tg [℃]	535
At [℃]	590
StP [℃]	477
AP [℃]	517
SP [℃]	679
Ht cndct. [W/m･K]	1.179
Sp. heat [kJ/kg･K]	0.782
Ht diffus. [1E-6 m2/sec]	0.579

Chemical properties [class]	
Acid res. (surface)	1
Alkaline detergent res.	1
Climate resistance	1
Water res. (powder)	1
Acid res. (powder)	1

Mechanical properties	
Knoop hardness	490 (5)
Abrasion hardness	115
Young's mod. [GPa]	75.7
Shear mod. [GPa]	30.8
Poisson's ratio	0.230
Stress optical coef. [1E-5 nm/cm／Pa]	2.83

Internal trans. (10mm)	
λ [nm]	τ
280	–
290	–
300	–
310	–
320	–
330	–
340	–
350	0.09
360	0.39
370	0.71
380	0.87
390	0.935
400	0.965
420	0.984
440	0.988
460	0.992
480	0.994
500	0.996
550	0.998
600	0.998
650	0.997
700	0.998
800	0.997
900	0.996
1000	0.996
1200	0.996
1400	0.992
1600	0.990
1800	0.975
2000	0.961
2200	0.911
2400	0.900

Specific gravity
2.6

Coef. disp. form. (pwr ser.)	
A0	2.42574282E+00
A1	-8.90909885E-03
A2	-1.08092631E-04
A3	1.90630501E-02
A4	1.17245652E-04
A5	9.74566345E-05
A6	-9.93663901E-06
A7	6.41905453E-07
A8	0.00000000E+00

Relative Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90 (ref.)	1.7	1.7	1.9	2.1	2.2	2.4	2.4	2.5	2.7	3.0	3.6	3.7	4.4	5.3	5.9
60 to 80 (ref.)	1.6	1.6	1.9	2.0	2.1	2.3	2.3	2.4	2.6	2.9	3.5	3.5	4.3	5.1	5.6
40 to 60	1.5	1.5	1.7	1.9	2.0	2.2	2.2	2.3	2.5	2.7	3.3	3.4	4.1	4.8	5.4
20 to 40	1.4	1.5	1.7	1.8	1.9	2.1	2.1	2.2	2.4	2.6	3.2	3.2	3.9	4.6	5.2
0 to 20	1.4	1.4	1.6	1.7	1.9	2.0	2.1	2.1	2.3	2.5	3.0	3.1	3.7	4.4	5.0
-20 to 0	1.4	1.5	1.6	1.7	1.9	2.0	2.0	2.1	2.3	2.5	3.0	3.1	3.7	4.3	4.8
-40 to -20	1.5	1.5	1.7	1.8	1.9	2.1	2.1	2.1	2.3	2.5	3.0	3.1	3.6	4.3	4.7
-60 to -40 (ref.)	1.7	1.7	1.9	2.0	2.1	2.2	2.2	2.3	2.5	2.7	3.1	3.2	3.7	4.3	4.7
-70 to -60 (ref.)	1.9	1.9	2.1	2.2	2.3	2.4	2.4	2.5	2.6	2.8	3.3	3.3	3.8	4.4	4.8

Absolute Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90	0.7	0.8	1.0	1.1	1.3	1.4	1.5	1.5	1.7	2.0	2.6	2.7	3.4	4.2	4.8
60 to 80	0.5	0.6	0.8	0.9	1.1	1.2	1.3	1.3	1.5	1.8	2.4	2.5	3.2	4.0	4.5
40 to 60	0.3	0.4	0.5	0.7	0.8	1.0	1.0	1.1	1.3	1.5	2.1	2.1	2.8	3.6	4.1
20 to 40	0.1	0.1	0.3	0.4	0.6	0.7	0.8	0.8	1.0	1.2	1.8	1.8	2.5	3.2	3.7
0 to 20	-0.2	-0.1	0.1	0.2	0.3	0.5	0.5	0.5	0.7	1.0	1.4	1.5	2.1	2.8	3.3
-20 to 0	-0.4	-0.3	-0.2	-0.1	0.1	0.2	0.2	0.3	0.5	0.7	1.1	1.2	1.8	2.4	2.9
-40 to -20	-0.6	-0.6	-0.4	-0.3	-0.2	-0.1	0.0	0.0	0.2	0.4	0.8	0.9	1.4	2.1	2.5
-60 to -40	-0.8	-0.8	-0.6	-0.5	-0.4	-0.3	-0.3	-0.3	-0.1	0.1	0.5	0.6	1.1	1.7	2.1
-70 to -60	-1.0	-1.0	-0.8	-0.7	-0.6	-0.5	-0.5	-0.5	-0.3	-0.1	0.3	0.3	0.8	1.4	1.8

Coef. disp. form. (frac. eq.)(ref.)	
P1	1.06655195E-01
Q1	7.73737086E+01
P2	1.07806800E-02
Q2	5.66985919E-02
P3	3.11436527E-01
Q3	7.16172753E-03

Fitting error of disp. form. σ [1E-6]	Visible	Infrared
Power ser. eq.	0.5	7.2
Frac. eq. (ref.)	1.4	9.7

Prod. Freq. (A to D)	C

Similar glass type			
OHARA	S-TIL27	HOYA	-
CDGM	H-QF3	SCHOTT	-

2022-7-1	StP, AP, SP
2019-4-1	Transmittance
2015-4-1	Color Code, Prod. Freq.

HIKARI GLASS CO., LTD.

J-F1

n_d = 1.625880 n_e = 1.630026

ν_d = 35.72 ν_e = 35.46

Glass code (d)
626357
Glass code (e)
630355

Spectral l.	Refractive idx
2.058	1.59141
1.970	1.59282
1.530	1.59944
1.129	1.60574
1.064	1.60696
t	1.60800
s	1.61214
A'	1.615109
r	1.617899
C	1.620742
C'	1.621548
He-Ne	1.622305
D	1.625727
d	1.625880
e	1.630026
F	1.638263
F'	1.639316
g	1.648579
h	1.657647
0.389	1.663446
i	–

Partial dispersion	
F-C	0.017521
F'-C'	0.017768
C-t	0.012744
C-A'	0.005633
d-C	0.005138
e-C	0.009284
g-d	0.022699
g-F	0.010316
h-g	0.009068
i-g	–
C'-t	0.013550
e-C'	0.008478
F'-e	0.009290
i-F'	–

Relative partial dispersion	
C-t／F-C	0.7274
C-A'／F-C	0.3215
d-C／F-C	0.2932
e-C／F-C	0.5299
g-d／F-C	1.2955
g-F／F-C	0.5888
h-g／F-C	0.5176
i-g／F-C	–
C'-t／F'-C'	0.7626
e-C'／F'-C'	0.4771
F'-e／F'-C'	0.5229
i-F'／F'-C'	–

Deviation of relative partial disp.	
ΔPdC	−0.0001
ΔPgF	0.0044

Internal CC (80%/5%)
383/355
Color Code (80%/5%)
395/355

CCI	
B	0.00
G	1.05
R	1.08

Thermal properties	
CTE(−30,70) [1E-7/℃]	81
CTE(100,300) [1E-7/℃]	91
Tg [℃]	576
At [℃]	616
StP [℃]	520
AP [℃]	556
SP [℃]	693
Ht cndct. [W/m·K]	1.150
Sp. heat [kJ/kg·K]	0.767
Ht diffus. [1E-6 m2/sec]	0.557

Chemical properties [class]	
Acid res. (surface)	1
Alkaline detergent res.	1
Climate resistance	1
Water res. (powder)	2
Acid res. (powder)	1

Mechanical properties	
Knoop hardness	489 (5)
Abrasion hardness	111
Young's mod. [GPa]	81.5
Shear mod. [GPa]	33.1
Poisson's ratio	0.231
Stress optical coef. [1E-5 nm/cm／Pa]	3.14

Internal trans. (10mm)	
λ [nm]	τ
280	–
290	–
300	–
310	–
320	–
330	–
340	–
350	0.01
360	0.14
370	0.46
380	0.74
390	0.88
400	0.943
420	0.982
440	0.990
460	0.993
480	0.994
500	0.996
550	0.998
600	0.998
650	0.998
700	0.998
800	0.998
900	0.997
1000	0.998
1200	0.999
1400	0.989
1600	0.988
1800	0.968
2000	0.950
2200	0.87
2400	0.83

Specific gravity
2.69

Coef. disp. form. (pwr ser.)	
A0	2.57291645E+00
A1	−1.04210510E-02
A2	−1.02025424E-04
A3	2.37163029E-02
A4	4.42698668E-04
A5	9.19547318E-05
A6	−8.93128864E-06
A7	7.90992496E-07
A8	0.00000000E+00

Relative Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90 (ref.)	2.7	2.8	3.0	3.2	3.4	3.7	3.7	3.8	4.1	4.5	5.3	5.4	6.5	7.7	8.6
60 to 80 (ref.)	2.5	2.6	2.9	3.0	3.2	3.5	3.5	3.6	3.9	4.2	5.0	5.1	6.2	7.4	8.2
40 to 60	2.3	2.4	2.6	2.8	3.0	3.2	3.3	3.3	3.6	3.9	4.7	4.8	5.8	6.9	7.7
20 to 40	2.1	2.2	2.4	2.6	2.8	3.0	3.0	3.1	3.3	3.7	4.4	4.5	5.4	6.5	7.3
0 to 20	1.9	2.0	2.2	2.4	2.6	2.8	2.8	2.9	3.1	3.4	4.1	4.2	5.1	6.1	6.8
−20 to 0	1.8	1.9	2.1	2.3	2.4	2.6	2.7	2.7	2.9	3.2	3.9	3.9	4.8	5.8	6.5
−40 to −20	1.8	1.9	2.1	2.2	2.4	2.5	2.6	2.6	2.8	3.1	3.7	3.8	4.6	5.5	6.2
−60 to −40 (ref.)	1.9	1.9	2.1	2.2	2.4	2.5	2.6	2.6	2.8	3.1	3.6	3.7	4.4	5.3	6.0
−70 to −60 (ref.)	2.0	2.0	2.2	2.3	2.5	2.6	2.7	2.7	2.9	3.1	3.7	3.7	4.4	5.3	5.9

Absolute Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90	1.7	1.8	2.0	2.2	2.4	2.7	2.7	2.8	3.1	3.5	4.3	4.4	5.4	6.7	7.6
60 to 80	1.4	1.5	1.8	2.0	2.1	2.4	2.4	2.5	2.8	3.1	3.9	4.0	5.0	6.2	7.1
40 to 60	1.1	1.1	1.4	1.6	1.8	2.0	2.0	2.1	2.3	2.7	3.4	3.5	4.5	5.6	6.4
20 to 40	0.7	0.8	1.0	1.2	1.4	1.5	1.6	1.7	1.9	2.2	2.9	3.0	3.9	5.0	5.8
0 to 20	0.4	0.4	0.6	0.8	1.0	1.1	1.2	1.2	1.5	1.8	2.4	2.5	3.4	4.4	5.1
−20 to 0	0.0	0.1	0.3	0.4	0.6	0.7	0.8	0.8	1.1	1.3	1.9	2.0	2.8	3.8	4.5
−40 to −20	−0.4	−0.3	−0.1	0.0	0.2	0.3	0.4	0.4	0.6	0.9	1.5	1.5	2.3	3.2	3.9
−60 to −40	−0.7	−0.7	−0.5	−0.4	−0.2	−0.1	0.0	0.0	0.2	0.4	1.0	1.0	1.8	2.6	3.2
−70 to −60	−1.0	−0.9	−0.8	−0.6	−0.5	−0.4	−0.3	−0.3	−0.1	0.1	0.6	0.7	1.3	2.1	2.7

Coef. disp. form. (frac. eq.)(ref.)	
P1	1.23165675E-01
Q1	8.24765904E+01
P2	1.63187357E-02
Q2	5.73814106E-02
P3	3.27670057E-01
Q3	7.43227866E-03

Fitting error of disp. form. σ [1E-6]		
	Visible	Infrared
Power ser. eq.	0.5	3.1
Frac. eq. (ref.)	1.2	5.6

Prod. Freq. (A to D)	C

Similar glass type			
OHARA	S-TIM1	HOYA	E-F1
CDGM	H-F13	SCHOTT	–

2022-7-1	StP, AP, SP
2019-4-1	Transmittance
2018-4-1	Prod. Freq.

J-F2

n_d = 1.620040 n_e = 1.624072

ν_d = 36.40 ν_e = 36.13

Glass code (d)
620364
Glass code (e)
624361

Spectral l.	Refractive idx
2.058	1.58620
1.970	1.58759
1.530	1.59416
1.129	1.60039
1.064	1.60159
t	1.60260
s	1.60665
A'	1.609544
r	1.612266
C	1.615037
C'	1.615823
He-Ne	1.616559
D	1.619891
d	1.620040
e	1.624072
F	1.632073
F'	1.633095
g	1.642086
h	1.650877
0.389	1.656494
i	1.667178

Partial dispersion	
F-C	0.017036
F'-C'	0.017272
C-t	0.012433
C-A'	0.005493
d-C	0.005003
e-C	0.009035
g-d	0.022046
g-F	0.010013
h-g	0.008791
i-g	0.025092
C'-t	0.013219
e-C'	0.008249
F'-e	0.009023
i-F'	-

Relative partial dispersion	
C-t／F-C	0.7298
C-A'／F-C	0.3224
d-C／F-C	0.2937
e-C／F-C	0.5303
g-d／F-C	1.2941
g-F／F-C	0.5878
h-g／F-C	0.5160
i-g／F-C	1.4729
C'-t／F'-C'	0.7653
e-C'／F'-C'	0.4776
F'-e／F'-C'	0.5224
i-F'／F'-C'	1.9733

Deviation of relative partial disp.	
ΔPdC	0.0000
ΔPgF	0.0045

Internal CC (80%/5%)
380/353
Color Code (80%/5%)
390/355
CCI

B	0.00
G	0.83
R	0.86

Thermal properties	
CTE(-30,70) [1E-7/℃]	73
CTE(100,300) [1E-7/℃]	91
Tg [℃]	581
At [℃]	613
StP [℃]	540
AP [℃]	571
SP [℃]	710
Ht cndct. [W/m･K]	1.180
Sp. heat [kJ/kg･K]	0.762
Ht diffus. [1E-6 m2/sec]	0.580

Chemical properties [class]	
Acid res. (surface)	1
Alkaline detergent res.	1
Climate resistance	1
Water res. (powder)	2
Acid res. (powder)	1

Mechanical properties	
Knoop hardness	493 (5)
Abrasion hardness	109
Young's mod. [GPa]	82.5
Shear mod. [GPa]	33.5
Poisson's ratio	0.231
Stress optical coef. [1E-5 nm/cm／Pa]	3.15

Internal trans. (10mm)	
λ [nm]	τ
280	-
290	-
300	-
310	-
320	-
330	-
340	-
350	0.02
360	0.19
370	0.55
380	0.81
390	0.922
400	0.962
420	0.984
440	0.988
460	0.990
480	0.992
500	0.994
550	0.997
600	0.997
650	0.997
700	0.998
800	0.997
900	0.996
1000	0.996
1200	0.997
1400	0.985
1600	0.988
1800	0.973
2000	0.957
2200	0.88
2400	0.85

Specific gravity
2.66

Coef. disp. form. (pwr ser.)	
A0	2.55848782E+00
A1	-1.11821288E-02
A2	0.00000000E+00
A3	2.03054502E-02
A4	2.04096825E-03
A5	-4.37338902E-04
A6	8.55288881E-05
A7	-7.96769390E-06
A8	3.26555576E-07

Relative Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90 (ref.)	2.4	2.5	2.7	2.9	3.1	3.3	3.4	3.5	3.8	4.1	4.9	5.0	6.1	7.3	8.1
60 to 80 (ref.)	2.3	2.4	2.6	2.8	3.0	3.2	3.3	3.3	3.6	3.9	4.7	4.8	5.9	7.0	7.8
40 to 60	2.2	2.3	2.5	2.7	2.9	3.0	3.1	3.2	3.4	3.8	4.5	4.6	5.6	6.7	7.4
20 to 40	2.1	2.2	2.4	2.6	2.7	2.9	3.0	3.0	3.3	3.6	4.3	4.4	5.3	6.3	7.0
0 to 20	2.1	2.1	2.3	2.5	2.7	2.8	2.9	2.9	3.2	3.5	4.1	4.2	5.1	6.1	6.7
-20 to 0	2.1	2.1	2.3	2.5	2.6	2.8	2.8	2.9	3.1	3.4	4.0	4.1	4.9	5.8	6.4
-40 to -20	2.1	2.2	2.3	2.5	2.7	2.8	2.9	2.9	3.1	3.4	4.0	4.0	4.8	5.7	6.2
-60 to -40 (ref.)	2.3	2.3	2.5	2.6	2.8	2.9	3.0	3.0	3.2	3.5	4.0	4.1	4.8	5.6	6.1
-70 to -60 (ref.)	2.5	2.5	2.7	2.8	2.9	3.1	3.1	3.2	3.4	3.6	4.1	4.2	4.9	5.6	6.1

Absolute Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90	1.5	1.5	1.7	1.9	2.1	2.3	2.4	2.5	2.7	3.1	3.9	4.0	5.1	6.3	7.1
60 to 80	1.3	1.3	1.5	1.7	1.9	2.1	2.2	2.2	2.5	2.8	3.6	3.7	4.7	5.9	6.7
40 to 60	1.0	1.1	1.3	1.4	1.6	1.8	1.9	1.9	2.2	2.5	3.2	3.3	4.3	5.4	6.1
20 to 40	0.8	0.8	1.0	1.2	1.3	1.5	1.6	1.6	1.9	2.2	2.8	2.9	3.9	4.9	5.6
0 to 20	0.5	0.5	0.7	0.9	1.0	1.2	1.3	1.3	1.5	1.8	2.5	2.6	3.4	4.4	5.0
-20 to 0	0.2	0.3	0.5	0.6	0.8	0.9	1.0	1.0	1.2	1.5	2.1	2.2	3.0	3.9	4.5
-40 to -20	0.0	0.0	0.2	0.3	0.5	0.6	0.7	0.7	0.9	1.2	1.7	1.8	2.6	3.4	3.9
-60 to -40	-0.3	-0.2	-0.1	0.0	0.2	0.3	0.4	0.4	0.6	0.8	1.3	1.4	2.1	2.9	3.4
-70 to -60	-0.4	-0.4	-0.3	-0.2	0.0	0.1	0.1	0.2	0.4	0.6	1.1	1.1	1.8	2.5	3.0

Coef. disp. form. (frac. eq.)(ref.)	
P1	1.04096463E-01
Q1	7.05431896E+01
P2	1.38585424E-02
Q2	5.95211317E-02
P3	3.27695044E-01
Q3	7.58005779E-03

Fitting error of disp. form. σ [1E-6]		
	Visible	Infrared
Power ser. eq.	1.0	6.2
Frac. eq. (ref.)	2.0	12.3

Prod. Freq. (A to D)	B

Similar glass type			
OHARA	S-TIM2	HOYA	E-F2
CDGM	H-F4	SCHOTT	N-F2

2022-7-1	StP, AP, SP
2019-4-1	Transmittance
2015-4-1	Color Code, Prod. Freq.

HIKARI GLASS CO., LTD.

J-F3

n_d = 1.612930 n_e = 1.616857

ν_d = 36.95 ν_e = 36.68

Glass code (d)
613370
Glass code (e)
617367

Spectral l.	Refractive idx
2.058	1.57955
1.970	1.58095
1.530	1.58751
1.129	1.59369
1.064	1.59487
t	1.59587
s	1.59986
A'	1.602690
r	1.605350
C	1.608054
C'	1.608820
He-Ne	1.609538
D	1.612785
d	1.612930
e	1.616857
F	1.624644
F'	1.625638
g	1.634371
h	1.642901
0.389	1.648344
i	–

Partial dispersion	
F-C	0.016590
F'-C'	0.016818
C-t	0.012185
C-A'	0.005364
d-C	0.004876
e-C	0.008803
g-d	0.021441
g-F	0.009727
h-g	0.008530
i-g	–
C'-t	0.012951
e-C'	0.008037
F'-e	0.008781
i-F'	–

Internal CC (80%/5%)
384/354
Color Code (80%/5%)
395/355
CCI

B	0.00
G	1.39
R	1.40

Internal trans. (10mm)	
λ [nm]	τ
280	–
290	–
300	–
310	–
320	–
330	–
340	–
350	0.01
360	0.15
370	0.46
380	0.73
390	0.87
400	0.933
420	0.971
440	0.980
460	0.984
480	0.987
500	0.991
550	0.996
600	0.996
650	0.995
700	0.997
800	0.997
900	0.996
1000	0.996
1200	0.996
1400	0.987
1600	0.989
1800	0.978
2000	0.967
2200	0.912
2400	0.89

Relative partial dispersion	
C-t／F-C	0.7345
C-A'／F-C	0.3233
d-C／F-C	0.2939
e-C／F-C	0.5306
g-d／F-C	1.2924
g-F／F-C	0.5863
h-g／F-C	0.5142
i-g／F-C	–
C'-t／F'-C'	0.7701
e-C'／F'-C'	0.4779
F'-e／F'-C'	0.5221
i-F'／F'-C'	–

Thermal properties	
CTE(-30,70) [1E-7/℃]	74
CTE(100,300) [1E-7/℃]	89
Tg [℃]	588
At [℃]	631
StP [℃]	526
AP [℃]	564
SP [℃]	711
Ht cndct. [W/m·K]	1.064
Sp. heat [kJ/kg·K]	0.748
Ht diffus. [1E-6 m2/sec]	0.539

Chemical properties [class]	
Acid res. (surface)	1
Alkaline detergent res.	1
Climate resistance	1
Water res. (powder)	1
Acid res. (powder)	1

Specific gravity
2.64

Coef. disp. form. (pwr ser.)	
A0	2.53547360E+00
A1	-1.04298990E-02
A2	-9.00763853E-05
A3	2.22719327E-02
A4	4.43442601E-04
A5	7.40581279E-05
A6	-6.90525545E-06
A7	6.52621989E-07
A8	0.00000000E+00

Deviation of relative partial disp.	
ΔPdC	0.0000
ΔPgF	0.0040

Mechanical properties	
Knoop hardness	509 (5)
Abrasion hardness	100
Young's mod. [GPa]	80.6
Shear mod. [GPa]	33.0
Poisson's ratio	0.221
Stress optical coef. [1E-5 nm/cm／Pa]	3.13

Relative Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90 (ref.)	2.8	2.8	3.0	3.2	3.4	3.6	3.7	3.7	4.0	4.4	5.1	5.2	6.2	7.3	8.1
60 to 80 (ref.)	2.7	2.7	2.9	3.1	3.3	3.4	3.5	3.6	3.8	4.2	4.9	5.0	6.0	7.0	7.8
40 to 60	2.5	2.6	2.8	2.9	3.1	3.3	3.3	3.4	3.6	4.0	4.7	4.8	5.7	6.7	7.4
20 to 40	2.4	2.4	2.6	2.8	2.9	3.1	3.2	3.2	3.4	3.8	4.4	4.5	5.4	6.4	7.1
0 to 20	2.3	2.4	2.5	2.7	2.8	3.0	3.0	3.1	3.3	3.6	4.2	4.3	5.1	6.1	6.7
-20 to 0	2.3	2.3	2.5	2.6	2.8	2.9	3.0	3.0	3.2	3.5	4.1	4.2	5.0	5.8	6.5
-40 to -20	2.3	2.4	2.5	2.6	2.8	2.9	2.9	3.0	3.2	3.5	4.0	4.1	4.8	5.7	6.3
-60 to -40 (ref.)	2.4	2.5	2.6	2.7	2.8	3.0	3.0	3.1	3.3	3.5	4.1	4.1	4.8	5.6	6.2
-70 to -60 (ref.)	2.6	2.6	2.8	2.9	3.0	3.1	3.2	3.2	3.4	3.6	4.1	4.2	4.9	5.6	6.2

Absolute Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90	1.8	1.9	2.1	2.2	2.4	2.6	2.7	2.7	3.0	3.3	4.1	4.2	5.2	6.3	7.1
60 to 80	1.6	1.6	1.8	2.0	2.2	2.4	2.4	2.5	2.7	3.1	3.8	3.9	4.8	5.9	6.7
40 to 60	1.3	1.4	1.5	1.7	1.9	2.0	2.1	2.1	2.4	2.7	3.4	3.5	4.4	5.4	6.1
20 to 40	1.0	1.1	1.2	1.4	1.5	1.7	1.8	1.8	2.0	2.3	3.0	3.1	3.9	4.9	5.6
0 to 20	0.7	0.8	0.9	1.1	1.2	1.4	1.4	1.5	1.7	2.0	2.6	2.7	3.5	4.4	5.1
-20 to 0	0.4	0.5	0.6	0.8	0.9	1.0	1.1	1.1	1.4	1.6	2.2	2.3	3.0	3.9	4.5
-40 to -20	0.2	0.2	0.3	0.5	0.6	0.7	0.8	0.8	1.0	1.3	1.8	1.9	2.6	3.4	4.0
-60 to -40	-0.1	-0.1	0.0	0.2	0.3	0.4	0.4	0.5	0.7	0.9	1.4	1.5	2.1	2.9	3.4
-70 to -60	-0.3	-0.3	-0.2	-0.1	0.0	0.1	0.2	0.2	0.4	0.6	1.1	1.2	1.8	2.5	3.0

Coef. disp. form. (frac. eq.)(ref.)	
P1	1.34356723E-01
Q1	8.86091303E+01
P2	1.55524745E-02
Q2	5.69109653E-02
P3	3.23009944E-01
Q3	7.25932793E-03

Fitting error of disp. form. σ [1E-6]		
	Visible	Infrared
Power ser. eq.	0.6	3.5
Frac. eq. (ref.)	1.1	5.5

Prod. Freq. (A to D)	D

Similar glass type			
OHARA	S-TIM3	HOYA	E-F3
CDGM	H-F2	SCHOTT	–

2022-7-1	StP, AP, SP
2019-4-1	Transmittance
2018-4-1	Prod. Freq.

HIKARI GLASS CO., LTD.

J-F5

n_d = 1.603420 n_e = 1.607179

ν_d = 38.03 ν_e = 37.76

Glass code (d)
603380
Glass code (e)
607378

Spectral l.	Refractive idx
2.058	1.57152
1.970	1.57286
1.530	1.57909
1.129	1.58497
1.064	1.58610
t	1.58706
s	1.59088
A'	1.593601
r	1.596154
C	1.598747
C'	1.599482
He-Ne	1.600170
D	1.603281
d	1.603420
e	1.607179
F	1.614615
F'	1.615562
g	1.623865
h	1.631934
0.389	1.637063
i	1.646748

Partial dispersion	
F-C	0.015868
F'-C'	0.016080
C-t	0.011688
C-A'	0.005146
d-C	0.004673
e-C	0.008432
g-d	0.020445
g-F	0.009250
h-g	0.008069
i-g	0.022883
C'-t	0.012423
e-C'	0.007697
F'-e	0.008383
i-F'	0.031186

Internal CC (80%/5%)
378/352
Color Code (80%/5%)
385/350

CCI	
B	0.00
G	0.77
R	0.76

Internal trans. (10mm)	
λ [nm]	τ
280	–
290	–
300	–
310	–
320	–
330	–
340	–
350	0.03
360	0.24
370	0.60
380	0.83
390	0.927
400	0.964
420	0.985
440	0.990
460	0.992
480	0.994
500	0.995
550	0.997
600	0.997
650	0.997
700	0.998
800	0.998
900	0.999
1000	0.999
1200	0.998
1400	0.992
1600	0.991
1800	0.973
2000	0.950
2200	0.88
2400	0.86

Thermal properties	
CTE(-30,70) [1E-7/℃]	77
CTE(100,300) [1E-7/℃]	92
Tg [℃]	583
At [℃]	624
StP [℃]	528
AP [℃]	565
SP [℃]	714
Ht cndct. [W/m·K]	1.085
Sp. heat [kJ/kg·K]	0.751
Ht diffus. [1E-6 m2/sec]	0.547

Relative partial dispersion	
C-t／F-C	0.7366
C-A'／F-C	0.3243
d-C／F-C	0.2945
e-C／F-C	0.5314
g-d／F-C	1.2884
g-F／F-C	0.5829
h-g／F-C	0.5085
i-g／F-C	1.4421
C'-t／F'-C'	0.7726
e-C'／F'-C'	0.4787
F'-e／F'-C'	0.5213
i-F'／F'-C'	1.9394

Chemical properties [class]	
Acid res. (surface)	1
Alkaline detergent res.	1
Climate resistance	1
Water res. (powder)	3
Acid res. (powder)	1

Coef. disp. form. (pwr ser.)	
A0	2.50730433E+00
A1	-9.63920240E-03
A2	-1.08925344E-04
A3	2.17730330E-02
A4	2.15713900E-04
A5	1.15184205E-04
A6	-1.21949895E-05
A7	8.47741632E-07
A8	0.00000000E+00

Deviation of relative partial disp.	
ΔPdC	0.0001
ΔPgF	0.0024

Mechanical properties	
Knoop hardness	485 (5)
Abrasion hardness	103
Young's mod. [GPa]	77.2
Shear mod. [GPa]	31.4
Poisson's ratio	0.227
Stress optical coef. [1E-5 nm/cm／Pa]	3.09

Specific gravity
2.63

Relative Δn/ΔT [1E-6/℃]															
Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90 (ref.)	2.4	2.4	2.6	2.9	3.1	3.3	3.3	3.4	3.7	4.0	4.7	4.8	5.7	6.8	7.4
60 to 80 (ref.)	2.3	2.3	2.6	2.7	2.9	3.1	3.2	3.3	3.5	3.8	4.5	4.6	5.5	6.5	7.1
40 to 60	2.2	2.2	2.4	2.6	2.8	3.0	3.0	3.1	3.3	3.6	4.3	4.4	5.3	6.2	6.8
20 to 40	2.1	2.1	2.3	2.5	2.7	2.9	2.9	3.0	3.2	3.5	4.1	4.2	5.0	6.0	6.5
0 to 20	2.0	2.1	2.2	2.4	2.6	2.8	2.8	2.9	3.1	3.3	3.9	4.0	4.9	5.7	6.3
-20 to 0	2.0	2.0	2.2	2.4	2.6	2.7	2.8	2.8	3.0	3.3	3.8	3.9	4.7	5.5	6.0
-40 to -20	2.1	2.1	2.3	2.4	2.6	2.8	2.8	2.8	3.0	3.3	3.8	3.9	4.6	5.4	5.9
-60 to -40 (ref.)	2.2	2.2	2.4	2.6	2.7	2.9	2.9	3.0	3.1	3.4	3.9	3.9	4.7	5.4	5.9
-70 to -60 (ref.)	2.4	2.4	2.6	2.7	2.9	3.0	3.1	3.1	3.3	3.5	4.0	4.1	4.8	5.5	5.9

Absolute Δn/ΔT [1E-6/℃]															
Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90	1.4	1.5	1.7	1.9	2.1	2.3	2.3	2.4	2.7	3.0	3.6	3.7	4.7	5.7	6.4
60 to 80	1.3	1.3	1.5	1.7	1.9	2.1	2.1	2.2	2.4	2.7	3.4	3.5	4.4	5.4	6.0
40 to 60	1.0	1.0	1.2	1.4	1.6	1.8	1.8	1.9	2.1	2.4	3.0	3.1	4.0	5.0	5.5
20 to 40	0.7	0.7	0.9	1.1	1.3	1.5	1.5	1.6	1.8	2.1	2.7	2.8	3.6	4.5	5.1
0 to 20	0.5	0.5	0.7	0.8	1.0	1.2	1.2	1.3	1.5	1.7	2.3	2.4	3.2	4.1	4.6
-20 to 0	0.2	0.2	0.4	0.6	0.7	0.9	0.9	1.0	1.2	1.4	2.0	2.0	2.8	3.6	4.1
-40 to -20	0.0	0.0	0.1	0.3	0.4	0.6	0.6	0.7	0.9	1.1	1.6	1.7	2.4	3.2	3.6
-60 to -40	-0.3	-0.3	-0.2	0.0	0.1	0.3	0.3	0.4	0.6	0.8	1.2	1.3	2.0	2.7	3.2
-70 to -60	-0.5	-0.5	-0.4	-0.2	-0.1	0.1	0.1	0.2	0.3	0.5	1.0	1.0	1.7	2.4	2.8

Coef. disp. form. (frac. eq.)(ref.)	
P1	1.03312268E-01
Q1	7.25877221E+01
P2	1.31044204E-02
Q2	5.75938132E-02
P3	3.21354498E-01
Q3	7.45537642E-03

Fitting error of disp. form. σ [1E-6]		
	Visible	Infrared
Power ser. eq.	0.6	4.5
Frac. eq. (ref.)	2.1	10.6

Prod. Freq. (A to D)	B

Similar glass type			
OHARA	S-TIM5	HOYA	E-F5
CDGM	H-F1	SCHOTT	–

2023-9-1	Prod. Freq.
2022-7-1	StP, AP, SP
2019-4-1	Transmittance

HIKARI GLASS CO., LTD.

J-F8

n_d = 1.595510 n_e = 1.599109

ν_d = 39.21 ν_e = 38.94

Glass code (d)
596392
Glass code (e)
599389

Spectral l.	Refractive idx
2.058	1.56450
1.970	1.56581
1.530	1.57196
1.129	1.57773
1.064	1.57884
t	1.57977
s	1.58346
A'	1.586081
r	1.588536
C	1.591028
C'	1.591733
He-Ne	1.592393
D	1.595377
d	1.595510
e	1.599109
F	1.606214
F'	1.607118
g	1.615031
h	1.622705
0.389	1.627568
i	–

Partial dispersion	
F-C	0.015186
F'-C'	0.015385
C-t	0.011262
C-A'	0.004947
d-C	0.004482
e-C	0.008081
g-d	0.019521
g-F	0.008817
h-g	0.007674
i-g	–
C'-t	0.011967
e-C'	0.007376
F'-e	0.008009
i-F'	–

Relative partial dispersion	
C-t／F-C	0.7416
C-A'／F-C	0.3258
d-C／F-C	0.2951
e-C／F-C	0.5321
g-d／F-C	1.2855
g-F／F-C	0.5806
h-g／F-C	0.5053
i-g／F-C	–
C'-t／F'-C'	0.7778
e-C'／F'-C'	0.4794
F'-e／F'-C'	0.5206
i-F'／F'-C'	–

Deviation of relative partial disp.	
ΔPdC	0.0002
ΔPgF	0.0020

Internal CC (80%/5%)
377/350
Color Code (80%/5%)
385/350

CCI	
B	0.00
G	0.72
R	0.73

Thermal properties	
CTE(-30,70) [1E-7/℃]	78
CTE(100,300) [1E-7/℃]	91
Tg [℃]	580
At [℃]	627
StP [℃]	–
AP [℃]	–
SP [℃]	–
Ht cndct. [W/m･K]	1.070
Sp. heat [kJ/kg･K]	0.732
Ht diffus. [1E-6 m2/sec]	0.556

Chemical properties [class]	
Acid res. (surface)	1
Alkaline detergent res.	1
Climate resistance	1
Water res. (powder)	2
Acid res. (powder)	1

Mechanical properties	
Knoop hardness	483 (5)
Abrasion hardness	112
Young's mod. [GPa]	77.3
Shear mod. [GPa]	31.4
Poisson's ratio	0.231
Stress optical coef. [1E-5 nm/cm／Pa]	3.07

Internal trans. (10mm)	
λ [nm]	τ
280	–
290	–
300	–
310	–
320	–
330	–
340	–
350	0.05
360	0.29
370	0.64
380	0.85
390	0.933
400	0.966
420	0.985
440	0.990
460	0.992
480	0.994
500	0.995
550	0.997
600	0.998
650	0.997
700	0.999
800	0.998
900	0.996
1000	0.995
1200	0.993
1400	0.987
1600	0.986
1800	0.972
2000	0.954
2200	0.89
2400	0.88

Specific gravity
2.63

Coef. disp. form. (pwr ser.)	
A0	2.48625113E+00
A1	-1.00589301E-02
A2	-3.66798847E-05
A3	1.96315837E-02
A4	7.63732181E-04
A5	-3.17124943E-05
A6	5.33168997E-06
A7	0.00000000E+00
A8	0.00000000E+00

Relative Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90 (ref.)	2.3	2.3	2.5	2.7	2.9	3.1	3.1	3.2	3.5	3.8	4.4	4.5	5.4	6.4	7.0
60 to 80 (ref.)	2.2	2.2	2.4	2.6	2.8	3.0	3.0	3.1	3.3	3.6	4.3	4.4	5.2	6.1	6.8
40 to 60	2.1	2.1	2.3	2.5	2.6	2.8	2.9	2.9	3.2	3.4	4.1	4.2	5.0	5.8	6.4
20 to 40	2.0	2.0	2.2	2.4	2.5	2.7	2.7	2.8	3.0	3.3	3.9	4.0	4.7	5.6	6.2
0 to 20	1.9	2.0	2.1	2.3	2.4	2.6	2.7	2.7	2.9	3.2	3.8	3.8	4.6	5.4	5.9
-20 to 0	1.9	2.0	2.1	2.3	2.4	2.6	2.6	2.7	2.9	3.1	3.7	3.7	4.4	5.2	5.7
-40 to -20	2.0	2.0	2.2	2.3	2.5	2.6	2.7	2.7	2.9	3.1	3.6	3.7	4.4	5.1	5.6
-60 to -40 (ref.)	2.2	2.2	2.3	2.5	2.6	2.7	2.8	2.8	3.0	3.2	3.7	3.8	4.4	5.1	5.6
-70 to -60 (ref.)	2.3	2.4	2.5	2.6	2.8	2.9	2.9	3.0	3.2	3.4	3.8	3.9	4.5	5.2	5.6

Absolute Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90	1.3	1.4	1.5	1.7	1.9	2.1	2.1	2.2	2.5	2.8	3.4	3.5	4.4	5.3	6.0
60 to 80	1.1	1.2	1.3	1.5	1.7	1.9	1.9	2.0	2.2	2.5	3.2	3.3	4.1	5.0	5.6
40 to 60	0.9	0.9	1.1	1.2	1.4	1.6	1.6	1.7	1.9	2.2	2.8	2.9	3.7	4.6	5.2
20 to 40	0.6	0.7	0.8	1.0	1.1	1.3	1.4	1.4	1.6	1.9	2.5	2.6	3.3	4.1	4.7
0 to 20	0.4	0.4	0.6	0.7	0.9	1.0	1.1	1.1	1.3	1.6	2.1	2.2	2.9	3.7	4.2
-20 to 0	0.1	0.2	0.3	0.4	0.6	0.7	0.8	0.8	1.0	1.3	1.8	1.9	2.5	3.3	3.8
-40 to -20	-0.1	-0.1	0.0	0.2	0.3	0.5	0.5	0.5	0.7	1.0	1.4	1.5	2.1	2.8	3.3
-60 to -40	-0.4	-0.3	-0.2	-0.1	0.0	0.2	0.2	0.2	0.4	0.6	1.1	1.2	1.8	2.4	2.9
-70 to -60	-0.6	-0.5	-0.4	-0.3	-0.2	0.0	0.0	0.0	0.2	0.4	0.8	0.9	1.5	2.1	2.5

Coef. disp. form. (frac. eq.)(ref.)	
P1	1.23388650E-01
Q1	8.57201552E+01
P2	1.44977538E-02
Q2	5.45737083E-02
P3	3.16679170E-01
Q3	7.07804359E-03

Fitting error of disp. form. σ [1E-6]		
	Visible	Infrared
Power ser. eq.	0.9	6.0
Frac. eq. (ref.)	0.9	5.5

Prod. Freq. (A to D)	C

Similar glass type			
OHARA	S-TIM8	HOYA	E-F8
CDGM	H-QF14	SCHOTT	–

2019-4-1	Transmittance
2018-4-1	Prod. Freq.
2015-4-1	Color Code, Similar glass type

HIKARI GLASS CO., LTD.

J-F16

n_d = 1.592700 n_e = 1.596673

ν_d = 35.27 ν_e = 35.00

Glass code (d)
593353
Glass code (e)
597350

Spectral l.	Refractive idx
2.058	1.56023
1.970	1.56153
1.530	1.56767
1.129	1.57358
1.064	1.57472
t	1.57570
s	1.57961
A'	1.582422
r	1.585077
C	1.587788
C'	1.588558
He-Ne	1.589281
D	1.592554
d	1.592700
e	1.596673
F	1.604592
F'	1.605607
g	1.614567
h	1.623384
0.389	1.629044
i	1.639866

Coef. disp. form. (pwr ser.)	
A0	2.47262695E+00
A1	-1.01687674E-02
A2	0.00000000E+00
A3	1.97436840E-02
A4	1.81579852E-03
A5	-3.58960460E-04
A6	7.21398135E-05
A7	-6.71121675E-06
A8	2.80287467E-07

Partial dispersion	
F-C	0.016804
F'-C'	0.017049
C-t	0.012091
C-A'	0.005366
d-C	0.004912
e-C	0.008885
g-d	0.021867
g-F	0.009975
h-g	0.008817
i-g	0.025299
C'-t	0.012861
e-C'	0.008115
F'-e	0.008934
i-F'	0.034259

Relative partial dispersion	
C-t／F-C	0.7195
C-A'／F-C	0.3193
d-C／F-C	0.2923
e-C／F-C	0.5287
g-d／F-C	1.3013
g-F／F-C	0.5936
h-g／F-C	0.5247
i-g／F-C	1.5055
C'-t／F'-C'	0.7544
e-C'／F'-C'	0.4760
F'-e／F'-C'	0.5240
i-F'／F'-C'	2.0094

Deviation of relative partial disp.	
ΔPdC	-0.0008
ΔPgF	0.0084

Internal CC (80%/5%)
371/347
Color Code (80%/5%)
380/350
CCI

B	0.00
G	0.59
R	0.58

Thermal properties	
CTE(-30,70) [1E-7/℃]	86
CTE(100,300) [1E-7/℃]	99
Tg [℃]	494
At [℃]	553
StP [℃]	443
AP [℃]	481
SP [℃]	632
Ht cndct. [W/m･K]	0.968
Sp. heat [kJ/kg･K]	0.721
Ht diffus. [1E-6 m2/sec]	0.509

Chemical properties [class]	
Acid res. (surface)	1
Alkaline detergent res.	1
Climate resistance	1
Water res. (powder)	1
Acid res. (powder)	1

Mechanical properties	
Knoop hardness	419 (4)
Abrasion hardness	154
Young's mod. [GPa]	64.2
Shear mod. [GPa]	25.8
Poisson's ratio	0.245
Stress optical coef. [1E-5 nm/cm／Pa]	3.22

Internal trans. (10mm)	
λ [nm]	τ
280	-
290	-
300	-
310	-
320	-
330	-
340	-
350	0.10
360	0.43
370	0.77
380	0.913
390	0.961
400	0.977
420	0.986
440	0.987
460	0.990
480	0.992
500	0.994
550	0.997
600	0.998
650	0.996
700	0.997
800	0.996
900	0.996
1000	0.997
1200	0.998
1400	0.994
1600	0.988
1800	0.980
2000	0.980
2200	0.945
2400	0.940

Specific gravity
2.64

Relative Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90 (ref.)	-0.5	-0.4	-0.3	-0.1	0.1	0.3	0.4	0.4	0.7	1.0	1.8	1.9	2.9	4.0	4.8
60 to 80 (ref.)	-0.6	-0.5	-0.3	-0.2	0.0	0.2	0.3	0.3	0.6	0.9	1.6	1.7	2.7	3.8	4.5
40 to 60	-0.7	-0.7	-0.5	-0.3	-0.1	0.1	0.1	0.2	0.4	0.7	1.4	1.5	2.4	3.5	4.2
20 to 40	-0.8	-0.7	-0.6	-0.4	-0.2	-0.1	0.0	0.0	0.3	0.6	1.2	1.3	2.2	3.2	3.9
0 to 20	-0.8	-0.8	-0.6	-0.5	-0.3	-0.2	-0.1	-0.1	0.2	0.4	1.1	1.2	2.0	3.0	3.6
-20 to 0	-0.8	-0.8	-0.6	-0.5	-0.3	-0.2	-0.1	-0.1	0.1	0.4	1.0	1.1	1.9	2.8	3.4
-40 to -20	-0.8	-0.7	-0.6	-0.5	-0.3	-0.2	-0.1	-0.1	0.1	0.4	0.9	1.0	1.8	2.7	3.3
-60 to -40 (ref.)	-0.6	-0.6	-0.5	-0.3	-0.2	0.0	0.0	0.0	0.2	0.5	1.0	1.1	1.8	2.7	3.2
-70 to -60 (ref.)	-0.4	-0.4	-0.3	-0.1	0.0	0.1	0.2	0.2	0.4	0.6	1.1	1.2	1.9	2.7	3.3

Absolute Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90	-1.4	-1.4	-1.2	-1.0	-0.9	-0.7	-0.6	-0.5	-0.3	0.0	0.8	0.9	1.9	3.0	3.8
60 to 80	-1.6	-1.6	-1.4	-1.2	-1.1	-0.9	-0.8	-0.8	-0.5	-0.2	0.5	0.6	1.6	2.7	3.4
40 to 60	-1.9	-1.8	-1.7	-1.5	-1.3	-1.2	-1.1	-1.1	-0.8	-0.5	0.2	0.2	1.2	2.2	2.9
20 to 40	-2.1	-2.1	-1.9	-1.8	-1.6	-1.4	-1.4	-1.4	-1.1	-0.8	-0.2	-0.1	0.8	1.8	2.4
0 to 20	-2.4	-2.3	-2.2	-2.0	-1.9	-1.7	-1.7	-1.6	-1.4	-1.2	-0.5	-0.5	0.4	1.3	2.0
-20 to 0	-2.6	-2.6	-2.5	-2.3	-2.2	-2.0	-2.0	-1.9	-1.7	-1.5	-0.9	-0.8	0.0	0.9	1.5
-40 to -20	-2.9	-2.9	-2.7	-2.6	-2.5	-2.3	-2.3	-2.2	-2.0	-1.8	-1.3	-1.2	-0.4	0.4	1.0
-60 to -40	-3.1	-3.1	-3.0	-2.9	-2.7	-2.6	-2.6	-2.5	-2.3	-2.1	-1.6	-1.5	-0.8	0.0	0.5
-70 to -60	-3.3	-3.3	-3.2	-3.1	-2.9	-2.8	-2.8	-2.7	-2.6	-2.4	-1.9	-1.8	-1.1	-0.4	0.2

Coef. disp. form. (frac. eq.)(ref.)	
P1	9.48272387E-02
Q1	6.81020799E+01
P2	1.61938727E-02
Q2	5.90567549E-02
P3	3.12759244E-01
Q3	7.46626033E-03

Fitting error of disp. form. σ [1E-6]		
	Visible	Infrared
Power ser. eq.	0.8	8.0
Frac. eq. (ref.)	2.0	15.3

Prod. Freq. (A to D)	D

Similar glass type			
OHARA	S-FTM16	HOYA	FF5
CDGM	-	SCHOTT	-

2022-7-1	StP, AP, SP
2019-4-1	Transmittance
2018-4-1	Prod. Freq.

J-SF1

n_d = 1.717360 n_e = 1.723086

ν_d = 29.57 ν_e = 29.34

Glass code (d)
717296
Glass code (e)
723293

Spectral l.	Refractive idx
2.058	1.67538
1.970	1.67679
1.530	1.68368
1.129	1.69085
1.064	1.69233
t	1.69361
s	1.69888
A'	1.702770
r	1.706496
C	1.710337
C'	1.711433
He-Ne	1.712463
D	1.717150
d	1.717360
e	1.723086
F	1.734595
F'	1.736078
g	1.749237
h	1.762313
0.389	1.770782
i	–

Partial dispersion	
F-C	0.024258
F'-C'	0.024645
C-t	0.016731
C-A'	0.007567
d-C	0.007023
e-C	0.012749
g-d	0.031877
g-F	0.014642
h-g	0.013076
i-g	–
C'-t	0.017827
e-C'	0.011653
F'-e	0.012992
i-F'	–

Relative partial dispersion	
C-t／F-C	0.6897
C-A'／F-C	0.3119
d-C／F-C	0.2895
e-C／F-C	0.5256
g-d／F-C	1.3141
g-F／F-C	0.6036
h-g／F-C	0.5390
i-g／F-C	–
C'-t／F'-C'	0.7234
e-C'／F'-C'	0.4728
F'-e／F'-C'	0.5272
i-F'／F'-C'	–

Deviation of relative partial disp.	
ΔPdC	−0.0010
ΔPgF	0.0089

Internal CC (80%/5%)
393/360
Color Code (80%/5%)
415/360

CCI	
B	0.00
G	2.59
R	2.65

Thermal properties	
CTE(−30,70) [1E-7/℃]	93
CTE(100,300) [1E-7/℃]	109
Tg [℃]	587
At [℃]	620
StP [℃]	536
AP [℃]	569
SP [℃]	689
Ht cndct. [W/m·K]	1.098
Sp. heat [kJ/kg·K]	0.720
Ht diffus. [1E-6 m2/sec]	0.493

Chemical properties [class]	
Acid res. (surface)	1
Alkaline detergent res.	1
Climate resistance	1
Water res. (powder)	1
Acid res. (powder)	1

Mechanical properties	
Knoop hardness	496 (5)
Abrasion hardness	194
Young's mod. [GPa]	87.5
Shear mod. [GPa]	34.9
Poisson's ratio	0.255
Stress optical coef. [1E-5 nm/cm／Pa]	2.78

Internal trans. (10mm)	
λ [nm]	τ
280	–
290	–
300	–
310	–
320	–
330	–
340	–
350	–
360	0.05
370	0.26
380	0.56
390	0.77
400	0.87
420	0.940
440	0.965
460	0.976
480	0.983
500	0.988
550	0.995
600	0.996
650	0.996
700	0.997
800	0.995
900	0.993
1000	0.994
1200	0.995
1400	0.994
1600	0.987
1800	0.966
2000	0.950
2200	0.905
2400	0.86

Specific gravity
3.07

Coef. disp. form. (pwr ser.)	
A0	2.84777930E+00
A1	−1.14171302E-02
A2	0.00000000E+00
A3	3.10426999E-02
A4	2.54456183E-03
A5	−4.60296278E-04
A6	1.02222014E-04
A7	−1.01220546E-05
A8	4.62539051E-07

Relative Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90 (ref.)	0.4	0.6	0.8	1.1	1.3	1.5	1.6	1.7	2.1	2.6	3.7	3.9	5.4	7.1	8.5
60 to 80 (ref.)	0.3	0.5	0.8	0.9	1.1	1.4	1.5	1.5	1.9	2.4	3.5	3.7	5.2	6.8	8.1
40 to 60	0.2	0.4	0.6	0.8	1.0	1.2	1.3	1.4	1.8	2.2	3.3	3.5	4.9	6.5	7.7
20 to 40	0.2	0.3	0.6	0.7	0.9	1.1	1.2	1.3	1.6	2.1	3.1	3.3	4.6	6.1	7.3
0 to 20	0.1	0.3	0.5	0.7	0.8	1.1	1.1	1.2	1.5	2.0	3.0	3.1	4.4	5.8	6.9
−20 to 0	0.2	0.3	0.5	0.7	0.8	1.0	1.1	1.2	1.5	1.9	2.9	3.0	4.2	5.6	6.6
−40 to −20	0.3	0.4	0.6	0.7	0.9	1.1	1.1	1.2	1.5	1.9	2.8	2.9	4.1	5.4	6.4
−60 to −40 (ref.)	0.4	0.5	0.8	0.9	1.0	1.2	1.3	1.3	1.6	2.0	2.9	3.0	4.1	5.3	6.3
−70 to −60 (ref.)	0.7	0.8	1.0	1.1	1.2	1.4	1.5	1.5	1.8	2.2	3.0	3.1	4.2	5.4	6.3

Absolute Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90	−0.6	−0.5	−0.2	0.0	0.2	0.5	0.5	0.6	1.0	1.5	2.6	2.8	4.3	6.0	7.3
60 to 80	−0.8	−0.7	−0.4	−0.2	0.0	0.2	0.3	0.4	0.8	1.2	2.4	2.5	3.9	5.6	6.9
40 to 60	−1.0	−0.9	−0.7	−0.5	−0.3	−0.1	0.0	0.1	0.4	0.9	2.0	2.1	3.5	5.1	6.3
20 to 40	−1.3	−1.2	−0.9	−0.8	−0.6	−0.4	−0.3	−0.2	0.1	0.6	1.6	1.7	3.0	4.6	5.7
0 to 20	−1.5	−1.4	−1.2	−1.0	−0.9	−0.6	−0.6	−0.5	−0.2	0.2	1.2	1.3	2.6	4.0	5.1
−20 to 0	−1.8	−1.7	−1.4	−1.3	−1.1	−0.9	−0.9	−0.8	−0.5	−0.1	0.8	1.0	2.1	3.5	4.5
−40 to −20	−2.0	−1.9	−1.7	−1.6	−1.4	−1.2	−1.2	−1.1	−0.8	−0.4	0.4	0.6	1.7	3.0	3.9
−60 to −40	−2.3	−2.2	−2.0	−1.8	−1.7	−1.5	−1.5	−1.4	−1.1	−0.8	0.1	0.2	1.2	2.4	3.4
−70 to −60	−2.5	−2.3	−2.2	−2.0	−1.9	−1.7	−1.7	−1.6	−1.4	−1.0	−0.2	−0.1	0.9	2.0	2.9

Coef. disp. form. (frac. eq.)(ref.)	
P1	1.09129972E-01
Q1	8.10331506E+01
P2	2.10593358E-02
Q2	6.04288183E-02
P3	3.59828783E-01
Q3	8.39419828E-03

Fitting error of disp. form. σ [1E-6]		
	Visible	Infrared
Power ser. eq.	0.9	4.1
Frac. eq. (ref.)	1.8	8.6

Prod. Freq. (A to D)	B

Similar glass type			
OHARA	S-TIH1	HOYA	E-FD1、E-FD1L
CDGM	H-ZF3	SCHOTT	N-SF1

2022-7-1	StP, AP, SP
2020-4-1	Similar glass type
2019-4-1	Transmittance

HIKARI GLASS CO., LTD.

J-SF2

n_d = 1.647690 n_e = 1.652232

ν_d = 33.73 ν_e = 33.47

Glass code (d)
648337
Glass code (e)
652335

Spectral l.	Refractive idx
2.058	1.61216
1.970	1.61348
1.530	1.61980
1.129	1.62610
1.064	1.62736
t	1.62843
s	1.63280
A'	1.635977
r	1.638993
C	1.642082
C'	1.642960
He-Ne	1.643784
D	1.647523
d	1.647690
e	1.652232
F	1.661287
F'	1.662448
g	1.672677
h	1.682722
0.389	1.689162
i	–

Partial dispersion	
F-C	0.019205
F'-C'	0.019488
C-t	0.013654
C-A'	0.006105
d-C	0.005608
e-C	0.010150
g-d	0.024987
g-F	0.011390
h-g	0.010045
i-g	–
C'-t	0.014532
e-C'	0.009272
F'-e	0.010216
i-F'	–

Relative partial dispersion	
C-t／F-C	0.7110
C-A'／F-C	0.3179
d-C／F-C	0.2920
e-C／F-C	0.5285
g-d／F-C	1.3011
g-F／F-C	0.5931
h-g／F-C	0.5230
i-g／F-C	–
C'-t／F'-C'	0.7457
e-C'／F'-C'	0.4758
F'-e／F'-C'	0.5242
i-F'／F'-C'	–

Deviation of relative partial disp.	
ΔPdC	−0.0004
ΔPgF	0.0053

Internal CC (80%/5%)
382/354
Color Code (80%/5%)
390/355

CCI	
B	0.00
G	1.03
R	1.02

Thermal properties	
CTE(−30,70) [1E-7/℃]	90
CTE(100,300) [1E-7/℃]	117
Tg [℃]	540
At [℃]	577
StP [℃]	473
AP [℃]	509
SP [℃]	641
Ht cndct. [W/m·K]	1.002
Sp. heat [kJ/kg·K]	0.742
Ht diffus. [1E-6 m2/sec]	0.495

Chemical properties [class]	
Acid res. (surface)	1
Alkaline detergent res.	1
Climate resistance	1
Water res. (powder)	2
Acid res. (powder)	1

Mechanical properties	
Knoop hardness	490 (5)
Abrasion hardness	151
Young's mod. [GPa]	80.5
Shear mod. [GPa]	32.3
Poisson's ratio	0.247
Stress optical coef. [1E-5 nm/cm／Pa]	2.70

Internal trans. (10mm)	
λ [nm]	τ
280	–
290	–
300	–
310	–
320	–
330	–
340	–
350	0.01
360	0.16
370	0.49
380	0.77
390	0.900
400	0.952
420	0.981
440	0.987
460	0.990
480	0.993
500	0.994
550	0.998
600	0.998
650	0.997
700	0.997
800	0.997
900	0.996
1000	0.997
1200	0.998
1400	0.996
1600	0.989
1800	0.967
2000	0.947
2200	0.89
2400	0.85

Specific gravity
2.72

Coef. disp. form. (pwr ser.)	
A0	2.63768374E+00
A1	−1.04781511E-02
A2	0.00000000E+00
A3	2.39749005E-02
A4	1.92856512E-03
A5	−3.66733662E-04
A6	7.71499779E-05
A7	−7.46498850E-06
A8	3.25251898E-07

Relative Δn/ΔT [1E-6/℃]															
Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90 (ref.)	0.1	0.2	0.3	0.6	0.8	1.0	1.1	1.2	1.5	1.9	2.7	2.9	4.0	5.3	6.3
60 to 80 (ref.)	0.0	0.1	0.3	0.5	0.7	0.9	1.0	1.1	1.4	1.8	2.6	2.7	3.8	5.1	6.0
40 to 60	0.0	0.0	0.2	0.4	0.6	0.8	0.9	1.0	1.2	1.6	2.4	2.5	3.6	4.8	5.7
20 to 40	−0.1	0.0	0.2	0.3	0.5	0.7	0.8	0.9	1.1	1.5	2.3	2.4	3.4	4.5	5.4
0 to 20	−0.1	−0.1	0.1	0.3	0.5	0.7	0.8	0.8	1.1	1.4	2.1	2.2	3.2	4.3	5.1
−20 to 0	−0.1	0.0	0.2	0.3	0.5	0.7	0.8	0.8	1.1	1.4	2.1	2.2	3.1	4.1	4.9
−40 to −20	0.1	0.1	0.3	0.4	0.6	0.8	0.8	0.9	1.1	1.4	2.1	2.2	3.0	4.0	4.7
−60 to −40 (ref.)	0.2	0.3	0.4	0.6	0.8	0.9	1.0	1.0	1.3	1.6	2.2	2.3	3.1	4.0	4.7
−70 to −60 (ref.)	0.5	0.5	0.7	0.8	1.0	1.1	1.2	1.2	1.5	1.7	2.3	2.4	3.2	4.1	4.7

Absolute Δn/ΔT [1E-6/℃]															
Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90	−0.9	−0.8	−0.6	−0.4	−0.2	0.0	0.1	0.1	0.5	0.9	1.7	1.8	3.0	4.3	5.2
60 to 80	−1.1	−1.0	−0.8	−0.6	−0.4	−0.2	−0.1	0.0	0.3	0.6	1.5	1.6	2.7	3.9	4.8
40 to 60	−1.3	−1.2	−1.0	−0.8	−0.6	−0.4	−0.4	−0.3	0.0	0.3	1.1	1.2	2.3	3.5	4.4
20 to 40	−1.5	−1.4	−1.3	−1.1	−0.9	−0.7	−0.6	−0.6	−0.3	0.0	0.8	0.9	1.9	3.0	3.9
0 to 20	−1.7	−1.7	−1.5	−1.3	−1.1	−0.9	−0.9	−0.8	−0.6	−0.2	0.5	0.6	1.5	2.6	3.4
−20 to 0	−1.9	−1.9	−1.7	−1.6	−1.4	−1.2	−1.1	−1.1	−0.8	−0.5	0.1	0.2	1.1	2.1	2.9
−40 to −20	−2.1	−2.1	−1.9	−1.8	−1.6	−1.5	−1.4	−1.4	−1.1	−0.8	−0.2	−0.1	0.7	1.7	2.4
−60 to −40	−2.3	−2.3	−2.2	−2.0	−1.9	−1.7	−1.7	−1.6	−1.4	−1.1	−0.5	−0.4	0.4	1.2	1.9
−70 to −60	−2.5	−2.5	−2.3	−2.2	−2.1	−1.9	−1.9	−1.8	−1.6	−1.3	−0.8	−0.7	0.1	0.9	1.5

Coef. disp. form. (frac. eq.)(ref.)	
P1	1.16164065E-01
Q1	8.55335644E+01
P2	1.75342706E-02
Q2	5.79488130E-02
P3	3.35341056E-01
Q3	7.82326842E-03

Fitting error of disp. form. σ [1E-6]		
	Visible	Infrared
Power ser. eq.	0.8	3.9
Frac. eq. (ref.)	1.2	8.4

Prod. Freq. (A to D)	B

Similar glass type			
OHARA	S-TIM22	HOYA	E-FD2
CDGM	H-ZF1	SCHOTT	N-SF2

2022-7-1	StP, AP, SP
2019-4-1	Transmittance
2015-4-1	Color Code, Prod. Freq.

HIKARI GLASS CO., LTD.

J-SF4

n_d = 1.755200 n_e = 1.761659

ν_d = 27.57 ν_e = 27.35

Glass code (d)
755276
Glass code (e)
762274

Spectral l.	Refractive idx
2.058	1.70897
1.970	1.71047
1.530	1.71783
1.129	1.72563
1.064	1.72725
t	1.72866
s	1.73450
A'	1.738835
r	1.743000
C	1.747305
C'	1.748535
He-Ne	1.749691
D	1.754963
d	1.755200
e	1.761659
F	1.774696
F'	1.776381
g	1.791384
h	1.806389
0.389	1.816164
i	–

Partial dispersion	
F-C	0.027391
F'-C'	0.027846
C-t	0.018649
C-A'	0.008470
d-C	0.007895
e-C	0.014354
g-d	0.036184
g-F	0.016688
h-g	0.015005
i-g	–
C'-t	0.019879
e-C'	0.013124
F'-e	0.014722
i-F'	–

Relative partial dispersion	
C-t／F-C	0.6808
C-A'／F-C	0.3092
d-C／F-C	0.2882
e-C／F-C	0.5240
g-d／F-C	1.3210
g-F／F-C	0.6093
h-g／F-C	0.5478
i-g／F-C	–
C'-t／F'-C'	0.7139
e-C'／F'-C'	0.4713
F'-e／F'-C'	0.5287
i-F'／F'-C'	–

Deviation of relative partial disp.	
ΔPdC	−0.0014
ΔPgF	0.0112

Internal CC (80%/5%)
394/362
Color Code (80%/5%)
420/365

CCI	
B	0.00
G	2.68
R	2.74

Thermal properties	
CTE(−30,70) [1E-7/℃]	84
CTE(100,300) [1E-7/℃]	99
Tg [℃]	617
At [℃]	648
StP [℃]	560
AP [℃]	593
SP [℃]	711
Ht cndct. [W/m·K]	1.040
Sp. heat [kJ/kg·K]	0.671
Ht diffus. [1E-6 m2/sec]	0.480

Chemical properties [class]	
Acid res. (surface)	1
Alkaline detergent res.	1
Climate resistance	1
Water res. (powder)	2
Acid res. (powder)	1

Mechanical properties	
Knoop hardness	504 (5)
Abrasion hardness	145
Young's mod. [GPa]	91.2
Shear mod. [GPa]	36.5
Poisson's ratio	0.251
Stress optical coef. [1E-5 nm/cm／Pa]	2.75

Internal trans. (10mm)	
λ [nm]	τ
280	–
290	–
300	–
310	–
320	–
330	–
340	–
350	–
360	0.03
370	0.20
380	0.51
390	0.75
400	0.86
420	0.941
440	0.964
460	0.975
480	0.982
500	0.987
550	0.995
600	0.996
650	0.995
700	0.996
800	0.996
900	0.996
1000	0.996
1200	0.997
1400	0.997
1600	0.988
1800	0.971
2000	0.960
2200	0.922
2400	0.89

Specific gravity
3.22

Coef. disp. form. (pwr ser.)	
A0	2.96384442E+00
A1	−1.22384397E-02
A2	0.00000000E+00
A3	3.57090539E-02
A4	2.72484712E-03
A5	−4.37315556E-04
A6	1.03210102E-04
A7	−1.04209554E-05
A8	5.02488681E-07

Relative Δn/ΔT [1E-6/℃]															
Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90 (ref.)	0.7	0.7	1.0	1.3	1.7	2.0	2.1	2.2	2.6	3.2	4.5	4.7	6.5	8.8	10.5
60 to 80 (ref.)	0.6	0.6	0.9	1.2	1.5	1.8	1.9	2.0	2.5	3.0	4.2	4.4	6.2	8.4	10.0
40 to 60	0.4	0.5	0.7	1.0	1.3	1.6	1.7	1.8	2.2	2.7	3.9	4.1	5.8	7.8	9.3
20 to 40	0.3	0.4	0.6	0.9	1.2	1.5	1.6	1.6	2.0	2.5	3.6	3.8	5.4	7.3	8.7
0 to 20	0.3	0.3	0.5	0.8	1.1	1.4	1.4	1.5	1.9	2.3	3.4	3.5	5.0	6.8	8.1
−20 to 0	0.2	0.3	0.5	0.8	1.0	1.3	1.4	1.4	1.8	2.2	3.2	3.3	4.7	6.4	7.6
−40 to −20	0.3	0.3	0.5	0.8	1.0	1.3	1.4	1.4	1.8	2.2	3.1	3.2	4.5	6.1	7.1
−60 to −40 (ref.)	0.4	0.5	0.7	0.9	1.1	1.4	1.4	1.5	1.8	2.2	3.1	3.2	4.4	5.8	6.8
−70 to −60 (ref.)	0.6	0.7	0.9	1.1	1.3	1.5	1.6	1.7	2.0	2.3	3.1	3.2	4.4	5.7	6.6

Absolute Δn/ΔT [1E-6/℃]															
Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90	−0.4	−0.3	0.0	0.3	0.6	0.9	1.0	1.1	1.6	2.1	3.4	3.6	5.4	7.7	9.3
60 to 80	−0.6	−0.6	−0.3	0.0	0.3	0.7	0.7	0.8	1.3	1.8	3.0	3.2	5.0	7.1	8.7
40 to 60	−0.9	−0.8	−0.6	−0.3	0.0	0.3	0.4	0.5	0.9	1.4	2.5	2.7	4.4	6.4	7.9
20 to 40	−1.2	−1.1	−0.9	−0.6	−0.3	0.0	0.0	0.1	0.5	1.0	2.1	2.2	3.8	5.7	7.1
0 to 20	−1.5	−1.4	−1.2	−0.9	−0.7	−0.4	−0.3	−0.2	0.1	0.6	1.6	1.7	3.2	5.0	6.2
−20 to 0	−1.7	−1.7	−1.5	−1.2	−1.0	−0.7	−0.7	−0.6	−0.2	0.2	1.1	1.3	2.6	4.3	5.4
−40 to −20	−2.0	−2.0	−1.8	−1.6	−1.3	−1.1	−1.0	−0.9	−0.6	−0.2	0.6	0.8	2.1	3.6	4.6
−60 to −40	−2.3	−2.3	−2.1	−1.9	−1.7	−1.4	−1.4	−1.3	−1.0	−0.6	0.2	0.3	1.5	2.9	3.8
−70 to −60	−2.5	−2.5	−2.3	−2.1	−1.9	−1.7	−1.6	−1.6	−1.3	−1.0	−0.2	−0.1	1.0	2.3	3.2

Coef. disp. form. (frac. eq.)(ref.)	
P1	1.10339135E-01
Q1	8.00300370E+01
P2	2.34104129E-02
Q2	6.14797788E-02
P3	3.71956970E-01
Q3	8.66099124E-03

Fitting error of disp. form. σ [1E-6]		
	Visible	Infrared
Power ser. eq.	0.8	5.3
Frac. eq. (ref.)	2.5	10.1

Prod. Freq. (A to D)	B

Similar glass type			
OHARA	S-TIH4	HOYA	E-FD4、E-FD4L
CDGM	H-ZF6	SCHOTT	N-SF4

2022-7-1	StP, AP, SP
2020-4-1	Similar glass type
2019-4-1	Transmittance

HIKARI GLASS CO., LTD.

J-SF5

n_d = 1.672700 n_e = 1.677639

ν_d = 32.19 ν_e = 31.94

Glass code (d)
673322
Glass code (e)
678319

Spectral l.	Refractive idx
2.058	1.63483
1.970	1.63621
1.530	1.64279
1.129	1.64942
1.064	1.65076
t	1.65191
s	1.65660
A'	1.660023
r	1.663279
C	1.666619
C'	1.667570
He-Ne	1.668463
D	1.672518
d	1.672700
e	1.677639
F	1.687520
F'	1.688788
g	1.700004
h	1.711077
0.389	1.718210
i	–

Coef. disp. form. (pwr ser.)	
A0	2.71072072E+00
A1	-1.02160186E-02
A2	-9.06763794E-05
A3	2.88337808E-02
A4	5.57561753E-04
A5	1.33564048E-04
A6	-1.34358407E-05
A7	1.19202152E-06
A8	0.00000000E+00

Partial dispersion	
F-C	0.020901
F'-C'	0.021218
C-t	0.014710
C-A'	0.006596
d-C	0.006081
e-C	0.011020
g-d	0.027304
g-F	0.012484
h-g	0.011073
i-g	–
C'-t	0.015661
e-C'	0.010069
F'-e	0.011149
i-F'	–

Relative partial dispersion	
C-t／F-C	0.7038
C-A'／F-C	0.3156
d-C／F-C	0.2909
e-C／F-C	0.5272
g-d／F-C	1.3063
g-F／F-C	0.5973
h-g／F-C	0.5298
i-g／F-C	–
C'-t／F'-C'	0.7381
e-C'／F'-C'	0.4745
F'-e／F'-C'	0.5255
i-F'／F'-C'	–

Deviation of relative partial disp.	
ΔPdC	-0.0008
ΔPgF	0.0069

Internal CC (80%/5%)
386/357
Color Code (80%/5%)
400/360

CCI	
B	0.00
G	1.40
R	1.45

Thermal properties	
CTE(-30,70) [1E-7/℃]	85
CTE(100,300) [1E-7/℃]	102
Tg [℃]	582
At [℃]	612
StP [℃]	529
AP [℃]	563
SP [℃]	692
Ht cndct. [W/m･K]	1.091
Sp. heat [kJ/kg･K]	0.723
Ht diffus. [1E-6 m2/sec]	0.520

Chemical properties [class]	
Acid res. (surface)	1
Alkaline detergent res.	1
Climate resistance	1
Water res. (powder)	2
Acid res. (powder)	1

Mechanical properties	
Knoop hardness	500 (5)
Abrasion hardness	151
Young's mod. [GPa]	83.3
Shear mod. [GPa]	33.4
Poisson's ratio	0.249
Stress optical coef. [1E-5 nm/cm／Pa]	2.71

Internal trans. (10mm)	
λ [nm]	τ
280	–
290	–
300	–
310	–
320	–
330	–
340	–
350	–
360	0.08
370	0.36
380	0.68
390	0.86
400	0.930
420	0.973
440	0.983
460	0.987
480	0.990
500	0.993
550	0.996
600	0.997
650	0.997
700	0.998
800	0.996
900	0.994
1000	0.995
1200	0.998
1400	0.998
1600	0.990
1800	0.973
2000	0.960
2200	0.917
2400	0.89

Specific gravity
2.9

Relative Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90 (ref.)	0.7	0.8	1.0	1.2	1.4	1.7	1.8	1.8	2.2	2.6	3.6	3.7	5.1	6.6	7.8
60 to 80 (ref.)	0.6	0.7	1.0	1.1	1.3	1.6	1.6	1.7	2.0	2.5	3.4	3.6	4.8	6.3	7.5
40 to 60	0.5	0.6	0.8	1.0	1.2	1.4	1.5	1.6	1.9	2.3	3.2	3.3	4.5	6.0	7.0
20 to 40	0.5	0.5	0.8	0.9	1.1	1.3	1.4	1.5	1.8	2.2	3.0	3.2	4.3	5.6	6.6
0 to 20	0.5	0.5	0.7	0.9	1.1	1.3	1.4	1.4	1.7	2.1	2.9	3.0	4.1	5.3	6.2
-20 to 0	0.5	0.6	0.8	0.9	1.1	1.3	1.3	1.4	1.7	2.0	2.8	2.9	3.9	5.1	5.9
-40 to -20	0.6	0.7	0.9	1.0	1.2	1.3	1.4	1.5	1.7	2.0	2.8	2.9	3.8	4.9	5.7
-60 to -40 (ref.)	0.8	0.9	1.0	1.2	1.3	1.5	1.6	1.6	1.9	2.2	2.8	2.9	3.8	4.8	5.5
-70 to -60 (ref.)	1.0	1.1	1.3	1.4	1.5	1.7	1.7	1.8	2.0	2.3	3.0	3.1	3.9	4.8	5.5

Absolute Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90	-0.3	-0.3	0.0	0.2	0.4	0.6	0.7	0.8	1.1	1.6	2.6	2.7	4.0	5.6	6.7
60 to 80	-0.5	-0.4	-0.2	0.0	0.2	0.4	0.5	0.6	0.9	1.3	2.3	2.4	3.7	5.2	6.3
40 to 60	-0.7	-0.6	-0.4	-0.2	0.0	0.2	0.2	0.3	0.6	1.0	1.9	2.0	3.2	4.6	5.7
20 to 40	-0.9	-0.9	-0.7	-0.5	-0.3	-0.1	0.0	0.0	0.3	0.7	1.6	1.7	2.8	4.1	5.1
0 to 20	-1.2	-1.1	-0.9	-0.7	-0.6	-0.4	-0.3	-0.3	0.0	0.4	1.2	1.3	2.3	3.6	4.5
-20 to 0	-1.4	-1.3	-1.1	-1.0	-0.8	-0.6	-0.6	-0.5	-0.3	0.1	0.8	0.9	1.9	3.0	3.9
-40 to -20	-1.6	-1.6	-1.4	-1.2	-1.1	-0.9	-0.9	-0.8	-0.6	-0.2	0.5	0.6	1.5	2.5	3.3
-60 to -40	-1.8	-1.8	-1.6	-1.5	-1.3	-1.2	-1.1	-1.1	-0.8	-0.5	0.1	0.2	1.0	2.0	2.7
-70 to -60	-2.0	-2.0	-1.8	-1.7	-1.5	-1.4	-1.3	-1.3	-1.1	-0.8	-0.2	-0.1	0.7	1.6	2.2

Coef. disp. form. (frac. eq.)(ref.)	
P1	1.26549349E-01
Q1	9.15118960E+01
P2	1.95616062E-02
Q2	5.84865283E-02
P3	3.43630919E-01
Q3	7.87974955E-03

Fitting error of disp. form. σ [1E-6]		
	Visible	Infrared
Power ser. eq.	0.7	3.7
Frac. eq. (ref.)	1.4	5.8

Prod. Freq. (A to D)	B

Similar glass type			
OHARA	S-TIM25	HOYA	E-FD5
CDGM	H-ZF2	SCHOTT	N-SF5

2022-7-1	StP, AP, SP
2019-4-1	Transmittance
2015-4-1	Color Code, Prod. Freq., Similar glass type

HIKARI GLASS CO., LTD.

J-SF6

n_d = 1.805180 n_e = 1.812633

ν_d = 25.45 ν_e = 25.24

Glass code (d)
805255
Glass code (e)
813252

Spectral l.	Refractive idx
2.058	1.75397
1.970	1.75551
1.530	1.76319
1.129	1.77161
1.064	1.77341
t	1.77497
s	1.78153
A'	1.786439
r	1.791185
C	1.796109
C'	1.797519
He-Ne	1.798846
D	1.804907
d	1.805180
e	1.812633
F	1.827749
F'	1.829709
g	1.847229
h	1.864867
0.389	1.876421
i	–

Partial dispersion	
F-C	0.031640
F'-C'	0.032190
C-t	0.021142
C-A'	0.009670
d-C	0.009071
e-C	0.016524
g-d	0.042049
g-F	0.019480
h-g	0.017638
i-g	–
C'-t	0.022552
e-C'	0.015114
F'-e	0.017076
i-F'	–

Relative partial dispersion	
C-t／F-C	0.6682
C-A'／F-C	0.3056
d-C／F-C	0.2867
e-C／F-C	0.5223
g-d／F-C	1.3290
g-F／F-C	0.6157
h-g／F-C	0.5575
i-g／F-C	–
C'-t／F'-C'	0.7006
e-C'／F'-C'	0.4695
F'-e／F'-C'	0.5305
i-F'／F'-C'	–

Deviation of relative partial disp.	
ΔPdC	−0.0020
ΔPgF	0.0140

Internal CC (80%/5%)
398/363
Color Code (80%/5%)
440/365

CCI	
B	0.00
G	3.24
R	3.41

Thermal properties	
CTE(−30,70) [1E-7/℃]	86
CTE(100,300) [1E-7/℃]	110
Tg [℃]	571
At [℃]	611
StP [℃]	524
AP [℃]	558
SP [℃]	679
Ht cndct. [W/m·K]	1.070
Sp. heat [kJ/kg·K]	0.662
Ht diffus. [1E-6 m2/sec]	0.484

Chemical properties [class]	
Acid res. (surface)	1
Alkaline detergent res.	1
Climate resistance	1
Water res. (powder)	2
Acid res. (powder)	1

Mechanical properties	
Knoop hardness	482 (5)
Abrasion hardness	182
Young's mod. [GPa]	92.9
Shear mod. [GPa]	36.7
Poisson's ratio	0.264
Stress optical coef. [1E-5 nm/cm／Pa]	2.95

Internal trans. (10mm)	
λ [nm]	τ
280	–
290	–
300	–
310	–
320	–
330	–
340	–
350	–
360	–
370	0.20
380	0.50
390	0.71
400	0.82
420	0.918
440	0.954
460	0.971
480	0.980
500	0.984
550	0.991
600	0.994
650	0.995
700	0.996
800	0.995
900	0.995
1000	0.996
1200	0.998
1400	0.999
1600	0.990
1800	0.975
2000	0.966
2200	0.936
2400	0.89

Specific gravity
3.34

Coef. disp. form. (pwr ser.)	
A0	3.11993645E+00
A1	−1.26679163E-02
A2	0.00000000E+00
A3	4.21698355E-02
A4	3.04768926E-03
A5	−4.20720196E-04
A6	1.06770582E-04
A7	−1.09382035E-05
A8	5.57077794E-07

Relative Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90 (ref.)	−0.7	−0.6	−0.3	0.0	0.3	0.7	0.8	0.9	1.4	2.1	3.6	3.8	5.9	8.5	10.7
60 to 80 (ref.)	−0.9	−0.7	−0.4	−0.1	0.2	0.5	0.6	0.7	1.2	1.9	3.3	3.5	5.5	8.1	10.2
40 to 60	−1.0	−0.9	−0.5	−0.3	0.0	0.3	0.4	0.5	1.0	1.6	3.0	3.2	5.1	7.5	9.4
20 to 40	−1.1	−1.0	−0.7	−0.4	−0.1	0.2	0.3	0.4	0.8	1.4	2.7	2.9	4.7	6.9	8.7
0 to 20	−1.2	−1.0	−0.7	−0.5	−0.3	0.0	0.1	0.2	0.7	1.2	2.5	2.6	4.3	6.4	8.1
−20 to 0	−1.2	−1.1	−0.8	−0.5	−0.3	0.0	0.1	0.1	0.6	1.1	2.3	2.4	4.0	5.9	7.5
−40 to −20	−1.1	−1.0	−0.7	−0.5	−0.3	0.0	0.1	0.1	0.5	1.0	2.1	2.3	3.7	5.5	7.0
−60 to −40 (ref.)	−0.9	−0.8	−0.6	−0.4	−0.2	0.1	0.2	0.2	0.6	1.1	2.1	2.2	3.6	5.2	6.6
−70 to −60 (ref.)	−0.7	−0.6	−0.4	−0.2	0.0	0.3	0.3	0.4	0.8	1.2	2.2	2.3	3.6	5.1	6.3

Absolute Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90	−1.8	−1.7	−1.4	−1.1	−0.8	−0.4	−0.3	−0.2	0.3	1.0	2.5	2.7	4.7	7.4	9.5
60 to 80	−2.1	−1.9	−1.6	−1.3	−1.0	−0.7	−0.6	−0.5	0.0	0.7	2.1	2.3	4.3	6.8	8.9
40 to 60	−2.3	−2.2	−1.9	−1.6	−1.4	−1.0	−0.9	−0.9	−0.4	0.2	1.6	1.8	3.7	6.0	8.0
20 to 40	−2.6	−2.5	−2.2	−2.0	−1.7	−1.4	−1.3	−1.2	−0.8	−0.2	1.1	1.3	3.0	5.2	7.1
0 to 20	−2.9	−2.8	−2.5	−2.3	−2.0	−1.7	−1.7	−1.6	−1.1	−0.6	0.6	0.8	2.4	4.5	6.2
−20 to 0	−3.2	−3.1	−2.8	−2.6	−2.4	−2.1	−2.0	−1.9	−1.5	−1.0	0.1	0.3	1.8	3.7	5.3
−40 to −20	−3.5	−3.4	−3.1	−2.9	−2.6	−2.5	−2.4	−2.3	−1.9	−1.4	−0.4	−0.2	1.2	2.9	4.4
−60 to −40	−3.8	−3.7	−3.4	−3.2	−3.0	−2.8	−2.7	−2.7	−2.3	−1.8	−0.9	−0.7	0.6	2.2	3.5
−70 to −60	−4.0	−3.9	−3.7	−3.5	−3.3	−3.1	−3.0	−2.9	−2.6	−2.2	−1.2	−1.1	0.1	1.6	2.8

Coef. disp. form. (frac. eq.)(ref.)	
P1	1.01435791E-01
Q1	7.59148418E+01
P2	2.72714884E-02
Q2	6.17300189E-02
P3	3.86525039E-01
Q3	8.91225912E-03

Fitting error of disp. form. σ [1E-6]		
	Visible	Infrared
Power ser. eq.	0.9	3.7
Frac. eq. (ref.)	3.3	11.4

Prod. Freq. (A to D)	A

Similar glass type			
OHARA	S-TIH6	HOYA	FD60
CDGM	H-ZF7LA	SCHOTT	N-SF6

2022-7-1	StP, AP, SP
2019-4-1	Transmittance
2018-4-1	Young's mod., Shear mod.

HIKARI GLASS CO., LTD.

J-SF6HS

n_d = 1.805180 n_e = 1.812633

ν_d = 25.45 ν_e = 25.24

Glass code (d)
805255
Glass code (e)
813252

Spectral l.	Refractive idx
2.058	1.75397
1.970	1.75551
1.530	1.76319
1.129	1.77161
1.064	1.77341
t	1.77497
s	1.78153
A'	1.786439
r	1.791185
C	1.796109
C'	1.797519
He-Ne	1.798846
D	1.804907
d	1.805180
e	1.812633
F	1.827749
F'	1.829709
g	1.847229
h	1.864867
0.389	1.876421
i	–

Partial dispersion	
F-C	0.031640
F'-C'	0.032190
C-t	0.021142
C-A'	0.009670
d-C	0.009071
e-C	0.016524
g-d	0.042049
g-F	0.019480
h-g	0.017638
i-g	–
C'-t	0.022552
e-C'	0.015114
F'-e	0.017076
i-F'	–

Relative partial dispersion	
C-t／F-C	0.6682
C-A'／F-C	0.3056
d-C／F-C	0.2867
e-C／F-C	0.5223
g-d／F-C	1.3290
g-F／F-C	0.6157
h-g／F-C	0.5575
i-g／F-C	–
C'-t／F'-C'	0.7006
e-C'／F'-C'	0.4695
F'-e／F'-C'	0.5305
i-F'／F'-C'	–

Deviation of relative partial disp.	
ΔPdC	−0.0020
ΔPgF	0.0140

Internal CC (80%/5%)
390/361
Color Code (80%/5%)
425/360

CCI	
B	0.00
G	2.25
R	2.36

Thermal properties	
CTE(−30,70) [1E-7/℃]	86
CTE(100,300) [1E-7/℃]	110
Tg [℃]	571
At [℃]	611
StP [℃]	524
AP [℃]	558
SP [℃]	679
Ht cndct. [W/m·K]	1.070
Sp. heat [kJ/kg·K]	0.662
Ht diffus. [1E-6 m2/sec]	0.484

Chemical properties [class]	
Acid res. (surface)	1
Alkaline detergent res.	1
Climate resistance	1
Water res. (powder)	2
Acid res. (powder)	1

Mechanical properties	
Knoop hardness	482 (5)
Abrasion hardness	182
Young's mod. [GPa]	92.9
Shear mod. [GPa]	36.7
Poisson's ratio	0.264
Stress optical coef. [1E-5 nm/cm／Pa]	2.95

Internal trans. (10mm)	
λ [nm]	τ
280	–
290	–
300	–
310	–
320	–
330	–
340	–
350	–
360	0.04
370	0.26
380	0.58
390	0.80
400	0.89
420	0.949
440	0.972
460	0.982
480	0.987
500	0.991
550	0.997
600	0.998
650	0.999
700	0.999
800	0.999
900	0.999
1000	0.998
1200	0.997
1400	0.993
1600	0.987
1800	0.973
2000	0.962
2200	0.929
2400	0.88

Specific gravity
3.34

Coef. disp. form. (pwr ser.)	
A0	3.11993645E+00
A1	−1.26679163E-02
A2	0.00000000E+00
A3	4.21698355E-02
A4	3.04768926E-03
A5	−4.20720196E-04
A6	1.06770582E-04
A7	−1.09382035E-05
A8	5.57077794E-07

Relative Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90 (ref.)	−0.7	−0.6	−0.3	0.0	0.3	0.7	0.8	0.9	1.4	2.1	3.6	3.8	5.9	8.5	10.7
60 to 80 (ref.)	−0.9	−0.7	−0.4	−0.1	0.2	0.5	0.6	0.7	1.2	1.9	3.3	3.5	5.5	8.1	10.2
40 to 60	−1.0	−0.9	−0.5	−0.3	0.0	0.3	0.4	0.5	1.0	1.6	3.0	3.2	5.1	7.5	9.4
20 to 40	−1.1	−1.0	−0.7	−0.4	−0.1	0.2	0.3	0.4	0.8	1.4	2.7	2.9	4.7	6.9	8.7
0 to 20	−1.2	−1.0	−0.7	−0.5	−0.3	0.0	0.1	0.2	0.7	1.2	2.5	2.6	4.3	6.4	8.1
−20 to 0	−1.2	−1.1	−0.8	−0.5	−0.3	0.0	0.1	0.1	0.6	1.1	2.3	2.4	4.0	5.9	7.5
−40 to −20	−1.1	−1.0	−0.7	−0.5	−0.3	0.0	0.1	0.1	0.5	1.0	2.1	2.3	3.7	5.5	7.0
−60 to −40 (ref.)	−0.9	−0.8	−0.6	−0.4	−0.2	0.1	0.2	0.2	0.6	1.1	2.1	2.2	3.6	5.2	6.6
−70 to −60 (ref.)	−0.7	−0.6	−0.4	−0.2	0.0	0.3	0.3	0.4	0.8	1.2	2.2	2.3	3.6	5.1	6.3

Absolute Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90	−1.8	−1.7	−1.4	−1.1	−0.8	−0.4	−0.3	−0.2	0.3	1.0	2.5	2.7	4.7	7.4	9.5
60 to 80	−2.1	−1.9	−1.6	−1.3	−1.0	−0.7	−0.6	−0.5	0.0	0.7	2.1	2.3	4.3	6.8	8.9
40 to 60	−2.3	−2.2	−1.9	−1.6	−1.4	−1.0	−0.9	−0.9	−0.4	0.2	1.6	1.8	3.7	6.0	8.0
20 to 40	−2.6	−2.5	−2.2	−2.0	−1.7	−1.4	−1.3	−1.2	−0.8	−0.2	1.1	1.3	3.0	5.2	7.1
0 to 20	−2.9	−2.8	−2.5	−2.3	−2.0	−1.7	−1.7	−1.6	−1.1	−0.6	0.6	0.8	2.4	4.5	6.2
−20 to 0	−3.2	−3.1	−2.8	−2.6	−2.4	−2.1	−2.0	−1.9	−1.5	−1.0	0.1	0.3	1.8	3.7	5.3
−40 to −20	−3.5	−3.4	−3.1	−2.9	−2.6	−2.5	−2.4	−2.3	−1.9	−1.4	−0.4	−0.2	1.2	2.9	4.4
−60 to −40	−3.8	−3.7	−3.4	−3.2	−3.0	−2.8	−2.7	−2.7	−2.3	−1.8	−0.9	−0.7	0.6	2.2	3.5
−70 to −60	−4.0	−3.9	−3.7	−3.5	−3.3	−3.1	−3.0	−2.9	−2.6	−2.2	−1.2	−1.1	0.1	1.6	2.8

Coef. disp. form. (frac. eq.)(ref.)	
P1	1.01435791E-01
Q1	7.59148418E+01
P2	2.72714884E-02
Q2	6.17300189E-02
P3	3.86525039E-01
Q3	8.91225912E-03

Fitting error of disp. form. σ [1E-6]		
	Visible	Infrared
Power ser. eq.	0.9	3.7
Frac. eq. (ref.)	3.3	11.4

Prod. Freq. (A to D)	A

Similar glass type			
OHARA	S-TIH6	HOYA	FD60-W
CDGM	H-ZF7LAGT	SCHOTT	N-SF6HT

2022-7-1	StP, AP, SP
2019-4-1	Transmittance
2018-4-1	Young's mod., Shear mod., Similar glass type

HIKARI GLASS CO., LTD.

J-SF7

n_d = 1.639800 n_e = 1.644181

ν_d = 34.55 ν_e = 34.29

Glass code (d)
640346
Glass code (e)
644343

Spectral l.	Refractive idx
2.058	1.60479
1.970	1.60615
1.530	1.61255
1.129	1.61881
1.064	1.62005
t	1.62111
s	1.62539
A'	1.628474
r	1.631397
C	1.634385
C'	1.635233
He-Ne	1.636029
D	1.639639
d	1.639800
e	1.644181
F	1.652905
F'	1.654022
g	1.663859
h	1.673512
0.389	1.679697
i	–

Partial dispersion	
F-C	0.018520
F'-C'	0.018789
C-t	0.013279
C-A'	0.005911
d-C	0.005415
e-C	0.009796
g-d	0.024059
g-F	0.010954
h-g	0.009653
i-g	–
C'-t	0.014127
e-C'	0.008948
F'-e	0.009841
i-F'	–

Relative partial dispersion	
C-t／F-C	0.7170
C-A'／F-C	0.3192
d-C／F-C	0.2924
e-C／F-C	0.5289
g-d／F-C	1.2991
g-F／F-C	0.5915
h-g／F-C	0.5212
i-g／F-C	–
C'-t／F'-C'	0.7519
e-C'／F'-C'	0.4762
F'-e／F'-C'	0.5238
i-F'／F'-C'	–

Deviation of relative partial disp.	
ΔPdC	−0.0004
ΔPgF	0.0051

Internal CC (80%/5%)
383/355
Color Code (80%/5%)
395/355

CCI	
B	0.00
G	1.26
R	1.28

Thermal properties	
CTE(−30,70) [1E-7/℃]	79
CTE(100,300) [1E-7/℃]	97
Tg [℃]	584
At [℃]	624
StP [℃]	528
AP [℃]	565
SP [℃]	704
Ht cndct. [W/m·K]	1.030
Sp. heat [kJ/kg·K]	0.722
Ht diffus. [1E-6 m2/sec]	0.518

Chemical properties [class]	
Acid res. (surface)	1
Alkaline detergent res.	1
Climate resistance	1
Water res. (powder)	1
Acid res. (powder)	1

Mechanical properties	
Knoop hardness	495 (5)
Abrasion hardness	122
Young's mod. [GPa]	78.8
Shear mod. [GPa]	31.8
Poisson's ratio	0.238
Stress optical coef. [1E-5 nm/cm／Pa]	2.80

Internal trans. (10mm)	
λ [nm]	τ
280	–
290	–
300	–
310	–
320	–
330	–
340	–
350	–
360	0.13
370	0.45
380	0.74
390	0.89
400	0.944
420	0.976
440	0.983
460	0.987
480	0.990
500	0.993
550	0.997
600	0.998
650	0.997
700	0.998
800	0.997
900	0.996
1000	0.997
1200	0.998
1400	0.993
1600	0.988
1800	0.967
2000	0.947
2200	0.88
2400	0.85

Specific gravity
2.76

Coef. disp. form. (pwr ser.)	
A0	2.61297958E+00
A1	−9.85563637E-03
A2	−1.06186576E-04
A3	2.54765452E-02
A4	3.92630585E-04
A5	1.21161036E-04
A6	−1.21702106E-05
A7	9.86930857E-07
A8	0.00000000E+00

Relative Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90 (ref.)	1.4	1.5	1.7	1.9	2.1	2.4	2.4	2.5	2.8	3.2	4.0	4.1	5.3	6.5	7.4
60 to 80 (ref.)	1.3	1.4	1.6	1.8	2.0	2.2	2.3	2.4	2.6	3.0	3.8	3.9	5.0	6.3	7.1
40 to 60	1.2	1.3	1.5	1.7	1.9	2.1	2.1	2.2	2.5	2.8	3.6	3.7	4.8	5.9	6.7
20 to 40	1.2	1.2	1.4	1.6	1.8	2.0	2.0	2.1	2.3	2.7	3.4	3.5	4.5	5.6	6.4
0 to 20	1.1	1.1	1.3	1.5	1.7	1.9	1.9	2.0	2.2	2.6	3.3	3.4	4.3	5.4	6.1
−20 to 0	1.1	1.2	1.3	1.5	1.7	1.9	1.9	2.0	2.2	2.5	3.2	3.3	4.2	5.2	5.9
−40 to −20	1.2	1.2	1.4	1.5	1.7	1.9	1.9	2.0	2.2	2.5	3.1	3.2	4.1	5.0	5.7
−60 to −40 (ref.)	1.4	1.4	1.5	1.7	1.8	2.0	2.1	2.1	2.3	2.6	3.2	3.3	4.1	5.0	5.6
−70 to −60 (ref.)	1.6	1.6	1.7	1.9	2.0	2.2	2.2	2.3	2.5	2.7	3.3	3.4	4.2	5.0	5.6

Absolute Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90	0.4	0.5	0.7	0.9	1.1	1.3	1.4	1.5	1.8	2.1	3.0	3.1	4.2	5.5	6.3
60 to 80	0.3	0.3	0.5	0.7	0.9	1.1	1.2	1.2	1.5	1.9	2.7	2.8	3.9	5.1	5.9
40 to 60	0.0	0.0	0.2	0.4	0.6	0.8	0.9	0.9	1.2	1.6	2.3	2.4	3.5	4.6	5.4
20 to 40	−0.2	−0.2	0.0	0.2	0.3	0.5	0.6	0.7	0.9	1.2	2.0	2.1	3.1	4.1	4.9
0 to 20	−0.5	−0.5	−0.3	−0.1	0.1	0.3	0.3	0.4	0.6	0.9	1.6	1.7	2.6	3.7	4.4
−20 to 0	−0.7	−0.7	−0.5	−0.4	−0.2	0.0	0.0	0.1	0.3	0.6	1.2	1.3	2.2	3.2	3.9
−40 to −20	−1.0	−1.0	−0.8	−0.6	−0.5	−0.3	−0.3	−0.2	0.0	0.3	0.9	1.0	1.8	2.7	3.3
−60 to −40	−1.2	−1.2	−1.1	−0.9	−0.8	−0.6	−0.6	−0.5	−0.3	−0.1	0.5	0.6	1.4	2.2	2.8
−70 to −60	−1.4	−1.4	−1.3	−1.1	−1.0	−0.8	−0.8	−0.7	−0.5	−0.3	0.2	0.3	1.1	1.9	2.4

Coef. disp. form. (frac. eq.)(ref.)	
P1	1.16414550E-01
Q1	8.32585149E+01
P2	1.64966821E-02
Q2	5.83433442E-02
P3	3.33217429E-01
Q3	7.71106562E-03

Fitting error of disp. form. σ [1E-6]		
	Visible	Infrared
Power ser. eq.	0.6	5.9
Frac. eq. (ref.)	1.3	7.3

Prod. Freq. (A to D)	D

Similar glass type			
OHARA	S-TIM27	HOYA	E-FD7
CDGM	H-F51	SCHOTT	–

2022-7-1	StP, AP, SP
2019-4-1	Transmittance
2018-4-1	Prod. Freq.

J-SF8

n_d = 1.688930 n_e = 1.694153

ν_d = 31.16 ν_e = 30.92

Glass code (d)
689312
Glass code (e)
694309

Spectral l.	Refractive idx
2.058	1.64983
1.970	1.65119
1.530	1.65778
1.129	1.66454
1.064	1.66592
t	1.66710
s	1.67198
A'	1.675565
r	1.678988
C	1.682509
C'	1.683512
He-Ne	1.684454
D	1.688738
d	1.688930
e	1.694153
F	1.704616
F'	1.705961
g	1.717865
h	1.729635
0.389	1.737225
i	–

Partial dispersion	
F-C	0.022107
F'-C'	0.022449
C-t	0.015408
C-A'	0.006944
d-C	0.006421
e-C	0.011644
g-d	0.028935
g-F	0.013249
h-g	0.011770
i-g	–
C'-t	0.016411
e-C'	0.010641
F'-e	0.011808
i-F'	–

Relative partial dispersion	
C-t／F-C	0.6970
C-A'／F-C	0.3141
d-C／F-C	0.2905
e-C／F-C	0.5267
g-d／F-C	1.3089
g-F／F-C	0.5993
h-g／F-C	0.5324
i-g／F-C	–
C'-t／F'-C'	0.7310
e-C'／F'-C'	0.4740
F'-e／F'-C'	0.5260
i-F'／F'-C'	–

Deviation of relative partial disp.	
ΔPdC	−0.0008
ΔPgF	0.0072

Internal CC (80%/5%)
390/357
Color Code (80%/5%)
405/360

CCI	
B	0.00
G	1.78
R	1.81

Thermal properties	
CTE(−30,70) [1E-7/℃]	92
CTE(100,300) [1E-7/℃]	116
Tg [℃]	544
At [℃]	582
StP [℃]	489
AP [℃]	523
SP [℃]	648
Ht cndct. [W/m·K]	1.083
Sp. heat [kJ/kg·K]	0.746
Ht diffus. [1E-6 m2/sec]	0.494

Chemical properties [class]	
Acid res. (surface)	1
Alkaline detergent res.	1
Climate resistance	1
Water res. (powder)	1
Acid res. (powder)	1

Mechanical properties	
Knoop hardness	492 (5)
Abrasion hardness	180
Young's mod. [GPa]	86.4
Shear mod. [GPa]	34.5
Poisson's ratio	0.252
Stress optical coef. [1E-5 nm/cm／Pa]	2.68

Internal trans. (10mm)	
λ [nm]	τ
280	–
290	–
300	–
310	–
320	–
330	–
340	–
350	–
360	0.09
370	0.37
380	0.67
390	0.83
400	0.910
420	0.963
440	0.976
460	0.982
480	0.987
500	0.990
550	0.996
600	0.997
650	0.996
700	0.997
800	0.996
900	0.996
1000	0.996
1200	0.997
1400	0.994
1600	0.987
1800	0.967
2000	0.946
2200	0.900
2400	0.85

Specific gravity
2.93

Coef. disp. form. (pwr ser.)	
A0	2.76136798E+00
A1	−1.08932344E-02
A2	0.00000000E+00
A3	2.79459967E-02
A4	2.32580023E-03
A5	−4.32657789E-04
A6	9.28149250E-05
A7	−9.03546717E-06
A8	4.01729395E-07

Relative Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90 (ref.)	−0.1	−0.1	0.1	0.4	0.6	0.9	1.0	1.1	1.4	1.9	2.9	3.0	4.4	6.1	7.3
60 to 80 (ref.)	−0.2	−0.2	0.1	0.3	0.6	0.8	0.9	1.0	1.3	1.8	2.7	2.9	4.2	5.8	7.0
40 to 60	−0.3	−0.2	0.0	0.2	0.4	0.7	0.8	0.8	1.2	1.6	2.5	2.7	3.9	5.4	6.5
20 to 40	−0.3	−0.3	−0.1	0.1	0.4	0.6	0.7	0.8	1.1	1.5	2.4	2.5	3.7	5.1	6.1
0 to 20	−0.3	−0.3	−0.1	0.1	0.3	0.6	0.6	0.7	1.0	1.4	2.2	2.4	3.5	4.8	5.8
−20 to 0	−0.3	−0.2	−0.1	0.1	0.4	0.6	0.6	0.7	1.0	1.4	2.2	2.3	3.4	4.6	5.5
−40 to −20	−0.2	−0.1	0.0	0.2	0.4	0.7	0.7	0.8	1.1	1.4	2.2	2.3	3.3	4.5	5.3
−60 to −40 (ref.)	0.0	0.1	0.2	0.4	0.6	0.8	0.9	0.9	1.2	1.5	2.3	2.3	3.3	4.4	5.2
−70 to −60 (ref.)	0.3	0.3	0.5	0.6	0.8	1.0	1.1	1.1	1.4	1.7	2.4	2.5	3.4	4.4	5.2

Absolute Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90	−1.2	−1.1	−0.9	−0.6	−0.4	−0.1	0.0	0.0	0.4	0.8	1.8	2.0	3.3	5.0	6.2
60 to 80	−1.3	−1.3	−1.1	−0.8	−0.6	−0.3	−0.2	−0.2	0.2	0.6	1.6	1.7	3.0	4.6	5.7
40 to 60	−1.5	−1.5	−1.3	−1.1	−0.8	−0.6	−0.5	−0.4	−0.1	0.3	1.2	1.4	2.6	4.1	5.2
20 to 40	−1.7	−1.7	−1.5	−1.3	−1.1	−0.8	−0.8	−0.7	−0.4	0.0	0.9	1.0	2.2	3.6	4.6
0 to 20	−2.0	−1.9	−1.7	−1.5	−1.3	−1.1	−1.0	−1.0	−0.7	−0.3	0.5	0.6	1.8	3.1	4.0
−20 to 0	−2.2	−2.2	−2.0	−1.8	−1.6	−1.4	−1.3	−1.2	−0.9	−0.6	0.2	0.3	1.3	2.6	3.5
−40 to −20	−2.4	−2.4	−2.2	−2.0	−1.8	−1.6	−1.6	−1.5	−1.2	−0.9	−0.2	−0.1	0.9	2.1	2.9
−60 to −40	−2.6	−2.6	−2.4	−2.3	−2.1	−1.9	−1.8	−1.8	−1.5	−1.2	−0.5	−0.4	0.5	1.6	2.3
−70 to −60	−2.8	−2.8	−2.6	−2.4	−2.3	−2.1	−2.0	−2.0	−1.7	−1.4	−0.8	−0.7	0.2	1.2	1.9

Coef. disp. form. (frac. eq.)(ref.)	
P1	1.02971181E-01
Q1	7.75985325E+01
P2	1.94900806E-02
Q2	5.94772898E-02
P3	3.50160674E-01
Q3	8.19360173E-03

Fitting error of disp. form. σ [1E-6]		
	Visible	Infrared
Power ser. eq.	0.9	5.3
Frac. eq. (ref.)	1.4	10.5

Prod. Freq. (A to D)	C

Similar glass type			
OHARA	S-TIM28	HOYA	E-FD8
CDGM	H-ZF10	SCHOTT	N-SF8

2022-7-1	StP, AP, SP
2019-4-1	Transmittance
2015-4-1	Color Code, Prod. Freq.

HIKARI GLASS CO., LTD.

J-SF10

n_d = 1.728250 n_e = 1.734304

ν_d = 28.38 ν_e = 28.15

Glass code (d)
728284
Glass code (e)
734282

Spectral l.	Refractive idx
2.058	1.68423
1.970	1.68570
1.530	1.69287
1.129	1.70036
1.064	1.70191
t	1.70324
s	1.70878
A'	1.712868
r	1.716791
C	1.720838
C'	1.721994
He-Ne	1.723080
D	1.728028
d	1.728250
e	1.734304
F	1.746500
F'	1.748075
g	1.762074
h	1.776040
0.389	1.785117
i	–

Partial dispersion	
F-C	0.025662
F'-C'	0.026081
C-t	0.017595
C-A'	0.007970
d-C	0.007412
e-C	0.013466
g-d	0.033824
g-F	0.015574
h-g	0.013966
i-g	–
C'-t	0.018751
e-C'	0.012310
F'-e	0.013771
i-F'	–

Relative partial dispersion	
C-t／F-C	0.6856
C-A'／F-C	0.3106
d-C／F-C	0.2888
e-C／F-C	0.5247
g-d／F-C	1.3181
g-F／F-C	0.6069
h-g／F-C	0.5442
i-g／F-C	–
C'-t／F'-C'	0.7190
e-C'／F'-C'	0.4720
F'-e／F'-C'	0.5280
i-F'／F'-C'	–

Deviation of relative partial disp.	
ΔPdC	−0.0012
ΔPgF	0.0101

Internal CC (80%/5%)
392/362
Color Code (80%/5%)
415/365
CCI

B	0.00
G	2.38
R	2.48

Thermal properties	
CTE(−30,70) [1E-7/℃]	89
CTE(100,300) [1E-7/℃]	105
Tg [℃]	600
At [℃]	637
StP [℃]	548
AP [℃]	580
SP [℃]	698
Ht cndct. [W/m·K]	1.092
Sp. heat [kJ/kg·K]	0.722
Ht diffus. [1E-6 m2/sec]	0.493

Chemical properties [class]	
Acid res. (surface)	1
Alkaline detergent res.	1
Climate resistance	1
Water res. (powder)	2
Acid res. (powder)	1

Mechanical properties	
Knoop hardness	513 (5)
Abrasion hardness	159
Young's mod. [GPa]	88.6
Shear mod. [GPa]	35.4
Poisson's ratio	0.251
Stress optical coef. [1E-5 nm/cm／Pa]	2.79

Internal trans. (10mm)	
λ [nm]	τ
280	–
290	–
300	–
310	–
320	–
330	–
340	–
350	–
360	0.02
370	0.24
380	0.57
390	0.78
400	0.88
420	0.946
440	0.968
460	0.978
480	0.983
500	0.987
550	0.995
600	0.996
650	0.996
700	0.997
800	0.995
900	0.993
1000	0.994
1200	0.995
1400	0.995
1600	0.988
1800	0.972
2000	0.961
2200	0.927
2400	0.89

Specific gravity
3.06

Coef. disp. form. (pwr ser.)	
A0	2.87916509E+00
A1	−1.19049122E-02
A2	0.00000000E+00
A3	3.28054585E-02
A4	2.70047713E-03
A5	−4.76826023E-04
A6	1.07927203E-04
A7	−1.07672748E-05
A8	5.00986227E-07

Relative Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90 (ref.)	0.6	0.7	0.9	1.2	1.5	1.8	1.9	2.0	2.4	3.0	4.2	4.3	6.1	8.1	9.7
60 to 80 (ref.)	0.5	0.6	0.9	1.1	1.4	1.7	1.8	1.9	2.3	2.8	4.0	4.1	5.8	7.8	9.2
40 to 60	0.4	0.5	0.7	1.0	1.2	1.5	1.6	1.7	2.1	2.6	3.7	3.8	5.4	7.3	8.7
20 to 40	0.3	0.4	0.6	0.9	1.1	1.4	1.5	1.6	1.9	2.4	3.5	3.6	5.1	6.8	8.1
0 to 20	0.3	0.3	0.6	0.8	1.1	1.3	1.4	1.5	1.8	2.3	3.3	3.4	4.8	6.4	7.7
−20 to 0	0.3	0.4	0.6	0.8	1.0	1.3	1.3	1.4	1.8	2.2	3.1	3.2	4.6	6.1	7.2
−40 to −20	0.4	0.4	0.7	0.9	1.1	1.3	1.4	1.4	1.8	2.2	3.0	3.2	4.4	5.8	6.9
−60 to −40 (ref.)	0.6	0.6	0.8	1.0	1.2	1.4	1.5	1.6	1.9	2.2	3.1	3.2	4.3	5.7	6.6
−70 to −60 (ref.)	0.8	0.8	1.0	1.2	1.4	1.6	1.7	1.7	2.0	2.4	3.2	3.3	4.4	5.6	6.5

Absolute Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90	−0.4	−0.4	−0.1	0.2	0.5	0.8	0.8	0.9	1.3	1.9	3.1	3.2	4.9	7.0	8.6
60 to 80	−0.6	−0.6	−0.3	0.0	0.2	0.5	0.6	0.7	1.1	1.6	2.8	2.9	4.6	6.5	8.0
40 to 60	−0.9	−0.8	−0.6	−0.3	−0.1	0.2	0.3	0.4	0.8	1.2	2.3	2.5	4.0	5.9	7.3
20 to 40	−1.1	−1.1	−0.8	−0.6	−0.4	−0.1	0.0	0.1	0.4	0.9	1.9	2.1	3.5	5.3	6.6
0 to 20	−1.4	−1.3	−1.1	−0.9	−0.7	−0.4	−0.3	−0.3	0.1	0.5	1.5	1.6	3.0	4.6	5.8
−20 to 0	−1.6	−1.6	−1.4	−1.2	−1.0	−0.7	−0.6	−0.6	−0.3	0.2	1.1	1.2	2.5	4.0	5.1
−40 to −20	−1.9	−1.9	−1.6	−1.5	−1.2	−1.0	−1.0	−0.9	−0.6	−0.2	0.7	0.8	2.0	3.4	4.4
−60 to −40	−2.1	−2.1	−1.9	−1.7	−1.5	−1.3	−1.3	−1.2	−0.9	−0.6	0.2	0.3	1.4	2.7	3.7
−70 to −60	−2.3	−2.3	−2.1	−1.9	−1.8	−1.6	−1.5	−1.5	−1.2	−0.8	−0.1	0.0	1.1	2.3	3.1

Coef. disp. form. (frac. eq.)(ref.)	
P1	1.05750615E-01
Q1	7.65392188E+01
P2	2.21567515E-02
Q2	6.12519187E-02
P3	3.62700744E-01
Q3	8.59469460E-03

Fitting error of disp. form. σ [1E-6]		
	Visible	Infrared
Power ser. eq.	0.9	5.3
Frac. eq. (ref.)	2.0	12.4

Prod. Freq. (A to D)	B

Similar glass type			
OHARA	S-TIH10	HOYA	E-FD10、E-FD10L
CDGM	H-ZF4A	SCHOTT	N-SF10

2023-9-1	Prod. Freq.
2022-7-1	StP, AP, SP
2020-4-1	Similar glass type

HIKARI GLASS CO., LTD.

J-SF11

n_d = 1.784720 n_e = 1.791929

ν_d = 25.64 ν_e = 25.43

Glass code (d)
785256
Glass code (e)
792254

Spectral l.	Refractive idx
2.058	1.73456
1.970	1.73612
1.530	1.74381
1.129	1.75213
1.064	1.75389
t	1.75541
s	1.76180
A'	1.766569
r	1.771171
C	1.775941
C'	1.777306
He-Ne	1.778590
D	1.784456
d	1.784720
e	1.791929
F	1.806548
F'	1.808444
g	1.825394
h	1.842474
0.389	1.853672
i	–

Partial dispersion	
F-C	0.030607
F'-C'	0.031138
C-t	0.020531
C-A'	0.009372
d-C	0.008779
e-C	0.015988
g-d	0.040674
g-F	0.018846
h-g	0.017080
i-g	–
C'-t	0.021896
e-C'	0.014623
F'-e	0.016515
i-F'	–

Relative partial dispersion	
C-t／F-C	0.6708
C-A'／F-C	0.3062
d-C／F-C	0.2868
e-C／F-C	0.5224
g-d／F-C	1.3289
g-F／F-C	0.6157
h-g／F-C	0.5580
i-g／F-C	–
C'-t／F'-C'	0.7032
e-C'／F'-C'	0.4696
F'-e／F'-C'	0.5304
i-F'／F'-C'	–

Deviation of relative partial disp.	
ΔPdC	−0.0019
ΔPgF	0.0144

Internal CC (80%/5%)
397/364
Color Code (80%/5%)
430/365
CCI

B	0.00
G	3.12
R	3.25

Thermal properties	
CTE(−30,70) [1E-7/℃]	86
CTE(100,300) [1E-7/℃]	100
Tg [℃]	605
At [℃]	643
StP [℃]	557
AP [℃]	588
SP [℃]	704
Ht cndct. [W/m·K]	1.060
Sp. heat [kJ/kg·K]	0.697
Ht diffus. [1E-6 m2/sec]	0.468

Chemical properties [class]	
Acid res. (surface)	1
Alkaline detergent res.	1
Climate resistance	1
Water res. (powder)	1
Acid res. (powder)	1

Mechanical properties	
Knoop hardness	501 (5)
Abrasion hardness	130
Young's mod. [GPa]	91.9
Shear mod. [GPa]	36.5
Poisson's ratio	0.260
Stress optical coef. [1E-5 nm/cm／Pa]	2.75

Internal trans. (10mm)	
λ [nm]	τ
280	–
290	–
300	–
310	–
320	–
330	–
340	–
350	–
360	0.02
370	0.15
380	0.44
390	0.70
400	0.83
420	0.929
440	0.958
460	0.970
480	0.978
500	0.984
550	0.992
600	0.995
650	0.994
700	0.996
800	0.997
900	0.998
1000	0.998
1200	0.999
1400	0.999
1600	0.990
1800	0.973
2000	0.964
2200	0.931
2400	0.89

Specific gravity
3.25

Coef. disp. form. (pwr ser.)	
A0	3.05304325E+00
A1	−1.27339910E-02
A2	0.00000000E+00
A3	3.99774262E-02
A4	3.16619134E-03
A5	−5.02824259E-04
A6	1.22491876E-04
A7	−1.25325941E-05
A8	6.19354223E-07

Relative Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90 (ref.)	0.4	0.5	0.8	1.1	1.4	1.8	1.9	2.0	2.5	3.2	4.6	4.9	6.9	9.5	11.6
60 to 80 (ref.)	0.2	0.4	0.7	1.0	1.3	1.6	1.7	1.8	2.3	2.9	4.4	4.6	6.6	9.0	11.0
40 to 60	0.1	0.2	0.5	0.8	1.1	1.4	1.5	1.6	2.0	2.6	4.0	4.2	6.1	8.4	10.3
20 to 40	0.0	0.1	0.4	0.6	0.9	1.2	1.3	1.4	1.8	2.4	3.7	3.8	5.6	7.8	9.6
0 to 20	−0.1	0.0	0.3	0.5	0.7	1.0	1.1	1.2	1.6	2.2	3.4	3.5	5.2	7.3	8.9
−20 to 0	−0.2	−0.1	0.2	0.4	0.7	0.9	1.0	1.1	1.5	2.0	3.1	3.3	4.9	6.8	8.3
−40 to −20	−0.1	0.0	0.2	0.4	0.7	0.9	1.0	1.1	1.4	1.9	3.0	3.1	4.6	6.4	7.8
−60 to −40 (ref.)	0.0	0.1	0.4	0.5	0.7	1.0	1.1	1.1	1.5	1.9	2.9	3.1	4.4	6.1	7.3
−70 to −60 (ref.)	0.2	0.3	0.5	0.7	0.9	1.1	1.2	1.3	1.6	2.0	3.0	3.1	4.4	5.9	7.1

Absolute Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90	−0.7	−0.6	−0.2	0.0	0.3	0.7	0.8	0.9	1.4	2.0	3.5	3.7	5.8	8.4	10.4
60 to 80	−0.9	−0.8	−0.5	−0.2	0.1	0.4	0.5	0.6	1.1	1.7	3.1	3.3	5.3	7.8	9.7
40 to 60	−1.2	−1.1	−0.8	−0.6	−0.3	0.0	0.1	0.2	0.7	1.3	2.6	2.8	4.7	7.0	8.8
20 to 40	−1.6	−1.4	−1.1	−0.9	−0.7	−0.4	−0.3	−0.2	0.3	0.8	2.1	2.3	4.0	6.2	7.9
0 to 20	−1.9	−1.8	−1.5	−1.3	−1.0	−0.7	−0.7	−0.6	−0.2	0.4	1.6	1.7	3.4	5.4	7.0
−20 to 0	−2.2	−2.1	−1.8	−1.6	−1.4	−1.1	−1.0	−1.0	−0.6	−0.1	1.0	1.2	2.7	4.6	6.1
−40 to −20	−2.5	−2.4	−2.1	−1.9	−1.7	−1.5	−1.4	−1.3	−1.0	−0.5	0.5	0.7	2.1	3.8	5.2
−60 to −40	−2.8	−2.7	−2.5	−2.3	−2.1	−1.9	−1.8	−1.7	−1.4	−1.0	0.0	0.1	1.4	3.0	4.3
−70 to −60	−3.0	−2.9	−2.7	−2.5	−2.4	−2.2	−2.1	−2.0	−1.7	−1.3	−0.4	−0.3	1.0	2.4	3.6

Coef. disp. form. (frac. eq.)(ref.)	
P1	9.29465786E-02
Q1	6.79977659E+01
P2	2.55330790E-02
Q2	6.29260605E-02
P3	3.80476109E-01
Q3	9.01929143E-03

Fitting error of disp. form. σ [1E-6]		
	Visible	Infrared
Power ser. eq.	1.0	9.5
Frac. eq. (ref.)	2.7	14.1

Prod. Freq. (A to D)	B

Similar glass type			
OHARA	S-TIH11	HOYA	FD110
CDGM	H-ZF13	SCHOTT	N-SF11

2022-7-1	StP, AP, SP
2019-4-1	Transmittance
2016-4-1	Prod. Freq.

HIKARI GLASS CO., LTD.

J-SF13

n_d = 1.740770 n_e = 1.747068

ν_d = 27.74 ν_e = 27.52

Glass code (d)
741277
Glass code (e)
747275

Spectral l.	Refractive idx
2.058	1.69539
1.970	1.69688
1.530	1.70418
1.129	1.71187
1.064	1.71347
t	1.71484
s	1.72056
A'	1.724801
r	1.728868
C	1.733069
C'	1.734269
He-Ne	1.735397
D	1.740539
d	1.740770
e	1.747068
F	1.759772
F'	1.761414
g	1.776029
h	1.790639
0.389	1.800152
i	–

Partial dispersion	
F-C	0.026703
F'-C'	0.027145
C-t	0.018225
C-A'	0.008268
d-C	0.007701
e-C	0.013999
g-d	0.035259
g-F	0.016257
h-g	0.014610
i-g	–
C'-t	0.019425
e-C'	0.012799
F'-e	0.014346
i-F'	–

Relative partial dispersion	
C-t／F-C	0.6825
C-A'／F-C	0.3096
d-C／F-C	0.2884
e-C／F-C	0.5242
g-d／F-C	1.3204
g-F／F-C	0.6088
h-g／F-C	0.5471
i-g／F-C	–
C'-t／F'-C'	0.7156
e-C'／F'-C'	0.4715
F'-e／F'-C'	0.5285
i-F'／F'-C'	–

Deviation of relative partial disp.	
ΔPdC	−0.0013
ΔPgF	0.0110

Internal CC (80%/5%)
394/362
Color Code (80%/5%)
420/365
CCI

B	0.00
G	2.73
R	2.85

Thermal properties	
CTE(−30,70) [1E-7/℃]	86
CTE(100,300) [1E-7/℃]	103
Tg [℃]	604
At [℃]	636
StP [℃]	553
AP [℃]	585
SP [℃]	704
Ht cndct. [W/m·K]	1.132
Sp. heat [kJ/kg·K]	0.718
Ht diffus. [1E-6 m2/sec]	0.506

Chemical properties [class]	
Acid res. (surface)	1
Alkaline detergent res.	1
Climate resistance	1
Water res. (powder)	1
Acid res. (powder)	1

Mechanical properties	
Knoop hardness	492 (5)
Abrasion hardness	160
Young's mod. [GPa]	89.5
Shear mod. [GPa]	35.7
Poisson's ratio	0.254
Stress optical coef. [1E-5 nm/cm／Pa]	2.79

Internal trans. (10mm)	
λ [nm]	τ
280	–
290	–
300	–
310	–
320	–
330	–
340	–
350	–
360	0.03
370	0.20
380	0.51
390	0.74
400	0.85
420	0.938
440	0.962
460	0.972
480	0.979
500	0.984
550	0.992
600	0.994
650	0.994
700	0.995
800	0.994
900	0.993
1000	0.994
1200	0.995
1400	0.994
1600	0.987
1800	0.971
2000	0.961
2200	0.925
2400	0.89

Specific gravity
3.1

Coef. disp. form. (pwr ser.)	
A0	2.91742250E+00
A1	−1.21278695E-02
A2	0.00000000E+00
A3	3.44734103E-02
A4	2.66756706E-03
A5	−4.32503622E-04
A6	1.00646069E-04
A7	−1.00610625E-05
A8	4.80261151E-07

Relative Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90 (ref.)	0.7	0.8	1.1	1.4	1.7	2.0	2.1	2.2	2.6	3.2	4.4	4.6	6.4	8.6	10.2
60 to 80 (ref.)	0.5	0.6	1.0	1.3	1.5	1.8	1.9	2.0	2.4	3.0	4.2	4.4	6.1	8.2	9.8
40 to 60	0.4	0.5	0.8	1.1	1.4	1.7	1.7	1.8	2.2	2.7	3.9	4.0	5.7	7.6	9.2
20 to 40	0.3	0.4	0.7	1.0	1.2	1.5	1.6	1.6	2.0	2.5	3.6	3.8	5.3	7.2	8.6
0 to 20	0.2	0.3	0.6	0.9	1.1	1.4	1.4	1.5	1.9	2.3	3.4	3.5	5.0	6.7	8.1
−20 to 0	0.2	0.3	0.6	0.8	1.0	1.3	1.4	1.4	1.8	2.2	3.2	3.3	4.7	6.3	7.6
−40 to −20	0.3	0.4	0.6	0.8	1.1	1.3	1.4	1.4	1.8	2.2	3.1	3.2	4.5	6.0	7.2
−60 to −40 (ref.)	0.4	0.5	0.8	1.0	1.2	1.4	1.5	1.5	1.8	2.2	3.1	3.2	4.4	5.8	6.9
−70 to −60 (ref.)	0.6	0.7	0.9	1.1	1.3	1.6	1.6	1.7	2.0	2.3	3.1	3.3	4.4	5.8	6.8

Absolute Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90	−0.4	−0.3	0.1	0.3	0.6	0.9	1.0	1.1	1.5	2.1	3.3	3.5	5.3	7.4	9.1
60 to 80	−0.6	−0.5	−0.2	0.1	0.4	0.7	0.8	0.8	1.3	1.8	3.0	3.1	4.8	6.9	8.5
40 to 60	−0.9	−0.8	−0.5	−0.2	0.0	0.3	0.4	0.5	0.9	1.4	2.5	2.7	4.3	6.2	7.8
20 to 40	−1.2	−1.1	−0.8	−0.5	−0.3	0.0	0.1	0.1	0.5	1.0	2.1	2.2	3.7	5.6	7.0
0 to 20	−1.5	−1.4	−1.1	−0.9	−0.6	−0.4	−0.3	−0.2	0.1	0.6	1.6	1.7	3.2	4.9	6.2
−20 to 0	−1.7	−1.7	−1.4	−1.2	−0.9	−0.7	−0.6	−0.6	−0.2	0.2	1.1	1.3	2.6	4.2	5.5
−40 to −20	−2.0	−2.0	−1.7	−1.5	−1.3	−1.1	−1.0	−0.9	−0.6	−0.2	0.7	0.8	2.0	3.6	4.7
−60 to −40	−2.3	−2.2	−2.0	−1.8	−1.6	−1.4	−1.3	−1.3	−1.0	−0.6	0.2	0.3	1.5	2.9	4.0
−70 to −60	−2.5	−2.5	−2.2	−2.0	−1.9	−1.7	−1.6	−1.5	−1.3	−0.9	−0.1	0.0	1.1	2.4	3.4

Coef. disp. form. (frac. eq.)(ref.)	
P1	1.12550486E-01
Q1	8.07969473E+01
P2	2.33049439E-02
Q2	6.13187337E-02
P3	3.66354523E-01
Q3	8.63804110E-03

Fitting error of disp. form. σ [1E-6]		
	Visible	Infrared
Power ser. eq.	0.9	4.8
Frac. eq. (ref.)	2.3	10.7

Prod. Freq. (A to D)	C

Similar glass type			
OHARA	S-TIH13	HOYA	E-FD13
CDGM	H-ZF50	SCHOTT	–

2022-7-1	StP, AP, SP
2019-4-1	Transmittance
2018-4-1	Prod. Freq.

J-SF14

n_d = 1.761820 n_e = 1.768573

ν_d = 26.58 ν_e = 26.37

Glass code (d)
762266
Glass code (e)
769264

Spectral l.	Refractive idx
2.058	1.71383
1.970	1.71538
1.530	1.72298
1.129	1.73105
1.064	1.73273
t	1.73418
s	1.74025
A'	1.744758
r	1.749094
C	1.753580
C'	1.754862
He-Ne	1.756069
D	1.761573
d	1.761820
e	1.768573
F	1.782237
F'	1.784006
g	1.799796
h	1.815656
0.389	1.826028
i	–

Partial dispersion	
F-C	0.028657
F'-C'	0.029144
C-t	0.019396
C-A'	0.008822
d-C	0.008240
e-C	0.014993
g-d	0.037976
g-F	0.017559
h-g	0.015860
i-g	–
C'-t	0.020678
e-C'	0.013711
F'-e	0.015433
i-F'	–

Relative partial dispersion	
C-t／F-C	0.6768
C-A'／F-C	0.3078
d-C／F-C	0.2875
e-C／F-C	0.5232
g-d／F-C	1.3252
g-F／F-C	0.6127
h-g／F-C	0.5534
i-g／F-C	–
C'-t／F'-C'	0.7095
e-C'／F'-C'	0.4705
F'-e／F'-C'	0.5295
i-F'／F'-C'	–

Deviation of relative partial disp.	
ΔPdC	−0.0017
ΔPgF	0.0130

Internal CC (80%/5%)
396/364
Color Code (80%/5%)
425/365

CCI	
B	0.00
G	2.91
R	3.06

Thermal properties	
CTE(−30,70) [1E-7/℃]	83
CTE(100,300) [1E-7/℃]	99
Tg [℃]	617
At [℃]	647
StP [℃]	563
AP [℃]	597
SP [℃]	716
Ht cndct. [W/m·K]	1.020
Sp. heat [kJ/kg·K]	0.694
Ht diffus. [1E-6 m2/sec]	0.465

Chemical properties [class]	
Acid res. (surface)	1
Alkaline detergent res.	1
Climate resistance	1
Water res. (powder)	1
Acid res. (powder)	1

Mechanical properties	
Knoop hardness	513 (5)
Abrasion hardness	165
Young's mod. [GPa]	91.7
Shear mod. [GPa]	36.6
Poisson's ratio	0.254
Stress optical coef. [1E-5 nm/cm／Pa]	3.17

Internal trans. (10mm)	
λ [nm]	τ
280	–
290	–
300	–
310	–
320	–
330	–
340	–
350	–
360	0.02
370	0.15
380	0.45
390	0.71
400	0.84
420	0.937
440	0.963
460	0.973
480	0.979
500	0.985
550	0.993
600	0.996
650	0.996
700	0.997
800	0.997
900	0.997
1000	0.997
1200	0.998
1400	0.994
1600	0.989
1800	0.977
2000	0.972
2200	0.944
2400	0.922

Specific gravity
3.17

Coef. disp. form. (pwr ser.)	
A0	2.98193445E+00
A1	−1.26593840E-02
A2	0.00000000E+00
A3	3.70386685E-02
A4	2.96054842E-03
A5	−4.81643932E-04
A6	1.14549779E-04
A7	−1.16507463E-05
A8	5.68089035E-07

Relative Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90 (ref.)	1.3	1.4	1.7	2.0	2.2	2.6	2.7	2.8	3.2	3.9	5.3	5.5	7.5	9.9	11.8
60 to 80 (ref.)	1.2	1.3	1.6	1.8	2.1	2.4	2.5	2.6	3.0	3.6	5.0	5.2	7.1	9.4	11.3
40 to 60	1.0	1.1	1.4	1.6	1.9	2.1	2.2	2.3	2.8	3.3	4.6	4.8	6.6	8.8	10.5
20 to 40	0.9	1.0	1.2	1.4	1.7	2.0	2.0	2.1	2.5	3.1	4.3	4.5	6.2	8.2	9.8
0 to 20	0.8	0.9	1.1	1.3	1.5	1.8	1.9	2.0	2.3	2.9	4.0	4.2	5.8	7.7	9.2
−20 to 0	0.8	0.8	1.1	1.2	1.5	1.7	1.8	1.8	2.2	2.7	3.8	3.9	5.4	7.2	8.6
−40 to −20	0.8	0.9	1.1	1.2	1.4	1.7	1.7	1.8	2.1	2.6	3.6	3.8	5.2	6.8	8.1
−60 to −40 (ref.)	0.9	1.0	1.2	1.3	1.5	1.7	1.8	1.9	2.2	2.6	3.6	3.7	5.0	6.5	7.7
−70 to −60 (ref.)	1.1	1.2	1.3	1.5	1.7	1.9	1.9	2.0	2.3	2.7	3.6	3.7	5.0	6.4	7.5

Absolute Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90	0.2	0.3	0.6	0.9	1.2	1.5	1.6	1.7	2.1	2.8	4.2	4.4	6.3	8.8	10.6
60 to 80	0.0	0.1	0.4	0.6	0.9	1.2	1.3	1.4	1.8	2.4	3.8	4.0	5.9	8.2	10.0
40 to 60	−0.3	−0.2	0.1	0.3	0.5	0.8	0.9	1.0	1.4	2.0	3.3	3.4	5.2	7.4	9.1
20 to 40	−0.6	−0.5	−0.3	−0.1	0.2	0.4	0.5	0.6	1.0	1.5	2.7	2.9	4.6	6.6	8.2
0 to 20	−0.9	−0.8	−0.6	−0.4	−0.2	0.0	0.1	0.2	0.6	1.1	2.2	2.4	4.0	5.9	7.3
−20 to 0	−1.2	−1.2	−0.9	−0.8	−0.6	−0.3	−0.3	−0.2	0.2	0.6	1.7	1.9	3.3	5.1	6.4
−40 to −20	−1.5	−1.5	−1.3	−1.1	−0.9	−0.7	−0.6	−0.6	−0.2	0.2	1.2	1.3	2.7	4.3	5.6
−60 to −40	−1.9	−1.8	−1.6	−1.5	−1.3	−1.1	−1.0	−1.0	−0.7	−0.3	0.7	0.8	2.0	3.5	4.7
−70 to −60	−2.1	−2.0	−1.9	−1.7	−1.6	−1.4	−1.3	−1.3	−1.0	−0.6	0.3	0.4	1.6	3.0	4.0

Coef. disp. form. (frac. eq.)(ref.)	
P1	1.05344766E-01
Q1	7.48265970E+01
P2	2.43859017E-02
Q2	6.24217837E-02
P3	3.73151673E-01
Q3	8.83028805E-03

Fitting error of disp. form. σ [1E-6]		
	Visible	Infrared
Power ser. eq.	0.8	5.7
Frac. eq. (ref.)	2.8	10.3

Prod. Freq. (A to D)	C

Similar glass type			
OHARA	S-TIH14	HOYA	FD140
CDGM	H-ZF12	SCHOTT	N-SF14

2022-7-1	StP, AP, SP
2019-4-1	Transmittance
2015-4-1	Color Code, Prod. Freq.

HIKARI GLASS CO., LTD.

J-SF15

n_d = 1.698950 n_e = 1.704427

ν_d = 30.13 ν_e = 29.89

Glass code (d)
699301
Glass code (e)
704299

Spectral l.	Refractive idx
2.058	1.65842
1.970	1.65981
1.530	1.66653
1.129	1.67350
1.064	1.67493
t	1.67616
s	1.68124
A'	1.684973
r	1.688547
C	1.692227
C'	1.693276
He-Ne	1.694263
D	1.698749
d	1.698950
e	1.704427
F	1.715424
F'	1.716840
g	1.729392
h	1.741843
0.389	1.749895
i	–

Partial dispersion	
F-C	0.023197
F'-C'	0.023564
C-t	0.016067
C-A'	0.007254
d-C	0.006723
e-C	0.012200
g-d	0.030442
g-F	0.013968
h-g	0.012451
i-g	–
C'-t	0.017116
e-C'	0.011151
F'-e	0.012413
i-F'	–

Relative partial dispersion	
C-t／F-C	0.6926
C-A'／F-C	0.3127
d-C／F-C	0.2898
e-C／F-C	0.5259
g-d／F-C	1.3123
g-F／F-C	0.6021
h-g／F-C	0.5368
i-g／F-C	–
C'-t／F'-C'	0.7264
e-C'／F'-C'	0.4732
F'-e／F'-C'	0.5268
i-F'／F'-C'	–

Deviation of relative partial disp.	
ΔPdC	−0.0010
ΔPgF	0.0083

Internal CC (80%/5%)
387/358
Color Code (80%/5%)
405/360

CCI	
B	0.00
G	1.73
R	1.79

Thermal properties	
CTE(−30,70) [1E-7/℃]	92
CTE(100,300) [1E-7/℃]	113
Tg [℃]	571
At [℃]	606
StP [℃]	522
AP [℃]	554
SP [℃]	675
Ht cndct. [W/m·K]	1.071
Sp. heat [kJ/kg·K]	0.738
Ht diffus. [1E-6 m2/sec]	0.490

Chemical properties [class]	
Acid res. (surface)	1
Alkaline detergent res.	1
Climate resistance	1
Water res. (powder)	2
Acid res. (powder)	1

Mechanical properties	
Knoop hardness	468 (5)
Abrasion hardness	167
Young's mod. [GPa]	84.2
Shear mod. [GPa]	33.6
Poisson's ratio	0.254
Stress optical coef. [1E-5 nm/cm／Pa]	2.84

Internal trans. (10mm)	
λ [nm]	τ
280	–
290	–
300	–
310	–
320	–
330	–
340	–
350	–
360	0.08
370	0.34
380	0.66
390	0.84
400	0.916
420	0.963
440	0.975
460	0.982
480	0.987
500	0.990
550	0.995
600	0.996
650	0.996
700	0.997
800	0.995
900	0.993
1000	0.994
1200	0.996
1400	0.991
1600	0.988
1800	0.970
2000	0.951
2200	0.907
2400	0.86

Specific gravity
2.95

Coef. disp. form. (pwr ser.)	
A0	2.79018804E+00
A1	−1.10845992E-02
A2	0.00000000E+00
A3	2.97256583E-02
A4	2.19337541E-03
A5	−3.59769888E-04
A6	8.12762977E-05
A7	−8.02301606E-06
A8	3.73019506E-07

Relative Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90 (ref.)	−0.1	0.0	0.2	0.5	0.7	1.0	1.1	1.2	1.5	2.0	3.1	3.2	4.7	6.5	7.8
60 to 80 (ref.)	−0.2	−0.1	0.2	0.4	0.6	0.9	1.0	1.0	1.4	1.8	2.9	3.0	4.5	6.2	7.4
40 to 60	−0.3	−0.2	0.0	0.3	0.5	0.7	0.8	0.9	1.2	1.7	2.7	2.8	4.2	5.8	6.9
20 to 40	−0.4	−0.3	0.0	0.2	0.4	0.6	0.7	0.8	1.1	1.5	2.4	2.6	3.9	5.4	6.5
0 to 20	−0.4	−0.3	−0.1	0.1	0.3	0.5	0.6	0.7	1.0	1.4	2.3	2.4	3.6	5.1	6.1
−20 to 0	−0.4	−0.3	−0.1	0.1	0.3	0.5	0.6	0.6	0.9	1.3	2.2	2.3	3.5	4.8	5.8
−40 to −20	−0.3	−0.2	0.0	0.2	0.4	0.6	0.6	0.7	1.0	1.3	2.1	2.2	3.3	4.6	5.5
−60 to −40 (ref.)	−0.1	0.0	0.2	0.3	0.5	0.7	0.8	0.8	1.1	1.4	2.2	2.3	3.3	4.5	5.3
−70 to −60 (ref.)	0.1	0.2	0.4	0.5	0.7	0.9	0.9	1.0	1.3	1.6	2.3	2.4	3.4	4.5	5.3

Absolute Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90	−1.1	−1.1	−0.8	−0.6	−0.3	0.0	0.0	0.1	0.5	0.9	2.0	2.2	3.6	5.4	6.7
60 to 80	−1.3	−1.2	−1.0	−0.8	−0.5	−0.3	−0.2	−0.1	0.2	0.7	1.7	1.9	3.3	5.0	6.2
40 to 60	−1.6	−1.5	−1.2	−1.0	−0.8	−0.6	−0.5	−0.4	−0.1	0.3	1.3	1.5	2.8	4.4	5.6
20 to 40	−1.8	−1.7	−1.5	−1.3	−1.1	−0.8	−0.8	−0.7	−0.4	0.0	0.9	1.1	2.4	3.9	4.9
0 to 20	−2.0	−2.0	−1.8	−1.6	−1.4	−1.1	−1.1	−1.0	−0.7	−0.3	0.6	0.7	1.9	3.3	4.3
−20 to 0	−2.3	−2.2	−2.0	−1.8	−1.6	−1.4	−1.4	−1.3	−1.0	−0.7	0.2	0.3	1.4	2.8	3.7
−40 to −20	−2.5	−2.5	−2.3	−2.1	−1.9	−1.7	−1.7	−1.6	−1.3	−1.0	−0.2	−0.1	1.0	2.2	3.1
−60 to −40	−2.8	−2.7	−2.5	−2.4	−2.2	−2.0	−2.0	−1.9	−1.7	−1.3	−0.6	−0.5	0.5	1.6	2.4
−70 to −60	−3.0	−2.9	−2.7	−2.6	−2.4	−2.2	−2.2	−2.1	−1.9	−1.6	−0.9	−0.8	0.1	1.2	2.0

Coef. disp. form. (frac. eq.)(ref.)	
P1	1.11922422E-01
Q1	8.31931901E+01
P2	2.08150315E-02
Q2	5.98208007E-02
P3	3.52661928E-01
Q3	8.29447247E-03

Fitting error of disp. form. σ [1E-6]		
	Visible	Infrared
Power ser. eq.	0.8	5.0
Frac. eq. (ref.)	1.9	9.8

Prod. Freq. (A to D)	C

Similar glass type			
OHARA	S-TIM35	HOYA	E-FD15、E-FD15L
CDGM	H-ZF11	SCHOTT	N-SF15

2022-7-1	StP, AP, SP
2020-4-1	Similar glass type
2019-4-1	Transmittance

HIKARI GLASS CO., LTD.

J-SF03

n_d = 1.846660 n_e = 1.855032

ν_d = 23.80 ν_e = 23.61

Glass code (d)
847238
Glass code (e)
855236

Spectral l.	Refractive idx
2.058	1.79055
1.970	1.79217
1.530	1.80027
1.129	1.80936
1.064	1.81132
t	1.81303
s	1.82027
A'	1.825725
r	1.831009
C	1.836505
C'	1.838080
He-Ne	1.839564
D	1.846354
d	1.846660
e	1.855032
F	1.872084
F'	1.874302
g	1.894197
h	1.914364
0.389	1.927659
i	–

Partial dispersion	
F-C	0.035579
F'-C'	0.036222
C-t	0.023473
C-A'	0.010780
d-C	0.010155
e-C	0.018527
g-d	0.047537
g-F	0.022113
h-g	0.020167
i-g	–
C'-t	0.025048
e-C'	0.016952
F'-e	0.019270
i-F'	–

Relative partial dispersion	
C-t／F-C	0.6597
C-A'／F-C	0.3030
d-C／F-C	0.2854
e-C／F-C	0.5207
g-d／F-C	1.3361
g-F／F-C	0.6215
h-g／F-C	0.5668
i-g／F-C	–
C'-t／F'-C'	0.6915
e-C'／F'-C'	0.4680
F'-e／F'-C'	0.5320
i-F'／F'-C'	–

Deviation of relative partial disp.	
ΔPdC	−0.0025
ΔPgF	0.0171

Internal CC (80%/5%)
407/367
Color Code (70%/5%)
415/370

CCI	
B	0.00
G	4.96
R	5.03

Thermal properties	
CTE(−30,70) [1E-7/℃]	81
CTE(100,300) [1E-7/℃]	102
Tg [℃]	615
At [℃]	648
StP [℃]	–
AP [℃]	–
SP [℃]	–
Ht cndct. [W/m·K]	0.970
Sp. heat [kJ/kg·K]	0.590
Ht diffus. [1E-6 m2/sec]	0.466

Chemical properties [class]	
Acid res. (surface)	1
Alkaline detergent res.	1
Climate resistance	1
Water res. (powder)	1
Acid res. (powder)	1

Mechanical properties	
Knoop hardness	492 (5)
Abrasion hardness	179
Young's mod. [GPa]	94.4
Shear mod. [GPa]	37.3
Poisson's ratio	0.266
Stress optical coef. [1E-5 nm/cm／Pa]	2.92

Internal trans. (10mm)	
λ [nm]	τ
280	–
290	–
300	–
310	–
320	–
330	–
340	–
350	–
360	–
370	0.09
380	0.32
390	0.57
400	0.73
420	0.87
440	0.927
460	0.954
480	0.968
500	0.976
550	0.987
600	0.989
650	0.987
700	0.989
800	0.991
900	0.993
1000	0.994
1200	0.997
1400	0.999
1600	0.991
1800	0.983
2000	0.977
2200	0.962
2400	0.938

Specific gravity
3.53

Coef. disp. form. (pwr ser.)	
A0	3.25089291E+00
A1	−1.33244110E-02
A2	0.00000000E+00
A3	4.84040988E-02
A4	3.26383680E-03
A5	−4.01470701E-04
A6	1.16583198E-04
A7	−1.27242455E-05
A8	6.96171808E-07

Relative Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90 (ref.)	−0.4	−0.3	0.0	0.4	0.7	1.1	1.2	1.3	1.9	2.7	4.4	4.6	7.1	10.2	12.7
60 to 80 (ref.)	−0.6	−0.4	0.0	0.2	0.5	0.9	1.0	1.1	1.7	2.4	4.1	4.3	6.7	9.6	12.0
40 to 60	−0.7	−0.6	−0.2	0.0	0.3	0.7	0.8	0.9	1.4	2.1	3.7	3.9	6.1	8.9	11.2
20 to 40	−0.9	−0.7	−0.4	−0.1	0.2	0.5	0.6	0.7	1.2	1.8	3.3	3.5	5.6	8.3	10.3
0 to 20	−1.0	−0.8	−0.5	−0.3	0.0	0.3	0.4	0.5	1.0	1.6	3.0	3.2	5.2	7.6	9.6
−20 to 0	−1.0	−0.9	−0.6	−0.3	−0.1	0.2	0.3	0.4	0.9	1.4	2.8	3.0	4.8	7.1	8.9
−40 to −20	−0.9	−0.8	−0.5	−0.3	−0.1	0.2	0.3	0.4	0.8	1.3	2.6	2.8	4.5	6.6	8.2
−60 to −40 (ref.)	−0.8	−0.7	−0.4	−0.2	0.0	0.3	0.4	0.4	0.8	1.4	2.5	2.7	4.3	6.2	7.7
−70 to −60 (ref.)	−0.6	−0.5	−0.2	0.0	0.2	0.4	0.5	0.6	1.0	1.4	2.6	2.7	4.2	6.0	7.4

Absolute Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90	−1.6	−1.4	−1.0	−0.7	−0.4	0.0	0.1	0.2	0.8	1.5	3.2	3.4	5.9	9.0	11.4
60 to 80	−1.8	−1.7	−1.3	−1.0	−0.7	−0.3	−0.2	−0.1	0.4	1.2	2.8	3.0	5.4	8.3	10.7
40 to 60	−2.1	−2.0	−1.6	−1.4	−1.1	−0.7	−0.6	−0.5	0.0	0.7	2.2	2.5	4.7	7.4	9.7
20 to 40	−2.4	−2.3	−2.0	−1.7	−1.4	−1.1	−1.0	−0.9	−0.4	0.2	1.7	1.9	4.0	6.6	8.6
0 to 20	−2.7	−2.6	−2.3	−2.1	−1.8	−1.5	−1.4	−1.3	−0.9	−0.2	1.1	1.3	3.3	5.7	7.6
−20 to 0	−3.1	−2.9	−2.7	−2.4	−2.2	−1.9	−1.8	−1.7	−1.3	−0.7	0.6	0.8	2.6	4.8	6.6
−40 to −20	−3.4	−3.3	−3.0	−2.8	−2.6	−2.3	−2.2	−2.1	−1.7	−1.2	0.0	0.2	1.9	3.9	5.6
−60 to −40	−3.7	−3.6	−3.3	−3.1	−2.9	−2.7	−2.6	−2.5	−2.1	−1.7	−0.5	−0.4	1.2	3.1	4.5
−70 to −60	−3.9	−3.8	−3.6	−3.4	−3.2	−3.0	−2.9	−2.8	−2.5	−2.0	−0.9	−0.8	0.7	2.4	3.8

Coef. disp. form. (frac. eq.)(ref.)	
P1	1.11923941E-01
Q1	8.28410074E+01
P2	3.04841319E-02
Q2	6.23699294E-02
P3	3.97973273E-01
Q3	9.10166610E-03

Fitting error of disp. form. σ [1E-6]		
	Visible	Infrared
Power ser. eq.	0.9	6.0
Frac. eq. (ref.)	3.4	11.1

Prod. Freq. (A to D)	A

Similar glass type			
OHARA	S-TIH53	HOYA	FDS90
CDGM	H-ZF52	SCHOTT	N-SF57

2019-4-1	Transmittance
2018-4-1	Similar glass type
2015-4-1	Color Code, Similar glass type

HIKARI GLASS CO., LTD.

J-SF03HS

n_d = 1.846660 n_e = 1.855032

ν_d = 23.80 ν_e = 23.61

Glass code (d)
847238
Glass code (e)
855236

Spectral l.	Refractive idx
2.058	1.79055
1.970	1.79217
1.530	1.80027
1.129	1.80936
1.064	1.81132
t	1.81303
s	1.82027
A'	1.825725
r	1.831009
C	1.836505
C'	1.838080
He-Ne	1.839564
D	1.846354
d	1.846660
e	1.855032
F	1.872084
F'	1.874302
g	1.894197
h	1.914364
0.389	1.927659
i	–

Partial dispersion	
F-C	0.035579
F'-C'	0.036222
C-t	0.023473
C-A'	0.010780
d-C	0.010155
e-C	0.018527
g-d	0.047537
g-F	0.022113
h-g	0.020167
i-g	–
C'-t	0.025048
e-C'	0.016952
F'-e	0.019270
i-F'	–

Relative partial dispersion	
C-t／F-C	0.6597
C-A'／F-C	0.3030
d-C／F-C	0.2854
e-C／F-C	0.5207
g-d／F-C	1.3361
g-F／F-C	0.6215
h-g／F-C	0.5668
i-g／F-C	–
C'-t／F'-C'	0.6915
e-C'／F'-C'	0.4680
F'-e／F'-C'	0.5320
i-F'／F'-C'	–

Deviation of relative partial disp.	
ΔPdC	−0.0025
ΔPgF	0.0171

Internal CC (80%/5%)
398/367
Color Code (70%/5%)
405/370
CCI

B	0.00
G	3.22
R	3.39

Thermal properties	
CTE(−30,70) [1E-7/℃]	81
CTE(100,300) [1E-7/℃]	102
Tg [℃]	615
At [℃]	648
StP [℃]	–
AP [℃]	–
SP [℃]	–
Ht cndct. [W/m·K]	0.970
Sp. heat [kJ/kg·K]	0.590
Ht diffus. [1E-6 m2/sec]	0.466

Chemical properties [class]	
Acid res. (surface)	1
Alkaline detergent res.	1
Climate resistance	1
Water res. (powder)	1
Acid res. (powder)	1

Mechanical properties	
Knoop hardness	492 (5)
Abrasion hardness	179
Young's mod. [GPa]	94.4
Shear mod. [GPa]	37.3
Poisson's ratio	0.266
Stress optical coef. [1E-5 nm/cm／Pa]	2.92

Internal trans. (10mm)	
λ [nm]	τ
280	–
290	–
300	–
310	–
320	–
330	–
340	–
350	–
360	–
370	0.11
380	0.43
390	0.70
400	0.83
420	0.925
440	0.956
460	0.970
480	0.977
500	0.982
550	0.992
600	0.995
650	0.995
700	0.997
800	0.998
900	0.999
1000	0.998
1200	0.996
1400	0.993
1600	0.990
1800	0.986
2000	0.976
2200	0.953
2400	0.914

Specific gravity
3.53

Coef. disp. form. (pwr ser.)	
A0	3.25089291E+00
A1	−1.33244110E-02
A2	0.00000000E+00
A3	4.84040988E-02
A4	3.26383680E-03
A5	−4.01470701E-04
A6	1.16583198E-04
A7	−1.27242455E-05
A8	6.96171808E-07

Relative Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90 (ref.)	−0.4	−0.3	0.0	0.4	0.7	1.1	1.2	1.3	1.9	2.7	4.4	4.6	7.1	10.2	12.7
60 to 80 (ref.)	−0.6	−0.4	0.0	0.2	0.5	0.9	1.0	1.1	1.7	2.4	4.1	4.3	6.7	9.6	12.0
40 to 60	−0.7	−0.6	−0.2	0.0	0.3	0.7	0.8	0.9	1.4	2.1	3.7	3.9	6.1	8.9	11.2
20 to 40	−0.9	−0.7	−0.4	−0.1	0.2	0.5	0.6	0.7	1.2	1.8	3.3	3.5	5.6	8.3	10.3
0 to 20	−1.0	−0.8	−0.5	−0.3	0.0	0.3	0.4	0.5	1.0	1.6	3.0	3.2	5.2	7.6	9.6
−20 to 0	−1.0	−0.9	−0.6	−0.3	−0.1	0.2	0.3	0.4	0.9	1.4	2.8	3.0	4.8	7.1	8.9
−40 to −20	−0.9	−0.8	−0.5	−0.3	−0.1	0.2	0.3	0.4	0.8	1.3	2.6	2.8	4.5	6.6	8.2
−60 to −40 (ref.)	−0.8	−0.7	−0.4	−0.2	0.0	0.3	0.4	0.4	0.8	1.4	2.5	2.7	4.3	6.2	7.7
−70 to −60 (ref.)	−0.6	−0.5	−0.2	0.0	0.2	0.4	0.5	0.6	1.0	1.4	2.6	2.7	4.2	6.0	7.4

Absolute Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90	−1.6	−1.4	−1.0	−0.7	−0.4	0.0	0.1	0.2	0.8	1.5	3.2	3.4	5.9	9.0	11.4
60 to 80	−1.8	−1.7	−1.3	−1.0	−0.7	−0.3	−0.2	−0.1	0.4	1.2	2.8	3.0	5.4	8.3	10.7
40 to 60	−2.1	−2.0	−1.6	−1.4	−1.1	−0.7	−0.6	−0.5	0.0	0.7	2.2	2.5	4.7	7.4	9.7
20 to 40	−2.4	−2.3	−2.0	−1.7	−1.4	−1.1	−1.0	−0.9	−0.4	0.2	1.7	1.9	4.0	6.6	8.6
0 to 20	−2.7	−2.6	−2.3	−2.1	−1.8	−1.5	−1.4	−1.3	−0.9	−0.2	1.1	1.3	3.3	5.7	7.6
−20 to 0	−3.1	−2.9	−2.7	−2.4	−2.2	−1.9	−1.8	−1.7	−1.3	−0.7	0.6	0.8	2.6	4.8	6.6
−40 to −20	−3.4	−3.3	−3.0	−2.8	−2.6	−2.3	−2.2	−2.1	−1.7	−1.2	0.0	0.2	1.9	3.9	5.6
−60 to −40	−3.7	−3.6	−3.3	−3.1	−2.9	−2.7	−2.6	−2.5	−2.1	−1.7	−0.5	−0.4	1.2	3.1	4.5
−70 to −60	−3.9	−3.8	−3.6	−3.4	−3.2	−3.0	−2.9	−2.8	−2.5	−2.0	−0.9	−0.8	0.7	2.4	3.8

Coef. disp. form. (frac. eq.)(ref.)	
P1	1.11923941E-01
Q1	8.28410074E+01
P2	3.04841319E-02
Q2	6.23699294E-02
P3	3.97973273E-01
Q3	9.10166610E-03

Fitting error of disp. form. σ [1E-6]		
	Visible	Infrared
Power ser. eq.	0.9	6.0
Frac. eq. (ref.)	3.4	11.1

Prod. Freq. (A to D)	A

Similar glass type			
OHARA	S-TIH53W	HOYA	FDS90-SG
CDGM	H-ZF52GT	SCHOTT	N-SF57HT

2019-4-1	Transmittance
2018-4-1	Similar glass type
2017-4-1	1st edition

HIKARI GLASS CO., LTD.

J-SFS3

n_d = 1.784700 n_e = 1.791740

ν_d = 26.27 ν_e = 26.06

Glass code (d)
785263
Glass code (e)
792261

Spectral l.	Refractive idx
2.058	1.73526
1.970	1.73683
1.530	1.74451
1.129	1.75275
1.064	1.75448
t	1.75598
s	1.76226
A'	1.766938
r	1.771447
C	1.776116
C'	1.777451
He-Ne	1.778708
D	1.784442
d	1.784700
e	1.791740
F	1.805989
F'	1.807834
g	1.824304
h	1.840840
0.389	1.851648
i	–

Partial dispersion	
F-C	0.029873
F'-C'	0.030383
C-t	0.020135
C-A'	0.009178
d-C	0.008584
e-C	0.015624
g-d	0.039604
g-F	0.018315
h-g	0.016536
i-g	–
C'-t	0.021470
e-C'	0.014289
F'-e	0.016094
i-F'	–

Relative partial dispersion	
C-t／F-C	0.6740
C-A'／F-C	0.3072
d-C／F-C	0.2873
e-C／F-C	0.5230
g-d／F-C	1.3257
g-F／F-C	0.6131
h-g／F-C	0.5535
i-g／F-C	–
C'-t／F'-C'	0.7066
e-C'／F'-C'	0.4703
F'-e／F'-C'	0.5297
i-F'／F'-C'	–

Deviation of relative partial disp.	
ΔPdC	−0.0017
ΔPgF	0.0128

Internal CC (80%/5%)
399/363
Color Code (80%/5%)
435/365

CCI	
B	0.00
G	3.37
R	3.45

Thermal properties	
CTE(−30,70) [1E-7/℃]	84
CTE(100,300) [1E-7/℃]	104
Tg [℃]	581
At [℃]	626
StP [℃]	536
AP [℃]	569
SP [℃]	691
Ht cndct. [W/m·K]	1.080
Sp. heat [kJ/kg·K]	0.630
Ht diffus. [1E-6 m2/sec]	0.415

Chemical properties [class]	
Acid res. (surface)	1
Alkaline detergent res.	1
Climate resistance	1
Water res. (powder)	2
Acid res. (powder)	1

Mechanical properties	
Knoop hardness	492 (5)
Abrasion hardness	196
Young's mod. [GPa]	92.8
Shear mod. [GPa]	37.0
Poisson's ratio	0.256
Stress optical coef. [1E-5 nm/cm／Pa]	3.03

Internal trans. (10mm)	
λ [nm]	τ
280	–
290	–
300	–
310	–
320	–
330	–
340	–
350	–
360	0.02
370	0.17
380	0.44
390	0.68
400	0.81
420	0.922
440	0.957
460	0.970
480	0.978
500	0.985
550	0.994
600	0.995
650	0.994
700	0.996
800	0.996
900	0.996
1000	0.996
1200	0.996
1400	0.993
1600	0.988
1800	0.976
2000	0.967
2200	0.933
2400	0.89

Specific gravity
3.28

Coef. disp. form. (pwr ser.)	
A0	3.05623339E+00
A1	−1.28486167E-02
A2	0.00000000E+00
A3	3.87408706E-02
A4	3.39109066E-03
A5	−6.05526065E-04
A6	1.41221664E-04
A7	−1.44464234E-05
A8	6.88155857E-07

Relative Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90 (ref.)	0.1	0.2	0.6	0.8	1.1	1.4	1.5	1.6	2.1	2.8	4.3	4.5	6.4	8.9	11.0
60 to 80 (ref.)	−0.1	0.1	0.5	0.7	1.0	1.3	1.4	1.5	2.0	2.6	4.0	4.2	6.0	8.4	10.4
40 to 60	−0.2	0.0	0.3	0.5	0.8	1.1	1.1	1.2	1.7	2.3	3.6	3.8	5.6	7.8	9.7
20 to 40	−0.3	−0.1	0.2	0.4	0.6	0.9	1.0	1.1	1.5	2.1	3.3	3.5	5.1	7.2	9.0
0 to 20	−0.4	−0.2	0.1	0.3	0.5	0.7	0.8	0.9	1.3	1.9	3.1	3.2	4.7	6.6	8.3
−20 to 0	−0.4	−0.2	0.1	0.2	0.4	0.7	0.7	0.8	1.2	1.7	2.8	3.0	4.4	6.2	7.7
−40 to −20	−0.4	−0.2	0.1	0.2	0.4	0.7	0.7	0.8	1.2	1.7	2.7	2.8	4.1	5.8	7.1
−60 to −40 (ref.)	−0.2	−0.1	0.2	0.4	0.5	0.7	0.8	0.9	1.2	1.7	2.7	2.8	4.0	5.4	6.7
−70 to −60 (ref.)	0.0	0.1	0.4	0.5	0.7	0.9	1.0	1.0	1.4	1.8	2.7	2.8	3.9	5.3	6.5

Absolute Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90	−1.0	−0.8	−0.5	−0.2	0.0	0.3	0.4	0.5	1.0	1.7	3.1	3.3	5.2	7.7	9.8
60 to 80	−1.2	−1.1	−0.7	−0.5	−0.2	0.1	0.2	0.2	0.7	1.4	2.8	2.9	4.8	7.1	9.1
40 to 60	−1.5	−1.4	−1.0	−0.8	−0.6	−0.3	−0.2	−0.1	0.3	0.9	2.2	2.4	4.1	6.3	8.2
20 to 40	−1.8	−1.7	−1.3	−1.2	−0.9	−0.7	−0.6	−0.5	−0.1	0.5	1.7	1.9	3.5	5.6	7.3
0 to 20	−2.1	−2.0	−1.7	−1.5	−1.3	−1.0	−0.9	−0.9	−0.5	0.1	1.2	1.4	2.9	4.8	6.4
−20 to 0	−2.4	−2.3	−2.0	−1.8	−1.6	−1.4	−1.3	−1.2	−0.9	−0.3	0.7	0.9	2.2	4.0	5.5
−40 to −20	−2.7	−2.6	−2.3	−2.1	−2.0	−1.8	−1.7	−1.6	−1.2	−0.8	0.2	0.4	1.6	3.2	4.6
−60 to −40	−3.0	−2.9	−2.6	−2.5	−2.3	−2.1	−2.0	−2.0	−1.6	−1.2	−0.3	−0.2	1.0	2.4	3.7
−70 to −60	−3.2	−3.1	−2.8	−2.7	−2.6	−2.4	−2.3	−2.3	−1.9	−1.5	−0.7	−0.5	0.5	1.8	3.0

Coef. disp. form. (frac. eq.)(ref.)	
P1	9.33352719E-02
Q1	6.79499207E+01
P2	2.66834997E-02
Q2	6.09673098E-02
P3	3.79672929E-01
Q3	8.70602218E-03

Fitting error of disp. form. σ [1E-6]		
	Visible	Infrared
Power ser. eq.	1.1	10.3
Frac. eq. (ref.)	2.0	18.0

Prod. Freq. (A to D)	C

Similar glass type			
OHARA	S-TIH23	HOYA	–
CDGM	–	SCHOTT	–

2022-7-1	StP, AP, SP
2019-4-1	Transmittance
2015-4-1	Color Code, Prod. Freq., Similar glass type

HIKARI GLASS CO., LTD.

J-SFH1

n_d = 1.808090 n_e = 1.816440

ν_d = 22.74 ν_e = 22.55

Glass code (d)
808227
Glass code (e)
816226

Spectral l.	Refractive idx
2.058	1.75156
1.970	1.75327
1.530	1.76173
1.129	1.77098
1.064	1.77295
t	1.77466
s	1.78187
A'	1.787287
r	1.792532
C	1.797989
C'	1.799554
He-Ne	1.801030
D	1.807785
d	1.808090
e	1.816440
F	1.833527
F'	1.835758
g	1.855872
h	1.876462
0.389	1.890157
i	–

Partial dispersion	
F-C	0.035538
F'-C'	0.036204
C-t	0.023326
C-A'	0.010702
d-C	0.010101
e-C	0.018451
g-d	0.047782
g-F	0.022345
h-g	0.020590
i-g	–
C'-t	0.024891
e-C'	0.016886
F'-e	0.019318
i-F'	–

Relative partial dispersion	
C-t／F-C	0.6564
C-A'／F-C	0.3011
d-C／F-C	0.2842
e-C／F-C	0.5192
g-d／F-C	1.3445
g-F／F-C	0.6288
h-g／F-C	0.5794
i-g／F-C	–
C'-t／F'-C'	0.6875
e-C'／F'-C'	0.4664
F'-e／F'-C'	0.5336
i-F'／F'-C'	–

Deviation of relative partial disp.	
ΔPdC	−0.0032
ΔPgF	0.0226

Internal CC (80%/5%)
404/371
Color Code (80%/5%)
445/370
CCI
B 0.00
G 4.21
R 4.39

Thermal properties	
CTE(−30,70) [1E-7/℃]	91
CTE(100,300) [1E-7/℃]	113
Tg [℃]	581
At [℃]	619
StP [℃]	535
AP [℃]	569
SP [℃]	676
Ht cndct. [W/m·K]	0.862
Sp. heat [kJ/kg·K]	0.635
Ht diffus. [1E-6 m2/sec]	0.408

Chemical properties [class]	
Acid res. (surface)	1
Alkaline detergent res.	1
Climate resistance	1
Water res. (powder)	1
Acid res. (powder)	1

Mechanical properties	
Knoop hardness	408 (4)
Abrasion hardness	341
Young's mod. [GPa]	83.0
Shear mod. [GPa]	33.0
Poisson's ratio	0.259
Stress optical coef. [1E-5 nm/cm／Pa]	3.31

Internal trans. (10mm)	
λ [nm]	τ
280	–
290	–
300	–
310	–
320	–
330	–
340	–
350	–
360	–
370	0.04
380	0.25
390	0.55
400	0.75
420	0.908
440	0.952
460	0.968
480	0.978
500	0.983
550	0.992
600	0.996
650	0.996
700	0.998
800	0.996
900	0.994
1000	0.995
1200	0.996
1400	0.997
1600	0.989
1800	0.974
2000	0.966
2200	0.939
2400	0.908

Specific gravity
3.31

Coef. disp. form. (pwr ser.)	
A0	3.11637039E+00
A1	−1.40103252E-02
A2	0.00000000E+00
A3	4.55295459E-02
A4	3.79129507E-03
A5	−5.76203793E-04
A6	1.53793977E-04
A7	−1.65780029E-05
A8	8.81480500E-07

Relative Δn/ΔT [1E-6/℃]															
Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90 (ref.)	−3.9	−3.8	−3.6	−3.3	−2.9	−2.6	−2.5	−2.4	−1.8	−1.2	0.4	0.6	3.1	6.4	9.1
60 to 80 (ref.)	−3.9	−3.9	−3.6	−3.3	−3.0	−2.7	−2.6	−2.5	−2.0	−1.3	0.2	0.4	2.8	6.0	8.6
40 to 60	−4.0	−4.0	−3.7	−3.4	−3.1	−2.8	−2.7	−2.6	−2.1	−1.5	0.0	0.2	2.4	5.4	7.8
20 to 40	−4.0	−4.0	−3.7	−3.5	−3.2	−2.9	−2.8	−2.7	−2.2	−1.6	−0.2	0.0	2.1	4.9	7.2
0 to 20	−4.0	−4.0	−3.8	−3.5	−3.2	−2.9	−2.8	−2.7	−2.3	−1.7	−0.4	−0.2	1.8	4.4	6.5
−20 to 0	−3.9	−3.9	−3.7	−3.5	−3.2	−2.9	−2.8	−2.7	−2.3	−1.8	−0.5	−0.3	1.6	4.0	5.9
−40 to −20	−3.8	−3.8	−3.6	−3.3	−3.1	−2.8	−2.7	−2.6	−2.2	−1.7	−0.6	−0.4	1.4	3.7	5.4
−60 to −40 (ref.)	−3.5	−3.5	−3.4	−3.1	−2.9	−2.6	−2.5	−2.5	−2.1	−1.6	−0.5	−0.3	1.4	3.5	5.0
−70 to −60 (ref.)	−3.3	−3.3	−3.1	−2.9	−2.6	−2.4	−2.3	−2.2	−1.9	−1.4	−0.3	−0.2	1.4	3.4	4.8

Absolute Δn/ΔT [1E-6/℃]															
Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90	−5.0	−4.9	−4.7	−4.4	−4.0	−3.7	−3.6	−3.5	−3.0	−2.3	−0.8	−0.5	1.9	5.2	7.9
60 to 80	−5.1	−5.1	−4.8	−4.5	−4.2	−3.9	−3.8	−3.7	−3.2	−2.6	−1.1	−0.8	1.5	4.7	7.3
40 to 60	−5.3	−5.3	−5.1	−4.8	−4.5	−4.2	−4.1	−4.0	−3.5	−2.9	−1.5	−1.2	1.0	4.0	6.4
20 to 40	−5.5	−5.5	−5.3	−5.0	−4.7	−4.4	−4.3	−4.2	−3.8	−3.2	−1.9	−1.7	0.5	3.2	5.5
0 to 20	−5.7	−5.7	−5.5	−5.3	−5.0	−4.7	−4.6	−4.5	−4.1	−3.6	−2.3	−2.1	−0.1	2.5	4.6
−20 to 0	−6.0	−5.9	−5.7	−5.5	−5.3	−5.0	−4.9	−4.8	−4.4	−3.9	−2.7	−2.5	−0.6	1.8	3.7
−40 to −20	−6.2	−6.2	−6.0	−5.8	−5.5	−5.2	−5.2	−5.1	−4.7	−4.2	−3.1	−2.9	−1.1	1.1	2.8
−60 to −40	−6.4	−6.4	−6.2	−6.0	−5.8	−5.5	−5.4	−5.4	−5.0	−4.5	−3.5	−3.3	−1.7	0.4	1.9
−70 to −60	−6.5	−6.5	−6.4	−6.2	−6.0	−5.7	−5.6	−5.6	−5.2	−4.8	−3.8	−3.6	−2.1	−0.2	1.2

Coef. disp. form. (frac. eq.)(ref.)	
P1	9.85730452E-02
Q1	6.72412004E+01
P2	3.04158799E-02
Q2	6.53413919E-02
P3	3.82916992E-01
Q3	9.40813164E-03

Fitting error of disp. form. σ [1E-6]		
	Visible	Infrared
Power ser. eq.	0.9	4.3
Frac. eq. (ref.)	4.8	16.9

Prod. Freq. (A to D)	B

Similar glass type			
OHARA	S-NPH1	HOYA	FD225
CDGM	H-ZF71	SCHOTT	–

2022-7-1	StP, AP, SP
2019-4-1	Transmittance, Prod. Freq.
2017-4-1	Similar glass type

HIKARI GLASS CO., LTD.

J-SFH1HS

n_d = 1.808090 n_e = 1.816440

ν_d = 22.74 ν_e = 22.55

Glass code (d)
808227
Glass code (e)
816226

Spectral l.	Refractive idx
2.058	1.75156
1.970	1.75327
1.530	1.76173
1.129	1.77098
1.064	1.77295
t	1.77466
s	1.78187
A'	1.787287
r	1.792532
C	1.797989
C'	1.799554
He-Ne	1.801030
D	1.807785
d	1.808090
e	1.816440
F	1.833527
F'	1.835758
g	1.855872
h	1.876462
0.389	1.890157
i	–

Partial dispersion	
F-C	0.035538
F'-C'	0.036204
C-t	0.023326
C-A'	0.010702
d-C	0.010101
e-C	0.018451
g-d	0.047782
g-F	0.022345
h-g	0.020590
i-g	–
C'-t	0.024891
e-C'	0.016886
F'-e	0.019318
i-F'	–

Relative partial dispersion	
C-t／F-C	0.6564
C-A'／F-C	0.3011
d-C／F-C	0.2842
e-C／F-C	0.5192
g-d／F-C	1.3445
g-F／F-C	0.6288
h-g／F-C	0.5794
i-g／F-C	–
C'-t／F'-C'	0.6875
e-C'／F'-C'	0.4664
F'-e／F'-C'	0.5336
i-F'／F'-C'	–

Deviation of relative partial disp.	
ΔPdC	−0.0032
ΔPgF	0.0226

Internal CC (80%/5%)
393/370
Color Code (80%/5%)
420/370

CCI	
B	0.00
G	2.34
R	2.49

Thermal properties	
CTE(−30,70) [1E-7/℃]	91
CTE(100,300) [1E-7/℃]	113
Tg [℃]	581
At [℃]	619
StP [℃]	535
AP [℃]	569
SP [℃]	676
Ht cndct. [W/m·K]	0.862
Sp. heat [kJ/kg·K]	0.635
Ht diffus. [1E-6 m2/sec]	0.408

Chemical properties [class]	
Acid res. (surface)	1
Alkaline detergent res.	1
Climate resistance	1
Water res. (powder)	1
Acid res. (powder)	1

Mechanical properties	
Knoop hardness	408 (4)
Abrasion hardness	341
Young's mod. [GPa]	83.0
Shear mod. [GPa]	33.0
Poisson's ratio	0.259
Stress optical coef. [1E-5 nm/cm／Pa]	3.31

Internal trans. (10mm)	
λ [nm]	τ
280	–
290	–
300	–
310	–
320	–
330	–
340	–
350	–
360	–
370	0.06
380	0.38
390	0.73
400	0.89
420	0.958
440	0.972
460	0.978
480	0.983
500	0.987
550	0.993
600	0.996
650	0.996
700	0.998
800	0.999
900	0.999
1000	0.999
1200	0.999
1400	0.997
1600	0.992
1800	0.974
2000	0.957
2200	0.920
2400	0.88

Specific gravity
3.31

Coef. disp. form. (pwr ser.)	
A0	3.11637039E+00
A1	−1.40103252E-02
A2	0.00000000E+00
A3	4.55295459E-02
A4	3.79129507E-03
A5	−5.76203793E-04
A6	1.53793977E-04
A7	−1.65780029E-05
A8	8.81480500E-07

Relative Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90 (ref.)	−3.9	−3.8	−3.6	−3.3	−2.9	−2.6	−2.5	−2.4	−1.8	−1.2	0.4	0.6	3.1	6.4	9.1
60 to 80 (ref.)	−3.9	−3.9	−3.6	−3.3	−3.0	−2.7	−2.6	−2.5	−2.0	−1.3	0.2	0.4	2.8	6.0	8.6
40 to 60	−4.0	−4.0	−3.7	−3.4	−3.1	−2.8	−2.7	−2.6	−2.1	−1.5	0.0	0.2	2.4	5.4	7.8
20 to 40	−4.0	−4.0	−3.7	−3.5	−3.2	−2.9	−2.8	−2.7	−2.2	−1.6	−0.2	0.0	2.1	4.9	7.2
0 to 20	−4.0	−4.0	−3.8	−3.5	−3.2	−2.9	−2.8	−2.7	−2.3	−1.7	−0.4	−0.2	1.8	4.4	6.5
−20 to 0	−3.9	−3.9	−3.7	−3.5	−3.2	−2.9	−2.8	−2.7	−2.3	−1.8	−0.5	−0.3	1.6	4.0	5.9
−40 to −20	−3.8	−3.8	−3.6	−3.3	−3.1	−2.8	−2.7	−2.6	−2.2	−1.7	−0.6	−0.4	1.4	3.7	5.4
−60 to −40 (ref.)	−3.5	−3.5	−3.4	−3.1	−2.9	−2.6	−2.5	−2.5	−2.1	−1.6	−0.5	−0.3	1.4	3.5	5.0
−70 to −60 (ref.)	−3.3	−3.3	−3.1	−2.9	−2.6	−2.4	−2.3	−2.2	−1.9	−1.4	−0.3	−0.2	1.4	3.4	4.8

Absolute Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90	−5.0	−4.9	−4.7	−4.4	−4.0	−3.7	−3.6	−3.5	−3.0	−2.3	−0.8	−0.5	1.9	5.2	7.9
60 to 80	−5.1	−5.1	−4.8	−4.5	−4.2	−3.9	−3.8	−3.7	−3.2	−2.6	−1.1	−0.8	1.5	4.7	7.3
40 to 60	−5.3	−5.3	−5.1	−4.8	−4.5	−4.2	−4.1	−4.0	−3.5	−2.9	−1.5	−1.2	1.0	4.0	6.4
20 to 40	−5.5	−5.5	−5.3	−5.0	−4.7	−4.4	−4.3	−4.2	−3.8	−3.2	−1.9	−1.7	0.5	3.2	5.5
0 to 20	−5.7	−5.7	−5.5	−5.3	−5.0	−4.7	−4.6	−4.5	−4.1	−3.6	−2.3	−2.1	−0.1	2.5	4.6
−20 to 0	−6.0	−5.9	−5.7	−5.5	−5.3	−5.0	−4.9	−4.8	−4.4	−3.9	−2.7	−2.5	−0.6	1.8	3.7
−40 to −20	−6.2	−6.2	−6.0	−5.8	−5.5	−5.2	−5.2	−5.1	−4.7	−4.2	−3.1	−2.9	−1.1	1.1	2.8
−60 to −40	−6.4	−6.4	−6.2	−6.0	−5.8	−5.5	−5.4	−5.4	−5.0	−4.5	−3.5	−3.3	−1.7	0.4	1.9
−70 to −60	−6.5	−6.5	−6.4	−6.2	−6.0	−5.7	−5.6	−5.6	−5.2	−4.8	−3.8	−3.6	−2.1	−0.2	1.2

Coef. disp. form. (frac. eq.)(ref.)	
P1	9.85730452E-02
Q1	6.72412004E+01
P2	3.04158799E-02
Q2	6.53413919E-02
P3	3.82916992E-01
Q3	9.40813164E-03

Fitting error of disp. form. σ [1E-6]		
	Visible	Infrared
Power ser. eq.	0.9	4.3
Frac. eq. (ref.)	4.8	16.9

Prod. Freq. (A to D)	D

Similar glass type			
OHARA	S-NPH1-W	HOYA	FD225
CDGM	H-ZF71	SCHOTT	–

–	–
2022-7-1	StP, AP, SP, Prod. Freq.
2019-4-1	1st edition

HIKARI GLASS CO., LTD.

J-SFH2

n_d = 1.860740 n_e = 1.869508

ν_d = 23.08 ν_e = 22.89

Glass code (d)
861231
Glass code (e)
870229

Spectral l.	Refractive idx
2.058	1.80120
1.970	1.80300
1.530	1.81192
1.129	1.82167
1.064	1.82375
t	1.82555
s	1.83315
A'	1.838854
r	1.844377
C	1.850120
C'	1.851766
He-Ne	1.853318
D	1.860420
d	1.860740
e	1.869508
F	1.887417
F'	1.889752
g	1.910759
h	1.932175
0.389	1.946358
i	–

Partial dispersion	
F-C	0.037297
F'-C'	0.037986
C-t	0.024570
C-A'	0.011266
d-C	0.010620
e-C	0.019388
g-d	0.050019
g-F	0.023342
h-g	0.021416
i-g	–
C'-t	0.026216
e-C'	0.017742
F'-e	0.020244
i-F'	–

Relative partial dispersion	
C-t／F-C	0.6588
C-A'／F-C	0.3021
d-C／F-C	0.2847
e-C／F-C	0.5198
g-d／F-C	1.3411
g-F／F-C	0.6258
h-g／F-C	0.5742
i-g／F-C	–
C'-t／F'-C'	0.6901
e-C'／F'-C'	0.4671
F'-e／F'-C'	0.5329
i-F'／F'-C'	–

Deviation of relative partial disp.	
ΔPdC	−0.0029
ΔPgF	0.0202

Internal CC (80%/5%)
403/367
Color Code (70%/5%)
415/370
CCI
B 0.00
G 4.84
R 5.24

Thermal properties	
CTE(−30,70) [1E-7/℃]	84
CTE(100,300) [1E-7/℃]	98
Tg [℃]	589
At [℃]	630
StP [℃]	546
AP [℃]	580
SP [℃]	696
Ht cndct. [W/m·K]	0.813
Sp. heat [kJ/kg·K]	0.572
Ht diffus. [1E-6 m2/sec]	0.372

Chemical properties [class]	
Acid res. (surface)	1
Alkaline detergent res.	1
Climate resistance	1
Water res. (powder)	1
Acid res. (powder)	1

Mechanical properties	
Knoop hardness	441 (4)
Abrasion hardness	309
Young's mod. [GPa]	88.8
Shear mod. [GPa]	35.0
Poisson's ratio	0.268
Stress optical coef. [1E-5 nm/cm／Pa]	3.04

Internal trans. (10mm)	
λ [nm]	τ
280	–
290	–
300	–
310	–
320	–
330	–
340	–
350	–
360	–
370	0.10
380	0.36
390	0.63
400	0.77
420	0.88
440	0.916
460	0.938
480	0.954
500	0.965
550	0.985
600	0.992
650	0.993
700	0.995
800	0.996
900	0.997
1000	0.997
1200	0.999
1400	0.998
1600	0.995
1800	0.986
2000	0.977
2200	0.942
2400	0.906

Specific gravity
3.82

Coef. disp. form. (pwr ser.)	
A0	3.29659106E+00
A1	−1.51583913E-02
A2	0.00000000E+00
A3	4.96966192E-02
A4	3.87657158E-03
A5	−5.33127104E-04
A6	1.43134944E-04
A7	−1.50873439E-05
A8	8.02061962E-07

Relative Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90 (ref.)	−2.9	−2.8	−2.5	−2.2	−1.8	−1.5	−1.4	−1.2	−0.7	0.0	1.7	2.0	4.5	7.9	10.7
60 to 80 (ref.)	−3.0	−2.9	−2.6	−2.3	−2.0	−1.6	−1.5	−1.4	−0.9	−0.2	1.4	1.7	4.1	7.4	10.0
40 to 60	−3.1	−3.1	−2.8	−2.5	−2.2	−1.8	−1.7	−1.6	−1.1	−0.5	1.1	1.3	3.6	6.7	9.2
20 to 40	−3.2	−3.2	−2.9	−2.6	−2.3	−2.0	−1.9	−1.8	−1.3	−0.7	0.8	1.0	3.2	6.0	8.3
0 to 20	−3.3	−3.2	−3.0	−2.7	−2.4	−2.1	−2.0	−1.9	−1.5	−0.9	0.5	0.7	2.8	5.4	7.5
−20 to 0	−3.3	−3.2	−3.0	−2.7	−2.5	−2.2	−2.1	−2.0	−1.6	−1.0	0.3	0.5	2.4	4.8	6.8
−40 to −20	−3.2	−3.2	−2.9	−2.7	−2.5	−2.2	−2.1	−2.0	−1.6	−1.1	0.1	0.3	2.1	4.4	6.1
−60 to −40 (ref.)	−3.0	−3.0	−2.8	−2.6	−2.3	−2.1	−2.0	−1.9	−1.5	−1.0	0.1	0.3	1.9	4.0	5.6
−70 to −60 (ref.)	−2.8	−2.8	−2.6	−2.4	−2.1	−1.9	−1.8	−1.7	−1.4	−0.9	0.2	0.3	1.9	3.8	5.3

Absolute Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90	−4.0	−3.9	−3.6	−3.3	−3.0	−2.6	−2.5	−2.4	−1.9	−1.1	0.5	0.8	3.3	6.7	9.5
60 to 80	−4.2	−4.2	−3.8	−3.6	−3.2	−2.9	−2.8	−2.7	−2.2	−1.5	0.2	0.4	2.8	6.0	8.7
40 to 60	−4.5	−4.4	−4.2	−3.9	−3.6	−3.2	−3.1	−3.0	−2.5	−1.9	−0.4	−0.1	2.2	5.2	7.6
20 to 40	−4.8	−4.7	−4.5	−4.2	−3.9	−3.6	−3.5	−3.4	−2.9	−2.3	−0.9	−0.7	1.5	4.3	6.6
0 to 20	−5.1	−5.0	−4.8	−4.5	−4.3	−4.0	−3.9	−3.8	−3.3	−2.8	−1.4	−1.2	0.8	3.4	5.5
−20 to 0	−5.4	−5.3	−5.1	−4.9	−4.6	−4.3	−4.2	−4.2	−3.7	−3.2	−1.9	−1.7	0.1	2.6	4.5
−40 to −20	−5.7	−5.6	−5.4	−5.2	−4.9	−4.7	−4.6	−4.5	−4.1	−3.6	−2.4	−2.3	−0.5	1.7	3.5
−60 to −40	−6.0	−5.9	−5.7	−5.5	−5.3	−5.0	−5.0	−4.9	−4.5	−4.1	−3.0	−2.8	−1.2	0.8	2.4
−70 to −60	−6.2	−6.1	−5.9	−5.7	−5.5	−5.3	−5.2	−5.2	−4.8	−4.4	−3.4	−3.2	−1.7	0.2	1.6

Coef. disp. form. (frac. eq.)(ref.)	
P1	1.10507518E-01
Q1	7.39541338E+01
P2	3.18957625E-02
Q2	6.34615914E-02
P3	4.01415757E-01
Q3	9.05242609E-03

Fitting error of disp. form. σ [1E-6]		
	Visible	Infrared
Power ser. eq.	1.1	6.7
Frac. eq. (ref.)	4.3	12.7

Prod. Freq. (A to D)	B

Similar glass type			
OHARA	–	HOYA	–
CDGM	–	SCHOTT	–

2022-7-1	StP, AP, SP
2019-4-1	Transmittance
2018-4-1	Prod. Freq.

HIKARI GLASS CO., LTD.

J-SFH4

n_d = 1.663820 n_e = 1.669520

ν_d = 27.35 ν_e = 27.07

Glass code (d)
664274
Glass code (e)
670271

Spectral l.	Refractive idx
2.058	1.62274
1.970	1.62418
1.530	1.63103
1.129	1.63803
1.064	1.63947
t	1.64070
s	1.64580
A'	1.649567
r	1.653178
C	1.656918
C'	1.657989
He-Ne	1.658998
D	1.663612
d	1.663820
e	1.669520
F	1.681192
F'	1.682719
g	1.696531
h	1.710834
0.389	1.720477
i	–

Partial dispersion	
F-C	0.024274
F'-C'	0.024730
C-t	0.016216
C-A'	0.007351
d-C	0.006902
e-C	0.012602
g-d	0.032711
g-F	0.015339
h-g	0.014303
i-g	–
C'-t	0.017287
e-C'	0.011531
F'-e	0.013199
i-F'	–

Relative partial dispersion	
C-t／F-C	0.6680
C-A'／F-C	0.3028
d-C／F-C	0.2843
e-C／F-C	0.5192
g-d／F-C	1.3476
g-F／F-C	0.6319
h-g／F-C	0.5892
i-g／F-C	–
C'-t／F'-C'	0.6990
e-C'／F'-C'	0.4663
F'-e／F'-C'	0.5337
i-F'／F'-C'	–

Deviation of relative partial disp.	
ΔPdC	−0.0052
ΔPgF	0.0334

Internal CC (80%/5%)
405/375
Color Code (80%/5%)
425/375

CCI	
B	0.00
G	4.20
R	4.46

Thermal properties	
CTE(−30,70) [1E-7/℃]	111
CTE(100,300) [1E-7/℃]	143
Tg [℃]	476
At [℃]	520
StP [℃]	439
AP [℃]	470
SP [℃]	575
Ht cndct. [W/m·K]	0.807
Sp. heat [kJ/kg·K]	0.745
Ht diffus. [1E-6 m2/sec]	0.375

Chemical properties [class]	
Acid res. (surface)	1
Alkaline detergent res.	1
Climate resistance	1
Water res. (powder)	2
Acid res. (powder)	1

Mechanical properties	
Knoop hardness	343 (3)
Abrasion hardness	509
Young's mod. [GPa]	71.6
Shear mod. [GPa]	28.3
Poisson's ratio	0.266
Stress optical coef. [1E-5 nm/cm／Pa]	2.55

Internal trans. (10mm)	
λ [nm]	τ
280	–
290	–
300	–
310	–
320	–
330	–
340	–
350	–
360	–
370	0.01
380	0.16
390	0.48
400	0.72
420	0.905
440	0.953
460	0.968
480	0.974
500	0.978
550	0.984
600	0.988
650	0.991
700	0.994
800	0.996
900	0.998
1000	0.999
1200	0.999
1400	0.999
1600	0.992
1800	0.957
2000	0.908
2200	0.85
2400	0.79

Specific gravity
2.89

Coef. disp. form. (pwr ser.)	
A0	2.66988350E+00
A1	−9.72056100E−03
A2	−1.78592986E−04
A3	3.30802051E−02
A4	−4.66984185E−04
A5	5.77270500E−04
A6	−7.46804377E−05
A7	5.46919156E−06
A8	0.00000000E+00

Relative Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90 (ref.)	−4.6	−4.6	−4.4	−4.0	−3.7	−3.4	−3.3	−3.2	−2.7	−2.1	−0.7	−0.4	1.9	5.0	7.6
60 to 80 (ref.)	−4.6	−4.5	−4.3	−4.0	−3.7	−3.3	−3.2	−3.2	−2.7	−2.1	−0.7	−0.5	1.7	4.7	7.2
40 to 60	−4.5	−4.4	−4.2	−3.9	−3.6	−3.3	−3.2	−3.1	−2.7	−2.1	−0.8	−0.6	1.4	4.3	6.6
20 to 40	−4.3	−4.3	−4.1	−3.8	−3.5	−3.2	−3.1	−3.0	−2.6	−2.1	−0.9	−0.7	1.2	3.9	6.1
0 to 20	−4.2	−4.1	−3.9	−3.7	−3.4	−3.1	−3.0	−2.9	−2.6	−2.1	−0.9	−0.8	1.1	3.6	5.6
−20 to 0	−3.9	−3.9	−3.7	−3.5	−3.2	−2.9	−2.9	−2.8	−2.4	−2.0	−0.9	−0.7	1.0	3.3	5.1
−40 to −20	−3.6	−3.6	−3.4	−3.2	−3.0	−2.7	−2.6	−2.6	−2.2	−1.8	−0.8	−0.7	0.9	3.1	4.8
−60 to −40 (ref.)	−3.3	−3.3	−3.1	−2.9	−2.6	−2.4	−2.3	−2.2	−1.9	−1.5	−0.6	−0.5	1.0	3.0	4.5
−70 to −60 (ref.)	−2.9	−2.9	−2.7	−2.5	−2.3	−2.1	−2.0	−1.9	−1.6	−1.2	−0.4	−0.2	1.1	3.0	4.4

Absolute Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90	−5.7	−5.6	−5.3	−5.1	−4.7	−4.4	−4.3	−4.2	−3.7	−3.1	−1.7	−1.5	0.8	3.9	6.6
60 to 80	−5.7	−5.7	−5.4	−5.1	−4.8	−4.5	−4.4	−4.3	−3.8	−3.3	−1.9	−1.7	0.5	3.5	6.0
40 to 60	−5.7	−5.7	−5.4	−5.2	−4.9	−4.6	−4.5	−4.4	−4.0	−3.4	−2.1	−1.9	0.1	3.0	5.3
20 to 40	−5.7	−5.7	−5.5	−5.2	−5.0	−4.7	−4.6	−4.5	−4.1	−3.6	−2.4	−2.2	−0.3	2.4	4.6
0 to 20	−5.8	−5.8	−5.5	−5.3	−5.0	−4.8	−4.7	−4.6	−4.2	−3.7	−2.6	−2.5	−0.6	1.8	3.8
−20 to 0	−5.8	−5.8	−5.6	−5.4	−5.1	−4.9	−4.8	−4.7	−4.4	−3.9	−2.9	−2.7	−1.0	1.3	3.1
−40 to −20	−5.8	−5.8	−5.7	−5.4	−5.2	−5.0	−4.9	−4.8	−4.5	−4.1	−3.1	−3.0	−1.4	0.7	2.4
−60 to −40	−5.9	−5.9	−5.7	−5.5	−5.3	−5.0	−5.0	−4.9	−4.6	−4.2	−3.3	−3.2	−1.8	0.2	1.7
−70 to −60	−5.9	−5.9	−5.7	−5.6	−5.3	−5.1	−5.1	−5.0	−4.7	−4.4	−3.5	−3.4	−2.1	−0.3	1.1

Coef. disp. form. (frac. eq.)(ref.)	
P1	9.81224168E−02
Q1	6.98916297E+01
P2	1.98027993E−02
Q2	7.20938068E−02
P3	3.38032350E−01
Q3	8.24394223E−03

Fitting error of disp. form. σ [1E-6]		
	Visible	Infrared
Power ser. eq.	1.5	4.6
Frac. eq. (ref.)	5.0	8.2

Prod. Freq. (A to D)	A

Similar glass type			
OHARA	–	HOYA	–
CDGM	–	SCHOTT	–

2022-7-1	StP, AP, SP
2021-4-1	Refractive idx, Partial dispersion, Relative partial dispersion
2020-4-1	1st edition

HIKARI GLASS CO., LTD.

J-SFH5

n_d = 1.755750 n_e = 1.762936

ν_d = 24.71 ν_e = 24.49

Glass code (d)
756247
Glass code (e)
763245

Spectral l.	Refractive idx
2.058	1.70465
1.970	1.70639
1.530	1.71472
1.129	1.72335
1.064	1.72513
t	1.72667
s	1.73306
A'	1.737788
r	1.742335
C	1.747048
C'	1.748398
He-Ne	1.749669
D	1.755488
d	1.755750
e	1.762936
F	1.777633
F'	1.779553
g	1.796874
h	1.814702
0.389	1.826650
i	–

Coef. disp. form. (pwr ser.)	
A0	2.95136928E+00
A1	-1.22217040E-02
A2	-2.29797089E-04
A3	4.39763055E-02
A4	-5.94321969E-04
A5	7.66493369E-04
A6	-9.82633510E-05
A7	7.00260276E-06
A8	0.00000000E+00

Partial dispersion	
F-C	0.030585
F'-C'	0.031155
C-t	0.020377
C-A'	0.009260
d-C	0.008702
e-C	0.015888
g-d	0.041124
g-F	0.019241
h-g	0.017828
i-g	–
C'-t	0.021727
e-C'	0.014538
F'-e	0.016617
i-F'	–

Relative partial dispersion	
C-t／F-C	0.6662
C-A'／F-C	0.3028
d-C／F-C	0.2845
e-C／F-C	0.5195
g-d／F-C	1.3446
g-F／F-C	0.6291
h-g／F-C	0.5829
i-g／F-C	–
C'-t／F'-C'	0.6974
e-C'／F'-C'	0.4666
F'-e／F'-C'	0.5334
i-F'／F'-C'	–

Deviation of relative partial disp.	
ΔPdC	-0.0038
ΔPgF	0.0262

Internal CC (80%/5%)
404/377
Color Code (80%/5%)
445/375

CCI	
B	0.00
G	4.33
R	4.73

Thermal properties	
CTE(-30,70) [1E-7/℃]	84
CTE(100,300) [1E-7/℃]	107
Tg [℃]	540
At [℃]	595
StP [℃]	507
AP [℃]	542
SP [℃]	656
Ht cndct. [W/m·K]	0.836
Sp. heat [kJ/kg·K]	0.669
Ht diffus. [1E-6 m2/sec]	0.393

Chemical properties [class]	
Acid res. (surface)	1
Alkaline detergent res.	1
Climate resistance	1
Water res. (powder)	1
Acid res. (powder)	1

Mechanical properties	
Knoop hardness	391 (4)
Abrasion hardness	346
Young's mod. [GPa]	83.2
Shear mod. [GPa]	33.1
Poisson's ratio	0.256
Stress optical coef. [1E-5 nm/cm／Pa]	3.07

Internal trans. (10mm)	
λ [nm]	τ
280	–
290	–
300	–
310	–
320	–
330	–
340	–
350	–
360	–
370	–
380	0.12
390	0.47
400	0.74
420	0.905
440	0.942
460	0.957
480	0.965
500	0.971
550	0.983
600	0.988
650	0.992
700	0.993
800	0.995
900	0.997
1000	0.998
1200	0.999
1400	0.993
1600	0.987
1800	0.965
2000	0.934
2200	0.85
2400	0.77

Specific gravity
3.19

Relative Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90 (ref.)	-1.9	-1.9	-1.6	-1.2	-0.9	-0.5	-0.4	-0.3	0.2	0.9	2.5	2.7	5.1	8.4	11.2
60 to 80 (ref.)	-2.1	-2.0	-1.7	-1.4	-1.1	-0.7	-0.6	-0.5	0.0	0.7	2.2	2.4	4.7	7.8	10.5
40 to 60	-2.2	-2.2	-1.9	-1.6	-1.3	-0.9	-0.8	-0.7	-0.2	0.4	1.8	2.0	4.1	7.1	9.6
20 to 40	-2.3	-2.3	-2.0	-1.7	-1.5	-1.1	-1.0	-0.9	-0.5	0.1	1.4	1.6	3.6	6.4	8.8
0 to 20	-2.4	-2.4	-2.1	-1.9	-1.6	-1.3	-1.2	-1.1	-0.7	-0.1	1.1	1.3	3.2	5.8	7.9
-20 to 0	-2.5	-2.4	-2.2	-1.9	-1.7	-1.4	-1.3	-1.2	-0.8	-0.3	0.9	1.0	2.8	5.2	7.2
-40 to -20	-2.4	-2.4	-2.2	-1.9	-1.7	-1.4	-1.3	-1.3	-0.9	-0.4	0.7	0.8	2.5	4.7	6.5
-60 to -40 (ref.)	-2.3	-2.3	-2.1	-1.8	-1.6	-1.4	-1.3	-1.2	-0.9	-0.4	0.6	0.7	2.2	4.3	5.9
-70 to -60 (ref.)	-2.1	-2.1	-1.9	-1.7	-1.5	-1.2	-1.2	-1.1	-0.7	-0.3	0.6	0.7	2.1	4.0	5.6

Absolute Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90	-3.0	-2.9	-2.6	-2.3	-2.0	-1.6	-1.5	-1.4	-0.9	-0.2	1.4	1.6	4.0	7.2	10.0
60 to 80	-3.2	-3.2	-2.9	-2.6	-2.2	-1.9	-1.8	-1.7	-1.2	-0.5	0.9	1.2	3.4	6.6	9.2
40 to 60	-3.5	-3.5	-3.2	-2.9	-2.6	-2.3	-2.2	-2.1	-1.6	-1.0	0.4	0.6	2.8	5.7	8.2
20 to 40	-3.8	-3.8	-3.5	-3.3	-3.0	-2.6	-2.6	-2.5	-2.0	-1.4	-0.1	0.1	2.1	4.8	7.1
0 to 20	-4.1	-4.1	-3.8	-3.6	-3.3	-3.0	-2.9	-2.9	-2.4	-1.9	-0.7	-0.5	1.4	3.9	6.1
-20 to 0	-4.4	-4.4	-4.2	-3.9	-3.7	-3.4	-3.3	-3.2	-2.9	-2.4	-1.2	-1.1	0.7	3.0	5.0
-40 to -20	-4.7	-4.7	-4.5	-4.3	-4.1	-3.8	-3.7	-3.6	-3.3	-2.8	-1.8	-1.6	0.0	2.2	4.0
-60 to -40	-5.0	-5.0	-4.8	-4.6	-4.4	-4.2	-4.1	-4.0	-3.7	-3.3	-2.3	-2.2	-0.7	1.3	2.9
-70 to -60	-5.3	-5.3	-5.1	-4.9	-4.7	-4.5	-4.4	-4.3	-4.0	-3.6	-2.7	-2.6	-1.2	0.6	2.1

Coef. disp. form. (frac. eq.)(ref.)	
P1	9.75673240E-02
Q1	6.24777153E+01
P2	2.29130404E-02
Q2	7.02967186E-02
P3	3.71469828E-01
Q3	9.10137167E-03

Fitting error of disp. form. σ [1E-6]		
	Visible	Infrared
Power ser. eq.	2.2	8.6
Frac. eq. (ref.)	8.2	15.1

Prod. Freq. (A to D)	A

Similar glass type			
OHARA	–	HOYA	–
CDGM	–	SCHOTT	–

2022-7-1	StP, AP, SP
2021-4-1	Refractive idx, Partial dispersion, Relative partial dispersion
2020-4-1	1st edition

HIKARI GLASS CO., LTD.

J-SFH6

n_d = 1.713380 n_e = 1.719815

ν_d = 26.04 ν_e = 25.79

Glass code (d)
713260
Glass code (e)
720258

Spectral l.	Refractive idx
2.058	1.66768
1.970	1.66921
1.530	1.67665
1.129	1.68438
1.064	1.68597
t	1.68734
s	1.69305
A'	1.697280
r	1.701356
C	1.705581
C'	1.706791
He-Ne	1.707931
D	1.713145
d	1.713380
e	1.719815
F	1.732977
F'	1.734697
g	1.750227
h	1.766223
0.389	1.776959
i	–

Coef. disp. form. (pwr ser.)	
A0	2.82553965E+00
A1	-1.23310785E-02
A2	0.00000000E+00
A3	3.25389121E-02
A4	3.24003911E-03
A5	-6.19484120E-04
A6	1.56509513E-04
A7	-1.74645253E-05
A8	9.29550541E-07

Partial dispersion	
F-C	0.027396
F'-C'	0.027906
C-t	0.018237
C-A'	0.008301
d-C	0.007799
e-C	0.014234
g-d	0.036847
g-F	0.017250
h-g	0.015996
i-g	–
C'-t	0.019447
e-C'	0.013024
F'-e	0.014882
i-F'	–

Relative partial dispersion	
C-t／F-C	0.6657
C-A'／F-C	0.3030
d-C／F-C	0.2847
e-C／F-C	0.5196
g-d／F-C	1.3450
g-F／F-C	0.6297
h-g／F-C	0.5839
i-g／F-C	–
C'-t／F'-C'	0.6969
e-C'／F'-C'	0.4667
F'-e／F'-C'	0.5333
i-F'／F'-C'	–

Deviation of relative partial disp.	
ΔPdC	-0.0043
ΔPgF	0.0290

Internal CC (80%/5%)
404/374
Color Code (80%/5%)
425/375

CCI	
B	0.00
G	4.19
R	4.31

Thermal properties	
CTE(-30,70) [1E-7/℃]	101
CTE(100,300) [1E-7/℃]	131
Tg [℃]	524
At [℃]	568
StP [℃]	491
AP [℃]	516
SP [℃]	620
Ht cndct. [W/m･K]	0.842
Sp. heat [kJ/kg･K]	0.710
Ht diffus. [1E-6 m2/sec]	0.385

Chemical properties [class]	
Acid res. (surface)	1
Alkaline detergent res.	1
Climate resistance	1
Water res. (powder)	1
Acid res. (powder)	1

Mechanical properties	
Knoop hardness	394(4)
Abrasion hardness	432
Young's mod. [GPa]	76.5
Shear mod. [GPa]	30.3
Poisson's ratio	0.263
Stress optical coef. [1E-5 nm/cm／Pa]	2.74

Internal trans. (10mm)	
λ [nm]	τ
280	–
290	–
300	–
310	–
320	–
330	–
340	–
350	–
360	–
370	0.03
380	0.16
390	0.50
400	0.74
420	0.914
440	0.961
460	0.977
480	0.984
500	0.988
550	0.996
600	0.998
650	0.998
700	0.999
800	0.999
900	0.999
1000	0.999
1200	0.999
1400	0.998
1600	0.989
1800	0.955
2000	0.911
2200	0.84
2400	0.77

Specific gravity
3.09

Relative Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90 (ref.)	-4.2	-4.1	-3.8	-3.5	-3.2	-2.9	-2.8	-2.7	-2.2	-1.5	-0.1	0.2	2.4	5.5	8.2
60 to 80 (ref.)	-4.2	-4.1	-3.8	-3.5	-3.3	-2.9	-2.8	-2.8	-2.3	-1.7	-0.2	0.0	2.1	5.1	7.6
40 to 60	-4.2	-4.1	-3.8	-3.6	-3.3	-3.0	-2.9	-2.9	-2.4	-1.8	-0.5	-0.3	1.8	4.5	6.9
20 to 40	-4.2	-4.1	-3.9	-3.6	-3.4	-3.1	-3.0	-2.9	-2.5	-1.9	-0.7	-0.5	1.4	4.0	6.2
0 to 20	-4.2	-4.1	-3.8	-3.6	-3.4	-3.1	-3.0	-2.9	-2.5	-2.0	-0.8	-0.7	1.1	3.6	5.6
-20 to 0	-4.1	-4.0	-3.7	-3.5	-3.3	-3.1	-3.0	-2.9	-2.5	-2.1	-0.9	-0.8	0.9	3.1	5.1
-40 to -20	-3.9	-3.8	-3.6	-3.4	-3.2	-3.0	-2.9	-2.8	-2.5	-2.0	-1.0	-0.8	0.7	2.8	4.6
-60 to -40 (ref.)	-3.6	-3.6	-3.4	-3.2	-3.0	-2.8	-2.7	-2.6	-2.3	-1.9	-0.9	-0.8	0.6	2.6	4.2
-70 to -60 (ref.)	-3.4	-3.3	-3.1	-2.9	-2.7	-2.5	-2.5	-2.4	-2.1	-1.7	-0.8	-0.6	0.7	2.5	4.0

Absolute Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90	-5.2	-5.1	-4.8	-4.5	-4.3	-3.9	-3.8	-3.7	-3.2	-2.6	-1.1	-0.9	1.3	4.4	7.0
60 to 80	-5.3	-5.2	-4.9	-4.7	-4.4	-4.1	-4.0	-3.9	-3.4	-2.8	-1.4	-1.2	0.9	3.9	6.4
40 to 60	-5.5	-5.4	-5.1	-4.9	-4.6	-4.3	-4.2	-4.2	-3.7	-3.1	-1.8	-1.6	0.4	3.2	5.5
20 to 40	-5.7	-5.6	-5.3	-5.1	-4.9	-4.6	-4.5	-4.4	-4.0	-3.4	-2.2	-2.0	-0.1	2.5	4.7
0 to 20	-5.8	-5.7	-5.5	-5.3	-5.1	-4.8	-4.7	-4.6	-4.3	-3.7	-2.6	-2.4	-0.6	1.8	3.8
-20 to 0	-6.0	-5.9	-5.7	-5.5	-5.3	-5.0	-5.0	-4.9	-4.5	-4.0	-3.0	-2.8	-1.2	1.1	3.0
-40 to -20	-6.2	-6.1	-5.9	-5.7	-5.5	-5.3	-5.2	-5.1	-4.8	-4.4	-3.3	-3.2	-1.7	0.4	2.1
-60 to -40	-6.3	-6.3	-6.1	-5.9	-5.7	-5.5	-5.4	-5.4	-5.1	-4.7	-3.7	-3.6	-2.2	-0.3	1.2
-70 to -60	-6.4	-6.4	-6.2	-6.0	-5.9	-5.7	-5.6	-5.6	-5.3	-4.9	-4.0	-3.9	-2.6	-0.9	0.6

Coef. disp. form. (frac. eq.)(ref.)	
P1	9.27389277E-02
Q1	6.45462057E+01
P2	2.17316868E-02
Q2	7.04718985E-02
P3	3.56210137E-01
Q3	8.65769011E-03

Fitting error of disp. form. σ [1E-6]		
	Visible	Infrared
Power ser. eq.	0.9	5.0
Frac. eq. (ref.)	4.9	16.9

Prod. Freq. (A to D)	A

Similar glass type			
OHARA	–	HOYA	–
CDGM	–	SCHOTT	–

–	–
2022-7-1	StP, AP, SP
2021-4-1	1st edition

HIKARI GLASS CO., LTD.

J-SFH8

n_d = 1.622000 n_e = 1.626770

ν_d = 30.66 ν_e = 30.35

Glass code (d)
622307
Glass code (e)
627304

Spectral l.	Refractive idx
2.058	1.58657
1.970	1.58785
1.530	1.59400
1.129	1.60015
1.064	1.60138
t	1.60244
s	1.60679
A'	1.609981
r	1.613039
C	1.616197
C'	1.617099
He-Ne	1.617948
D	1.621826
d	1.622000
e	1.626770
F	1.636485
F'	1.637752
g	1.649161
h	1.660879
0.389	1.668730
i	–

Partial dispersion	
F-C	0.020288
F'-C'	0.020653
C-t	0.013754
C-A'	0.006216
d-C	0.005803
e-C	0.010573
g-d	0.027161
g-F	0.012676
h-g	0.011718
i-g	–
C'-t	0.014656
e-C'	0.009671
F'-e	0.010982
i-F'	–

Relative partial dispersion	
C-t／F-C	0.6779
C-A'／F-C	0.3064
d-C／F-C	0.2860
e-C／F-C	0.5211
g-d／F-C	1.3388
g-F／F-C	0.6248
h-g／F-C	0.5776
i-g／F-C	–
C'-t／F'-C'	0.7096
e-C'／F'-C'	0.4683
F'-e／F'-C'	0.5317
i-F'／F'-C'	–

Deviation of relative partial disp.	
ΔPdC	−0.0050
ΔPgF	0.0319

Internal CC (80%/5%)
393/368
Color Code (80%/5%)
405/370
CCI

B	0.00
G	2.11
R	2.36

Thermal properties	
CTE(−30,70) [1E-7/℃]	124
CTE(100,300) [1E-7/℃]	163
Tg [℃]	422
At [℃]	478
StP [℃]	387
AP [℃]	420
SP [℃]	528
Ht cndct. [W/m·K]	0.728
Sp. heat [kJ/kg·K]	0.760
Ht diffus. [1E-6 m2/sec]	0.341

Chemical properties [class]	
Acid res. (surface)	1
Alkaline detergent res.	2
Climate resistance	1
Water res. (powder)	2
Acid res. (powder)	2

Mechanical properties	
Knoop hardness	345(3)
Abrasion hardness	600
Young's mod. [GPa]	64.5
Shear mod. [GPa]	25.4
Poisson's ratio	0.270
Stress optical coef. [1E-5 nm/cm／Pa]	2.43

Internal trans. (10mm)	
λ [nm]	τ
280	–
290	–
300	–
310	–
320	–
330	–
340	–
350	–
360	–
370	0.09
380	0.45
390	0.75
400	0.88
420	0.951
440	0.968
460	0.974
480	0.976
500	0.978
550	0.984
600	0.987
650	0.990
700	0.993
800	0.996
900	0.998
1000	0.999
1200	0.999
1400	0.998
1600	0.986
1800	0.932
2000	0.86
2200	0.78
2400	0.70

Specific gravity
2.81

Coef. disp. form. (pwr ser.)	
A0	2.55435034E+00
A1	−1.00436655E-02
A2	0.00000000E+00
A3	2.22501317E-02
A4	2.74804538E-03
A5	−5.99590054E-04
A6	1.36350999E-04
A7	−1.45337260E-05
A8	7.28771109E-07

Relative Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90 (ref.)	−7.1	−7.1	−6.9	−6.6	−6.4	−6.2	−6.1	−6.0	−5.6	−5.2	−4.1	−3.9	−2.2	0.2	2.2
60 to 80 (ref.)	−6.9	−6.9	−6.7	−6.5	−6.3	−6.0	−5.9	−5.9	−5.5	−5.1	−4.0	−3.9	−2.2	0.1	2.0
40 to 60	−6.7	−6.6	−6.4	−6.3	−6.1	−5.8	−5.7	−5.7	−5.3	−4.9	−3.9	−3.8	−2.2	0.0	1.7
20 to 40	−6.4	−6.4	−6.2	−6.0	−5.8	−5.6	−5.5	−5.5	−5.1	−4.7	−3.8	−3.6	−2.1	−0.1	1.5
0 to 20	−6.1	−6.1	−5.9	−5.7	−5.5	−5.3	−5.3	−5.2	−4.9	−4.5	−3.6	−3.5	−2.1	−0.2	1.4
−20 to 0	−5.8	−5.7	−5.6	−5.4	−5.2	−5.0	−4.9	−4.9	−4.6	−4.2	−3.4	−3.2	−1.9	−0.2	1.3
−40 to −20	−5.3	−5.3	−5.1	−5.0	−4.8	−4.6	−4.6	−4.5	−4.2	−3.9	−3.1	−3.0	−1.7	−0.1	1.2
−60 to −40 (ref.)	−4.8	−4.8	−4.6	−4.5	−4.3	−4.1	−4.1	−4.0	−3.8	−3.4	−2.7	−2.6	−1.4	0.1	1.3
−70 to −60 (ref.)	−4.4	−4.3	−4.2	−4.0	−3.9	−3.7	−3.7	−3.6	−3.4	−3.0	−2.3	−2.2	−1.1	0.3	1.4

Absolute Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90	−8.1	−8.0	−7.8	−7.6	−7.4	−7.2	−7.1	−7.0	−6.7	−6.2	−5.1	−4.9	−3.2	−0.9	1.1
60 to 80	−8.0	−8.0	−7.8	−7.6	−7.4	−7.1	−7.0	−7.0	−6.6	−6.2	−5.1	−5.0	−3.3	−1.1	0.8
40 to 60	−7.9	−7.9	−7.7	−7.5	−7.3	−7.1	−7.0	−6.9	−6.6	−6.2	−5.2	−5.0	−3.5	−1.3	0.4
20 to 40	−7.8	−7.8	−7.6	−7.4	−7.2	−7.0	−6.9	−6.9	−6.5	−6.1	−5.2	−5.1	−3.6	−1.6	0.1
0 to 20	−7.7	−7.7	−7.5	−7.3	−7.1	−6.9	−6.9	−6.8	−6.5	−6.1	−5.2	−5.1	−3.7	−1.9	−0.3
−20 to 0	−7.6	−7.6	−7.4	−7.2	−7.1	−6.9	−6.8	−6.8	−6.5	−6.1	−5.3	−5.2	−3.9	−2.1	−0.7
−40 to −20	−7.5	−7.5	−7.3	−7.2	−7.0	−6.8	−6.8	−6.7	−6.4	−6.1	−5.3	−5.2	−4.0	−2.4	−1.1
−60 to −40	−7.4	−7.4	−7.2	−7.1	−6.9	−6.7	−6.7	−6.6	−6.4	−6.1	−5.4	−5.2	−4.1	−2.7	−1.5
−70 to −60	−7.3	−7.3	−7.2	−7.0	−6.9	−6.7	−6.7	−6.6	−6.4	−6.1	−5.4	−5.3	−4.2	−2.9	−1.8

Coef. disp. form. (frac. eq.)(ref.)	
P1	6.67640152E-02
Q1	5.24116669E+01
P2	1.52457750E-02
Q2	7.31296730E-02
P3	3.25603715E-01
Q3	7.94640726E-03

Fitting error of disp. form. σ [1E-6]		
	Visible	Infrared
Power ser. eq.	1.0	6.4
Frac. eq. (ref.)	4.2	23.4

Prod. Freq. (A to D)	A

Similar glass type			
OHARA	–	HOYA	–
CDGM	–	SCHOTT	–

–	–
–	–
2022-7-1	1st edition

HIKARI GLASS CO., LTD.

J-SFH9

n_d = 1.796310 n_e = 1.804568

ν_d = 22.61 ν_e = 22.40

Glass code (d)
796226
Glass code (e)
805224

Spectral l.	Refractive idx
2.058	1.73971
1.970	1.74154
1.530	1.75046
1.129	1.75983
1.064	1.76178
t	1.76347
s	1.77055
A'	1.775859
r	1.781002
C	1.786361
C'	1.787901
He-Ne	1.789352
D	1.796009
d	1.796310
e	1.804568
F	1.821585
F'	1.823822
g	1.844166
h	1.865425
0.389	–
i	–

Partial dispersion	
F-C	0.035224
F'-C'	0.035921
C-t	0.022889
C-A'	0.010502
d-C	0.009949
e-C	0.018207
g-d	0.047856
g-F	0.022581
h-g	0.021259
i-g	–
C'-t	0.024429
e-C'	0.016667
F'-e	0.019254
i-F'	–

Relative partial dispersion	
C-t／F-C	0.6498
C-A'／F-C	0.2981
d-C／F-C	0.2824
e-C／F-C	0.5169
g-d／F-C	1.3586
g-F／F-C	0.6411
h-g／F-C	0.6035
i-g／F-C	–
C'-t／F'-C'	0.6801
e-C'／F'-C'	0.4640
F'-e／F'-C'	0.5360
i-F'／F'-C'	–

Deviation of relative partial disp.	
ΔPdC	−0.0050
ΔPgF	0.0346

Internal CC (80%/5%)
421/386
Color Code (80%/5%)
475/385
CCI

B	0.00
G	8.83
R	9.34

Thermal properties	
CTE(−30,70) [1E-7/℃]	81
CTE(100,300) [1E-7/℃]	101
Tg [℃]	598
At [℃]	640
StP [℃]	552
AP [℃]	586
SP [℃]	697
Ht cndct. [W/m·K]	0.796
Sp. heat [kJ/kg·K]	0.666
Ht diffus. [1E-6 m2/sec]	0.361

Chemical properties [class]	
Acid res. (surface)	1
Alkaline detergent res.	1
Climate resistance	1
Water res. (powder)	1
Acid res. (powder)	1

Mechanical properties	
Knoop hardness	443(4)
Abrasion hardness	325
Young's mod. [GPa]	89.0
Shear mod. [GPa]	35.3
Poisson's ratio	0.260
Stress optical coef. [1E-5 nm/cm／Pa]	2.72

Internal trans. (10mm)	
λ [nm]	τ
280	–
290	–
300	–
310	–
320	–
330	–
340	–
350	–
360	–
370	–
380	0.01
390	0.12
400	0.41
420	0.79
440	0.900
460	0.936
480	0.952
500	0.963
550	0.978
600	0.986
650	0.990
700	0.993
800	0.996
900	0.997
1000	0.998
1200	0.999
1400	0.998
1600	0.993
1800	0.977
2000	0.953
2200	0.900
2400	0.84

Specific gravity
3.31

Coef. disp. form. (pwr ser.)	
A0	3.08187182E+00
A1	−1.53688449E-02
A2	0.00000000E+00
A3	4.03183905E-02
A4	5.73314810E-03
A5	−1.19345000E-03
A6	2.75250207E-04
A7	−2.94456264E-05
A8	1.53252305E-06

Relative Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90 (ref.)	−1.2	−1.1	−0.7	−0.3	0.0	0.5	0.6	0.7	1.3	2.2	4.1	4.4	7.5	12.0	16.0
60 to 80 (ref.)	−1.4	−1.2	−0.8	−0.5	−0.2	0.2	0.4	0.5	1.1	1.9	3.7	4.0	7.0	11.3	15.1
40 to 60	−1.6	−1.4	−1.1	−0.8	−0.4	−0.1	0.1	0.2	0.7	1.5	3.3	3.5	6.3	10.3	13.8
20 to 40	−1.7	−1.6	−1.3	−1.0	−0.7	−0.3	−0.2	−0.1	0.4	1.1	2.8	3.0	5.7	9.4	12.7
0 to 20	−1.9	−1.8	−1.5	−1.2	−0.9	−0.5	−0.4	−0.3	0.2	0.8	2.4	2.6	5.1	8.5	11.5
−20 to 0	−1.9	−1.9	−1.6	−1.3	−1.0	−0.7	−0.6	−0.5	0.0	0.6	2.0	2.2	4.5	7.7	10.4
−40 to −20	−2.0	−1.9	−1.6	−1.4	−1.1	−0.8	−0.7	−0.6	−0.2	0.4	1.8	1.9	4.0	7.0	9.4
−60 to −40 (ref.)	−1.9	−1.8	−1.5	−1.3	−1.1	−0.8	−0.7	−0.6	−0.2	0.3	1.6	1.8	3.7	6.3	8.6
−70 to −60 (ref.)	−1.7	−1.6	−1.4	−1.2	−1.0	−0.7	−0.6	−0.5	−0.1	0.4	1.5	1.7	3.5	5.9	8.0

Absolute Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90	−2.3	−2.2	−1.8	−1.4	−1.1	−0.6	−0.5	−0.4	0.2	1.0	3.0	3.3	6.4	10.8	14.8
60 to 80	−2.5	−2.4	−2.1	−1.7	−1.4	−1.0	−0.9	−0.7	−0.1	0.6	2.5	2.8	5.7	10.0	13.8
40 to 60	−2.9	−2.8	−2.4	−2.1	−1.8	−1.4	−1.3	−1.2	−0.6	0.1	1.8	2.1	4.9	8.9	12.4
20 to 40	−3.2	−3.2	−2.8	−2.5	−2.2	−1.9	−1.8	−1.7	−1.1	−0.4	1.2	1.4	4.0	7.7	11.0
0 to 20	−3.6	−3.5	−3.2	−2.9	−2.7	−2.3	−2.2	−2.1	−1.6	−1.0	0.6	0.8	3.2	6.6	9.6
−20 to 0	−4.0	−3.9	−3.6	−3.4	−3.1	−2.8	−2.7	−2.6	−2.1	−1.5	−0.1	0.1	2.3	5.5	8.2
−40 to −20	−4.3	−4.2	−4.0	−3.8	−3.5	−3.2	−3.1	−3.0	−2.6	−2.0	−0.7	−0.5	1.5	4.4	6.8
−60 to −40	−4.7	−4.6	−4.4	−4.2	−3.9	−3.7	−3.6	−3.5	−3.1	−2.6	−1.4	−1.2	0.7	3.3	5.5
−70 to −60	−4.9	−4.9	−4.7	−4.5	−4.2	−4.0	−3.9	−3.8	−3.5	−3.0	−1.9	−1.7	0.0	2.4	4.4

Coef. disp. form. (frac. eq.)(ref.)	
P1	6.61056793E-02
Q1	4.34911247E+01
P2	2.63461513E-02
Q2	7.20513447E-02
P3	3.82646761E-01
Q3	9.31805224E-03

Fitting error of disp. form. σ [1E-6]		
	Visible	Infrared
Power ser. eq.	1.5	9.1
Frac. eq. (ref.)	3.5	33.7

Prod. Freq. (A to D)	A

Similar glass type			
OHARA	–	HOYA	–
CDGM	–	SCHOTT	–

–	–
–	–
2023-9-1	1st edition

HIKARI GLASS CO., LTD.

J-LAK7

n_d = 1.651600 n_e = 1.654253

ν_d = 58.57 ν_e = 58.34

Glass code (d)
652586
Glass code (e)
654583

Spectral l.	Refractive idx
2.058	1.62263
1.970	1.62418
1.530	1.63114
1.129	1.63704
1.064	1.63808
t	1.63893
s	1.64215
A'	1.644307
r	1.646266
C	1.648206
C'	1.648747
He-Ne	1.649252
D	1.651501
d	1.651600
e	1.654253
F	1.659331
F'	1.659962
g	1.665356
h	1.670353
0.389	1.673398
i	1.678861

Coef. disp. form. (pwr ser.)	
A0	2.68232720E+00
A1	-1.19713031E-02
A2	-1.43724360E-04
A3	1.64555463E-02
A4	2.17295781E-04
A5	4.69383509E-06
A6	3.49394854E-08
A7	0.00000000E+00
A8	0.00000000E+00

Partial dispersion	
F-C	0.011125
F'-C'	0.011215
C-t	0.009279
C-A'	0.003899
d-C	0.003394
e-C	0.006047
g-d	0.013756
g-F	0.006025
h-g	0.004997
i-g	0.013505
C'-t	0.009820
e-C'	0.005506
F'-e	0.005709
i-F'	0.018899

Relative partial dispersion	
C-t／F-C	0.8341
C-A'／F-C	0.3505
d-C／F-C	0.3051
e-C／F-C	0.5436
g-d／F-C	1.2365
g-F／F-C	0.5416
h-g／F-C	0.4492
i-g／F-C	1.2139
C'-t／F'-C'	0.8756
e-C'／F'-C'	0.4909
F'-e／F'-C'	0.5091
i-F'／F'-C'	1.6852

Deviation of relative partial disp.	
ΔPdC	0.0014
ΔPgF	-0.0045

Internal CC (80%/5%)
333/262
Color Code (80%/5%)
350/265

CCI	
B	0.00
G	0.24
R	0.22

Thermal properties	
CTE(-30,70) [1E-7/℃]	66
CTE(100,300) [1E-7/℃]	82
Tg [℃]	651
At [℃]	681
StP [℃]	606
AP [℃]	634
SP [℃]	736
Ht cndct. [W/m･K]	0.953
Sp. heat [kJ/kg･K]	0.670
Ht diffus. [1E-6 m2/sec]	0.431

Chemical properties [class]	
Acid res. (surface)	5
Alkaline detergent res.	4
Climate resistance	2
Water res. (powder)	3
Acid res. (powder)	5

Mechanical properties	
Knoop hardness	583 (6)
Abrasion hardness	106
Young's mod. [GPa]	100.3
Shear mod. [GPa]	39.0
Poisson's ratio	0.285
Stress optical coef. [1E-5 nm/cm／Pa]	2.02

Internal trans. (10mm)	
λ [nm]	τ
280	0.17
290	0.28
300	0.40
310	0.53
320	0.66
330	0.77
340	0.85
350	0.907
360	0.944
370	0.966
380	0.978
390	0.985
400	0.989
420	0.992
440	0.994
460	0.995
480	0.997
500	0.998
550	0.998
600	0.998
650	0.998
700	0.998
800	0.998
900	0.997
1000	0.997
1200	0.996
1400	0.993
1600	0.990
1800	0.981
2000	0.963
2200	0.900
2400	0.70

Specific gravity
3.3

Relative Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90 (ref.)	2.0	2.1	2.1	2.3	2.4	2.5	2.6	2.6	2.7	2.9	3.2	3.3	3.7	4.0	4.3
60 to 80 (ref.)	1.9	2.0	2.1	2.2	2.3	2.4	2.4	2.5	2.6	2.8	3.1	3.2	3.5	3.9	4.1
40 to 60	1.8	1.8	2.0	2.1	2.2	2.3	2.3	2.3	2.5	2.6	3.0	3.0	3.3	3.7	3.9
20 to 40	1.7	1.8	1.9	2.0	2.1	2.2	2.2	2.2	2.4	2.5	2.8	2.9	3.2	3.5	3.7
0 to 20	1.7	1.7	1.8	1.9	2.0	2.1	2.1	2.2	2.3	2.4	2.7	2.8	3.1	3.4	3.6
-20 to 0	1.7	1.7	1.8	1.9	2.0	2.1	2.1	2.1	2.3	2.4	2.7	2.7	3.0	3.3	3.5
-40 to -20	1.7	1.8	1.9	1.9	2.0	2.1	2.2	2.2	2.3	2.4	2.7	2.7	3.0	3.3	3.5
-60 to -40 (ref.)	1.9	1.9	2.0	2.1	2.2	2.3	2.3	2.3	2.4	2.6	2.8	2.9	3.1	3.4	3.6
-70 to -60 (ref.)	2.1	2.1	2.2	2.3	2.4	2.5	2.5	2.5	2.6	2.8	3.0	3.0	3.3	3.6	3.7

Absolute Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90	1.0	1.1	1.2	1.3	1.4	1.5	1.5	1.6	1.7	1.9	2.2	2.2	2.6	3.0	3.2
60 to 80	0.8	0.9	1.0	1.1	1.2	1.3	1.3	1.3	1.5	1.7	2.0	2.0	2.4	2.7	2.9
40 to 60	0.6	0.6	0.7	0.8	0.9	1.0	1.0	1.1	1.2	1.4	1.7	1.7	2.0	2.4	2.6
20 to 40	0.3	0.3	0.4	0.5	0.6	0.7	0.8	0.8	0.9	1.1	1.4	1.4	1.7	2.0	2.2
0 to 20	0.1	0.1	0.2	0.3	0.4	0.5	0.5	0.5	0.6	0.8	1.1	1.1	1.4	1.7	1.9
-20 to 0	-0.2	-0.2	-0.1	0.0	0.1	0.2	0.2	0.2	0.3	0.5	0.7	0.8	1.1	1.3	1.5
-40 to -20	-0.5	-0.4	-0.4	-0.3	-0.2	-0.1	-0.1	-0.1	0.1	0.2	0.4	0.5	0.7	1.0	1.2
-60 to -40	-0.7	-0.7	-0.6	-0.5	-0.5	-0.4	-0.4	-0.3	-0.2	-0.1	0.1	0.2	0.4	0.7	0.8
-70 to -60	-0.9	-0.9	-0.8	-0.7	-0.7	-0.6	-0.6	-0.5	-0.4	-0.3	-0.1	-0.1	0.2	0.4	0.6

Coef. disp. form. (frac. eq.)(ref.)	
P1	1.23367890E-01
Q1	7.50281422E+01
P2	7.86744637E-02
Q2	1.56987933E-02
P3	2.80638114E-01
Q3	3.60652473E-03

Fitting error of disp. form. σ [1E-6]		
	Visible	Infrared
Power ser. eq.	0.4	2.9
Frac. eq. (ref.)	0.4	3.1

Prod. Freq. (A to D)	C

Similar glass type			
OHARA	S-LAL7	HOYA	LAC7
CDGM	H-LaK50A	SCHOTT	N-LAK7

2022-7-1	StP, AP, SP
2020-4-1	chemical properties
2019-4-1	Transmittance

HIKARI GLASS CO., LTD.

J-LAK7R

n_d = 1.651600 n_e = 1.654251

ν_d = 58.62 ν_e = 58.39

Glass code (d)
652586
Glass code (e)
654584

Spectral l.	Refractive idx
2.058	1.62217
1.970	1.62376
1.530	1.63092
1.129	1.63696
1.064	1.63802
t	1.63888
s	1.64213
A'	1.644299
r	1.646264
C	1.648206
C'	1.648747
He-Ne	1.649252
D	1.651501
d	1.651600
e	1.654251
F	1.659322
F'	1.659952
g	1.665335
h	1.670319
0.389	1.673357
i	1.678803

Partial dispersion	
F-C	0.011116
F'-C'	0.011205
C-t	0.009327
C-A'	0.003907
d-C	0.003394
e-C	0.006045
g-d	0.013735
g-F	0.006013
h-g	0.004984
i-g	0.013468
C'-t	0.009868
e-C'	0.005504
F'-e	0.005701
i-F'	0.018851

Relative partial dispersion	
C-t／F-C	0.8391
C-A'／F-C	0.3515
d-C／F-C	0.3053
e-C／F-C	0.5438
g-d／F-C	1.2356
g-F／F-C	0.5409
h-g／F-C	0.4484
i-g／F-C	1.2116
C'-t／F'-C'	0.8807
e-C'／F'-C'	0.4912
F'-e／F'-C'	0.5088
i-F'／F'-C'	1.6824

Deviation of relative partial disp.	
ΔPdC	0.0017
ΔPgF	−0.0051

Internal CC (80%/5%)
330/270
Color Code (80%/5%)
350/270

CCI	
B	0.00
G	0.18
R	0.18

Thermal properties	
CTE(−30,70) [1E-7/℃]	61
CTE(100,300) [1E-7/℃]	78
Tg [℃]	650
At [℃]	677
StP [℃]	607
AP [℃]	637
SP [℃]	741
Ht cndct. [W/m·K]	0.805
Sp. heat [kJ/kg·K]	0.642
Ht diffus. [1E-6 m2/sec]	0.375

Chemical properties [class]	
Acid res. (surface)	5
Alkaline detergent res.	4
Climate resistance	2
Water res. (powder)	2
Acid res. (powder)	4

Mechanical properties	
Knoop hardness	568 (6)
Abrasion hardness	87
Young's mod. [GPa]	101.7
Shear mod. [GPa]	39.6
Poisson's ratio	0.283
Stress optical coef. [1E-5 nm/cm／Pa]	2.11

Internal trans. (10mm)	
λ [nm]	τ
280	0.13
290	0.27
300	0.42
310	0.55
320	0.69
330	0.80
340	0.87
350	0.920
360	0.953
370	0.970
380	0.981
390	0.987
400	0.990
420	0.993
440	0.994
460	0.996
480	0.996
500	0.997
550	0.998
600	0.998
650	0.998
700	0.999
800	0.997
900	0.995
1000	0.996
1200	0.997
1400	0.993
1600	0.989
1800	0.979
2000	0.961
2200	0.88
2400	0.67

Specific gravity
3.34

Coef. disp. form. (pwr ser.)	
A0	2.68281356E+00
A1	−1.24621940E-02
A2	−1.36478256E-04
A3	1.62751692E-02
A4	2.53121787E-04
A5	1.72812439E-07
A6	2.34124836E-07
A7	0.00000000E+00
A8	0.00000000E+00

Relative Δn/ΔT [1E-6/℃]															
Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90 (ref.)	2.8	2.9	3.0	3.1	3.2	3.3	3.3	3.4	3.5	3.7	4.0	4.1	4.5	4.8	5.1
60 to 80 (ref.)	2.7	2.8	2.9	3.0	3.1	3.2	3.2	3.2	3.4	3.5	3.9	3.9	4.3	4.7	4.9
40 to 60	2.6	2.6	2.8	2.9	2.9	3.0	3.1	3.1	3.2	3.4	3.7	3.8	4.1	4.5	4.7
20 to 40	2.5	2.5	2.7	2.7	2.8	2.9	3.0	3.0	3.1	3.3	3.6	3.6	4.0	4.3	4.5
0 to 20	2.4	2.5	2.6	2.7	2.8	2.9	2.9	2.9	3.0	3.2	3.5	3.5	3.8	4.2	4.4
−20 to 0	2.4	2.5	2.6	2.7	2.7	2.8	2.9	2.9	3.0	3.1	3.4	3.5	3.8	4.1	4.3
−40 to −20	2.5	2.5	2.6	2.7	2.8	2.9	2.9	2.9	3.0	3.2	3.4	3.5	3.8	4.1	4.3
−60 to −40 (ref.)	2.6	2.7	2.8	2.9	2.9	3.0	3.0	3.1	3.2	3.3	3.6	3.6	3.9	4.2	4.3
−70 to −60 (ref.)	2.8	2.9	3.0	3.0	3.1	3.2	3.2	3.2	3.3	3.5	3.7	3.8	4.0	4.3	4.5

Absolute Δn/ΔT [1E-6/℃]															
Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90	1.8	1.9	2.0	2.1	2.2	2.3	2.3	2.3	2.5	2.6	3.0	3.0	3.4	3.8	4.0
60 to 80	1.6	1.7	1.8	1.9	2.0	2.1	2.1	2.1	2.3	2.4	2.7	2.8	3.1	3.5	3.7
40 to 60	1.4	1.4	1.5	1.6	1.7	1.8	1.8	1.8	2.0	2.1	2.4	2.5	2.8	3.2	3.4
20 to 40	1.1	1.1	1.2	1.3	1.4	1.5	1.5	1.5	1.7	1.8	2.1	2.1	2.5	2.8	3.0
0 to 20	0.8	0.9	1.0	1.0	1.1	1.2	1.2	1.3	1.4	1.5	1.8	1.8	2.1	2.5	2.6
−20 to 0	0.6	0.6	0.7	0.8	0.8	0.9	0.9	1.0	1.1	1.2	1.5	1.5	1.8	2.1	2.3
−40 to −20	0.3	0.3	0.4	0.5	0.6	0.6	0.7	0.7	0.8	0.9	1.2	1.2	1.5	1.8	1.9
−60 to −40	0.0	0.1	0.1	0.2	0.3	0.3	0.4	0.4	0.5	0.6	0.8	0.9	1.1	1.4	1.6
−70 to −60	−0.2	−0.1	−0.1	0.0	0.1	0.1	0.2	0.2	0.3	0.4	0.6	0.6	0.9	1.1	1.3

Coef. disp. form. (frac. eq.)(ref.)	
P1	1.26542642E-01
Q1	7.44164113E+01
P2	1.60959593E-01
Q2	1.20300900E-02
P3	1.98399854E-01
Q3	1.51065344E-03

Fitting error of disp. form. σ [1E-6]		
	Visible	Infrared
Power ser. eq.	0.5	3.4
Frac. eq. (ref.)	0.5	4.0

Prod. Freq. (A to D)	C

Similar glass type			
OHARA	S-LAL7	HOYA	LAC7
CDGM	H-LaK50A	SCHOTT	N-LAK7

2022-7-1	StP, AP, SP
2019-4-1	Transmittance
2018-4-1	Prod. Freq.

HIKARI GLASS CO., LTD.

J-LAK8

n_d = 1.713000 n_e = 1.716150

ν_d = 53.96 ν_e = 53.73

Glass code (d)
713540
Glass code (e)
716537

Spectral l.	Refractive idx
2.058	1.67966
1.970	1.68141
1.530	1.68925
1.129	1.69596
1.064	1.69714
t	1.69812
s	1.70186
A'	1.704390
r	1.706694
C	1.708982
C'	1.709622
He-Ne	1.710219
D	1.712882
d	1.713000
e	1.716150
F	1.722196
F'	1.722950
g	1.729400
h	1.735396
0.389	1.739061
i	1.745653

Coef. disp. form. (pwr ser.)	
A0	2.87779172E+00
A1	-1.35972618E-02
A2	-2.08866139E-04
A3	2.03518573E-02
A4	2.44901642E-04
A5	1.23070041E-05
A6	-1.32629677E-07
A7	0.00000000E+00
A8	0.00000000E+00

Partial dispersion	
F-C	0.013214
F'-C'	0.013328
C-t	0.010857
C-A'	0.004592
d-C	0.004018
e-C	0.007168
g-d	0.016400
g-F	0.007204
h-g	0.005996
i-g	0.016253
C'-t	0.011497
e-C'	0.006528
F'-e	0.006800
i-F'	0.022703

Relative partial dispersion	
C-t／F-C	0.8216
C-A'／F-C	0.3475
d-C／F-C	0.3041
e-C／F-C	0.5425
g-d／F-C	1.2411
g-F／F-C	0.5452
h-g／F-C	0.4538
i-g／F-C	1.2300
C'-t／F'-C'	0.8626
e-C'／F'-C'	0.4898
F'-e／F'-C'	0.5102
i-F'／F'-C'	1.7034

Deviation of relative partial disp.	
ΔPdC	0.0025
ΔPgF	-0.0086

Internal CC (80%/5%)
345/268
Color Code (80%/5%)
365/270
CCI

B	0.00
G	0.43
R	0.43

Thermal properties	
CTE(-30,70) [1E-7/℃]	53
CTE(100,300) [1E-7/℃]	72
Tg [℃]	652
At [℃]	678
StP [℃]	614
AP [℃]	641
SP [℃]	736
Ht cndct. [W/m･K]	0.880
Sp. heat [kJ/kg･K]	0.566
Ht diffus. [1E-6 m2/sec]	0.417

Chemical properties [class]	
Acid res. (surface)	6
Alkaline detergent res.	3
Climate resistance	1
Water res. (powder)	1
Acid res. (powder)	4

Mechanical properties	
Knoop hardness	625 (6)
Abrasion hardness	70
Young's mod. [GPa]	112.2
Shear mod. [GPa]	43.4
Poisson's ratio	0.291
Stress optical coef. [1E-5 nm/cm／Pa]	1.89

Internal trans. (10mm)	
λ [nm]	τ
280	0.11
290	0.19
300	0.29
310	0.40
320	0.53
330	0.65
340	0.76
350	0.84
360	0.900
370	0.938
380	0.961
390	0.973
400	0.981
420	0.987
440	0.990
460	0.993
480	0.995
500	0.997
550	0.998
600	0.998
650	0.998
700	0.998
800	0.998
900	0.999
1000	0.999
1200	0.999
1400	0.994
1600	0.993
1800	0.983
2000	0.960
2200	0.89
2400	0.63

Specific gravity
3.72

Relative Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90 (ref.)	4.0	4.0	4.2	4.3	4.5	4.6	4.6	4.7	4.9	5.1	5.5	5.5	6.0	6.5	6.7
60 to 80 (ref.)	3.9	4.0	4.1	4.3	4.4	4.5	4.6	4.6	4.8	5.0	5.4	5.4	5.9	6.3	6.6
40 to 60	3.9	3.9	4.0	4.2	4.3	4.4	4.5	4.5	4.7	4.8	5.2	5.3	5.7	6.1	6.4
20 to 40	3.8	3.8	4.0	4.1	4.2	4.4	4.4	4.4	4.6	4.8	5.1	5.2	5.6	6.0	6.3
0 to 20	3.8	3.8	4.0	4.1	4.2	4.3	4.4	4.4	4.6	4.7	5.1	5.1	5.5	5.9	6.1
-20 to 0	3.9	3.9	4.0	4.1	4.3	4.4	4.4	4.4	4.6	4.7	5.1	5.1	5.5	5.9	6.1
-40 to -20	4.0	4.0	4.1	4.3	4.4	4.5	4.5	4.5	4.7	4.8	5.1	5.2	5.5	5.9	6.1
-60 to -40 (ref.)	4.2	4.2	4.3	4.5	4.6	4.7	4.7	4.7	4.9	5.0	5.3	5.4	5.7	6.0	6.2
-70 to -60 (ref.)	4.4	4.5	4.6	4.7	4.8	4.9	4.9	5.0	5.1	5.2	5.5	5.6	5.9	6.2	6.4

Absolute Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90	3.0	3.0	3.1	3.3	3.4	3.5	3.6	3.6	3.8	4.0	4.4	4.4	4.9	5.4	5.6
60 to 80	2.8	2.8	3.0	3.1	3.2	3.4	3.4	3.4	3.6	3.8	4.2	4.2	4.7	5.1	5.4
40 to 60	2.6	2.6	2.8	2.9	3.0	3.1	3.2	3.2	3.4	3.5	3.9	3.9	4.4	4.8	5.0
20 to 40	2.4	2.4	2.5	2.6	2.8	2.9	2.9	3.0	3.1	3.3	3.6	3.7	4.1	4.5	4.7
0 to 20	2.1	2.2	2.3	2.4	2.5	2.6	2.7	2.7	2.8	3.0	3.3	3.4	3.8	4.1	4.4
-20 to 0	1.9	1.9	2.1	2.2	2.3	2.4	2.4	2.5	2.6	2.8	3.1	3.1	3.5	3.8	4.0
-40 to -20	1.7	1.7	1.9	2.0	2.1	2.2	2.2	2.2	2.3	2.5	2.8	2.8	3.2	3.5	3.7
-60 to -40	1.5	1.5	1.6	1.7	1.8	1.9	1.9	2.0	2.1	2.2	2.5	2.5	2.9	3.2	3.4
-70 to -60	1.3	1.3	1.5	1.6	1.6	1.7	1.8	1.8	1.9	2.0	2.3	2.3	2.6	2.9	3.1

Coef. disp. form. (frac. eq.)(ref.)	
P1	1.18244084E-01
Q1	6.79365479E+01
P2	3.54569746E-02
Q2	2.27963420E-02
P3	3.49564309E-01
Q3	4.95985311E-03

Fitting error of disp. form. σ [1E-6]		
	Visible	Infrared
Power ser. eq.	0.5	11.3
Frac. eq. (ref.)	0.7	13.1

Prod. Freq. (A to D)	B

Similar glass type			
OHARA	S-LAL8	HOYA	LAC8
CDGM	H-LaK7A	SCHOTT	N-LAK8

2022-7-1	StP, AP, SP
2019-4-1	Transmittance
2015-4-1	Color Code, Similar glass type, Please see the revision history about others.

HIKARI GLASS CO., LTD.

J-LAK9

n_d = 1.691000 n_e = 1.693998

ν_d = 54.93 ν_e = 54.71

Glass code (d)
691549
Glass code (e)
694547

Spectral l.	Refractive idx
2.058	1.65866
1.970	1.66037
1.530	1.66808
1.129	1.67465
1.064	1.67580
t	1.67675
s	1.68036
A'	1.682783
r	1.684987
C	1.687171
C'	1.687781
He-Ne	1.688350
D	1.690888
d	1.691000
e	1.693998
F	1.699750
F'	1.700467
g	1.706596
h	1.712290
0.389	1.715768
i	1.722021

Coef. disp. form. (pwr ser.)	
A0	2.80700795E+00
A1	-1.35938061E-02
A2	-1.53406686E-04
A3	1.88808096E-02
A4	2.80739188E-04
A5	5.33547368E-06
A6	1.19947182E-07
A7	0.00000000E+00
A8	0.00000000E+00

Partial dispersion	
F-C	0.012579
F'-C'	0.012686
C-t	0.010417
C-A'	0.004388
d-C	0.003829
e-C	0.006827
g-d	0.015596
g-F	0.006846
h-g	0.005694
i-g	0.015425
C'-t	0.011027
e-C'	0.006217
F'-e	0.006469
i-F'	0.021554

Relative partial dispersion	
C-t／F-C	0.8281
C-A'／F-C	0.3488
d-C／F-C	0.3044
e-C／F-C	0.5427
g-d／F-C	1.2398
g-F／F-C	0.5442
h-g／F-C	0.4527
i-g／F-C	1.2263
C'-t／F'-C'	0.8692
e-C'／F'-C'	0.4901
F'-e／F'-C'	0.5099
i-F'／F'-C'	1.6990

Deviation of relative partial disp.	
ΔPdC	0.0024
ΔPgF	−0.0079

Internal CC (80%/5%)
357/303
Color Code (80%/5%)
380/305
CCI

B	−
G	−
R	−

Thermal properties	
CTE(−30,70) [1E-7/℃]	59
CTE(100,300) [1E-7/℃]	75
Tg [℃]	658
At [℃]	686
StP [℃]	−
AP [℃]	−
SP [℃]	−
Ht cndct. [W/m·K]	0.946
Sp. heat [kJ/kg·K]	0.648
Ht diffus. [1E-6 m2/sec]	0.420

Chemical properties [class]	
Acid res. (surface)	5
Alkaline detergent res.	4
Climate resistance	1
Water res. (powder)	2
Acid res. (powder)	4

Mechanical properties	
Knoop hardness	679 (7)
Abrasion hardness	79
Young's mod. [GPa]	113.9
Shear mod. [GPa]	44.2
Poisson's ratio	0.289
Stress optical coef. [1E-5 nm/cm／Pa]	2.01

Internal trans. (10mm)	
λ [nm]	τ
280	−
290	−
300	−
310	0.11
320	0.24
330	0.41
340	0.58
350	0.73
360	0.83
370	0.900
380	0.937
390	0.960
400	0.973
420	0.985
440	0.989
460	0.991
480	0.994
500	0.995
550	0.997
600	0.995
650	0.993
700	0.989
800	0.982
900	0.997
1000	0.998
1200	0.998
1400	0.985
1600	0.984
1800	0.973
2000	0.944
2200	0.84
2400	0.60

Specific gravity
3.48

Relative Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90 (ref.)	3.2	3.3	3.4	3.5	3.6	3.8	3.8	3.8	4.0	4.2	4.6	4.6	5.1	5.5	5.8
60 to 80 (ref.)	3.1	3.1	3.3	3.4	3.5	3.6	3.7	3.7	3.9	4.0	4.4	4.5	4.9	5.3	5.6
40 to 60	3.0	3.0	3.1	3.2	3.4	3.5	3.5	3.5	3.7	3.9	4.2	4.3	4.7	5.1	5.4
20 to 40	2.9	2.9	3.0	3.1	3.2	3.4	3.4	3.4	3.6	3.7	4.1	4.1	4.5	4.9	5.2
0 to 20	2.8	2.8	3.0	3.1	3.2	3.3	3.3	3.3	3.5	3.6	4.0	4.0	4.4	4.8	5.0
−20 to 0	2.8	2.8	2.9	3.0	3.1	3.2	3.3	3.3	3.4	3.6	3.9	3.9	4.3	4.7	4.9
−40 to −20	2.8	2.9	3.0	3.1	3.2	3.3	3.3	3.3	3.4	3.6	3.9	3.9	4.3	4.6	4.8
−60 to −40 (ref.)	3.0	3.0	3.1	3.2	3.3	3.4	3.4	3.4	3.6	3.7	4.0	4.0	4.4	4.7	4.9
−70 to −60 (ref.)	3.2	3.2	3.3	3.4	3.5	3.6	3.6	3.6	3.7	3.9	4.2	4.2	4.5	4.8	5.0

Absolute Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90	2.2	2.2	2.4	2.5	2.6	2.7	2.7	2.8	2.9	3.1	3.5	3.6	4.0	4.4	4.7
60 to 80	2.0	2.0	2.1	2.3	2.4	2.5	2.5	2.5	2.7	2.9	3.3	3.3	3.7	4.2	4.4
40 to 60	1.7	1.7	1.9	2.0	2.1	2.2	2.2	2.2	2.4	2.6	2.9	3.0	3.4	3.8	4.0
20 to 40	1.4	1.5	1.6	1.7	1.8	1.9	1.9	1.9	2.1	2.3	2.6	2.6	3.0	3.4	3.6
0 to 20	1.1	1.2	1.3	1.4	1.5	1.6	1.6	1.6	1.8	1.9	2.3	2.3	2.7	3.0	3.2
−20 to 0	0.9	0.9	1.0	1.1	1.2	1.3	1.3	1.3	1.5	1.6	1.9	2.0	2.3	2.6	2.8
−40 to −20	0.6	0.6	0.7	0.8	0.9	1.0	1.0	1.0	1.1	1.3	1.6	1.6	1.9	2.2	2.4
−60 to −40	0.3	0.3	0.4	0.5	0.6	0.7	0.7	0.7	0.8	1.0	1.2	1.3	1.6	1.9	2.1
−70 to −60	0.1	0.1	0.2	0.3	0.4	0.5	0.5	0.5	0.6	0.7	1.0	1.0	1.3	1.6	1.8

Coef. disp. form. (frac. eq.)(ref.)	
P1	1.34618096E-01
Q1	7.60858750E+01
P2	8.04951206E-02
Q2	1.70486934E-02
P3	2.95434912E-01
Q3	3.64440992E-03

Fitting error of disp. form. σ [1E-6]		
	Visible	Infrared
Power ser. eq.	0.6	2.7
Frac. eq. (ref.)	0.6	2.9

Prod. Freq. (A to D)	D

Similar glass type			
OHARA	S-LAL9	HOYA	LAC9
CDGM	H-LaK59A	SCHOTT	N-LAK9

2019-4-1	Transmittance
2018-4-1	Prod. Freq.
2016-4-1	Similar glass type

HIKARI GLASS CO., LTD.

J-LAK10

n_d = 1.719990 n_e = 1.723401

ν_d = 50.27 ν_e = 50.01

Glass code (d)
720503
Glass code (e)
723500

Spectral l.	Refractive idx
2.058	1.68749
1.970	1.68901
1.530	1.69598
1.129	1.70225
1.064	1.70341
t	1.70438
s	1.70818
A'	1.710805
r	1.713235
C	1.715672
C'	1.716357
He-Ne	1.716996
D	1.719863
d	1.719990
e	1.723401
F	1.729995
F'	1.730821
g	1.737911
h	1.744540
0.389	1.748610
i	1.755962

Coef. disp. form. (pwr ser.)	
A0	2.89571408E+00
A1	-1.20013315E-02
A2	-1.36916169E-04
A3	2.19522159E-02
A4	3.57973143E-04
A5	8.26304425E-06
A6	2.73881720E-07
A7	0.00000000E+00
A8	0.00000000E+00

Partial dispersion	
F-C	0.014323
F'-C'	0.014464
C-t	0.011287
C-A'	0.004867
d-C	0.004318
e-C	0.007729
g-d	0.017921
g-F	0.007916
h-g	0.006629
i-g	0.018051
C'-t	0.011972
e-C'	0.007044
F'-e	0.007420
i-F'	0.025141

Relative partial dispersion	
C-t／F-C	0.7880
C-A'／F-C	0.3398
d-C／F-C	0.3015
e-C／F-C	0.5396
g-d／F-C	1.2512
g-F／F-C	0.5527
h-g／F-C	0.4628
i-g／F-C	1.2603
C'-t／F'-C'	0.8277
e-C'／F'-C'	0.4870
F'-e／F'-C'	0.5130
i-F'／F'-C'	1.7382

Deviation of relative partial disp.	
ΔPdC	0.0016
ΔPgF	−0.0073

Internal CC (80%/5%)
355/315
Color Code (80%/5%)
375/305

CCI	
B	0.00
G	0.43
R	0.41

Thermal properties	
CTE(-30,70) [1E-7/℃]	65
CTE(100,300) [1E-7/℃]	82
Tg [℃]	629
At [℃]	664
StP [℃]	586
AP [℃]	617
SP [℃]	726
Ht cndct. [W/m·K]	0.870
Sp. heat [kJ/kg·K]	0.560
Ht diffus. [1E-6 m2/sec]	0.415

Chemical properties [class]	
Acid res. (surface)	5
Alkaline detergent res.	3
Climate resistance	1
Water res. (powder)	2
Acid res. (powder)	4

Mechanical properties	
Knoop hardness	629 (6)
Abrasion hardness	100
Young's mod. [GPa]	106.0
Shear mod. [GPa]	40.9
Poisson's ratio	0.295
Stress optical coef. [1E-5 nm/cm／Pa]	2.05

Internal trans. (10mm)	
λ [nm]	τ
280	–
290	–
300	0.03
310	0.11
320	0.26
330	0.45
340	0.62
350	0.75
360	0.85
370	0.911
380	0.947
390	0.967
400	0.978
420	0.988
440	0.992
460	0.994
480	0.997
500	0.998
550	0.999
600	0.998
650	0.998
700	0.998
800	0.999
900	0.999
1000	0.999
1200	0.999
1400	0.999
1600	0.992
1800	0.979
2000	0.962
2200	0.901
2400	0.72

Specific gravity
3.74

Relative Δn/ΔT [1E-6/℃]															
Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90 (ref.)	3.6	3.7	3.9	4.0	4.2	4.3	4.4	4.4	4.6	4.9	5.5	5.5	6.1	6.7	7.2
60 to 80 (ref.)	3.6	3.6	3.8	3.9	4.1	4.2	4.3	4.3	4.5	4.8	5.3	5.4	6.0	6.6	7.0
40 to 60	3.5	3.5	3.7	3.8	4.0	4.1	4.1	4.2	4.4	4.7	5.2	5.2	5.8	6.3	6.7
20 to 40	3.4	3.5	3.6	3.8	3.9	4.0	4.1	4.1	4.3	4.6	5.0	5.1	5.6	6.2	6.6
0 to 20	3.4	3.5	3.6	3.7	3.8	4.0	4.0	4.0	4.2	4.5	5.0	5.0	5.5	6.0	6.4
-20 to 0	3.4	3.5	3.6	3.7	3.8	4.0	4.0	4.1	4.2	4.5	4.9	5.0	5.5	6.0	6.3
-40 to -20	3.5	3.6	3.7	3.8	3.9	4.0	4.1	4.1	4.3	4.5	5.0	5.0	5.5	5.9	6.3
-60 to -40 (ref.)	3.7	3.8	3.9	4.0	4.1	4.2	4.3	4.3	4.5	4.7	5.1	5.2	5.6	6.0	6.4
-70 to -60 (ref.)	3.9	4.0	4.1	4.2	4.3	4.4	4.5	4.5	4.7	4.9	5.3	5.3	5.8	6.2	6.5

Absolute Δn/ΔT [1E-6/℃]															
Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90	2.6	2.7	2.9	3.0	3.1	3.3	3.3	3.3	3.6	3.8	4.4	4.4	5.0	5.6	6.0
60 to 80	2.4	2.5	2.7	2.8	2.9	3.1	3.1	3.1	3.4	3.6	4.1	4.2	4.8	5.3	5.8
40 to 60	2.2	2.2	2.4	2.5	2.7	2.8	2.8	2.9	3.1	3.3	3.8	3.9	4.4	5.0	5.4
20 to 40	1.9	2.0	2.2	2.3	2.4	2.5	2.6	2.6	2.8	3.0	3.5	3.6	4.1	4.6	5.0
0 to 20	1.7	1.8	1.9	2.0	2.1	2.3	2.3	2.3	2.5	2.8	3.2	3.3	3.8	4.3	4.6
-20 to 0	1.4	1.5	1.7	1.8	1.9	2.0	2.0	2.1	2.2	2.5	2.9	3.0	3.4	3.9	4.2
-40 to -20	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.8	2.0	2.2	2.6	2.7	3.1	3.5	3.8
-60 to -40	1.0	1.0	1.2	1.3	1.4	1.5	1.5	1.5	1.7	1.9	2.3	2.3	2.8	3.2	3.5
-70 to -60	0.8	0.9	1.0	1.1	1.2	1.3	1.3	1.3	1.5	1.7	2.1	2.1	2.5	2.9	3.2

Coef. disp. form. (frac. eq.)(ref.)	
P1	1.18612501E-01
Q1	7.86740795E+01
P2	4.18812526E-02
Q2	2.43324368E-02
P3	3.45358995E-01
Q3	4.99355035E-03

Fitting error of disp. form. σ [1E-6]		
	Visible	Infrared
Power ser. eq.	0.6	2.3
Frac. eq. (ref.)	0.6	2.3

Prod. Freq. (A to D)	C

Similar glass type			
OHARA	S-LAL10	HOYA	LAC10
CDGM	H-LaK8A	SCHOTT	N-LAK10

2022-7-1	StP, AP, SP
2019-4-1	Transmittance
2015-4-1	Color Code

HIKARI GLASS CO., LTD.

J-LAK12

n_d = 1.677900 n_e = 1.680819

ν_d = 55.35 ν_e = 55.09

Glass code (d)
678554
Glass code (e)
681551

Spectral l.	Refractive idx
2.058	1.64867
1.970	1.65010
1.530	1.65664
1.129	1.66240
1.064	1.66345
t	1.66432
s	1.66767
A'	1.669970
r	1.672081
C	1.674187
C'	1.674777
He-Ne	1.675328
D	1.677791
d	1.677900
e	1.680819
F	1.686435
F'	1.687136
g	1.693135
h	1.698714
0.389	1.702124
i	1.708258

Coef. disp. form. (pwr ser.)	
A0	2.76331704E+00
A1	-1.11612524E-02
A2	-1.29016401E-04
A3	1.84973677E-02
A4	2.56863267E-04
A5	6.55822525E-06
A6	7.62548252E-08
A7	0.00000000E+00
A8	0.00000000E+00

Partial dispersion	
F-C	0.012248
F'-C'	0.012359
C-t	0.009872
C-A'	0.004217
d-C	0.003713
e-C	0.006632
g-d	0.015235
g-F	0.006700
h-g	0.005579
i-g	0.015123
C'-t	0.010462
e-C'	0.006042
F'-e	0.006317
i-F'	0.021122

Relative partial dispersion	
C-t／F-C	0.8060
C-A'／F-C	0.3443
d-C／F-C	0.3032
e-C／F-C	0.5415
g-d／F-C	1.2439
g-F／F-C	0.5470
h-g／F-C	0.4555
i-g／F-C	1.2347
C'-t／F'-C'	0.8465
e-C'／F'-C'	0.4889
F'-e／F'-C'	0.5111
i-F'／F'-C'	1.7090

Deviation of relative partial disp.	
ΔPdC	0.0010
ΔPgF	-0.0045

Internal CC (80%/5%)
349/293
Color Code (80%/5%)
365/295

CCI	
B	0.00
G	0.36
R	0.33

Thermal properties	
CTE(-30,70) [1E-7/℃]	78
CTE(100,300) [1E-7/℃]	91
Tg [℃]	640
At [℃]	669
StP [℃]	595
AP [℃]	624
SP [℃]	726
Ht cndct. [W/m･K]	0.803
Sp. heat [kJ/kg･K]	0.527
Ht diffus. [1E-6 m2/sec]	0.402

Chemical properties [class]	
Acid res. (surface)	6
Alkaline detergent res.	4
Climate resistance	2
Water res. (powder)	3
Acid res. (powder)	4

Mechanical properties	
Knoop hardness	497 (5)
Abrasion hardness	144
Young's mod. [GPa]	93.6
Shear mod. [GPa]	36.3
Poisson's ratio	0.291
Stress optical coef. [1E-5 nm/cm／Pa]	2.06

Internal trans. (10mm)	
λ [nm]	τ
280	-
290	0.04
300	0.11
310	0.24
320	0.40
330	0.56
340	0.70
350	0.81
360	0.89
370	0.934
380	0.960
390	0.975
400	0.982
420	0.989
440	0.991
460	0.993
480	0.995
500	0.997
550	0.998
600	0.997
650	0.997
700	0.998
800	0.998
900	0.998
1000	0.998
1200	0.997
1400	0.998
1600	0.992
1800	0.982
2000	0.969
2200	0.921
2400	0.74

Specific gravity
3.78

Relative Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90 (ref.)	0.3	0.3	0.4	0.6	0.7	0.8	0.9	0.9	1.1	1.2	1.6	1.7	2.1	2.6	2.8
60 to 80 (ref.)	0.2	0.2	0.4	0.5	0.6	0.7	0.8	0.8	1.0	1.1	1.5	1.5	2.0	2.4	2.7
40 to 60	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.7	0.8	1.0	1.4	1.4	1.8	2.3	2.5
20 to 40	0.1	0.1	0.2	0.3	0.5	0.6	0.6	0.6	0.8	0.9	1.3	1.3	1.7	2.1	2.4
0 to 20	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.6	0.7	0.9	1.2	1.3	1.7	2.0	2.3
-20 to 0	0.1	0.1	0.2	0.3	0.4	0.5	0.6	0.6	0.7	0.9	1.2	1.2	1.6	2.0	2.2
-40 to -20	0.2	0.2	0.3	0.4	0.5	0.6	0.7	0.7	0.8	1.0	1.3	1.3	1.7	2.0	2.2
-60 to -40 (ref.)	0.4	0.4	0.5	0.6	0.7	0.8	0.8	0.9	1.0	1.1	1.4	1.5	1.8	2.2	2.4
-70 to -60 (ref.)	0.6	0.6	0.7	0.8	0.9	1.0	1.0	1.1	1.2	1.3	1.6	1.7	2.0	2.4	2.5

Absolute Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90	-0.7	-0.7	-0.6	-0.4	-0.3	-0.2	-0.2	-0.1	0.0	0.2	0.5	0.6	1.0	1.5	1.7
60 to 80	-0.9	-0.9	-0.7	-0.6	-0.5	-0.4	-0.4	-0.3	-0.2	0.0	0.3	0.4	0.8	1.2	1.5
40 to 60	-1.1	-1.1	-1.0	-0.9	-0.8	-0.6	-0.6	-0.6	-0.4	-0.3	0.1	0.1	0.5	0.9	1.2
20 to 40	-1.4	-1.3	-1.2	-1.1	-1.0	-0.9	-0.9	-0.8	-0.7	-0.5	-0.2	-0.2	0.2	0.6	0.8
0 to 20	-1.6	-1.6	-1.4	-1.3	-1.2	-1.1	-1.1	-1.1	-1.0	-0.8	-0.5	-0.4	-0.1	0.3	0.5
-20 to 0	-1.8	-1.8	-1.7	-1.6	-1.5	-1.4	-1.4	-1.3	-1.2	-1.1	-0.8	-0.7	-0.4	0.0	0.2
-40 to -20	-2.1	-2.0	-1.9	-1.8	-1.7	-1.6	-1.6	-1.6	-1.5	-1.3	-1.0	-1.0	-0.6	-0.3	-0.1
-60 to -40	-2.3	-2.3	-2.2	-2.1	-2.0	-1.9	-1.9	-1.8	-1.7	-1.6	-1.3	-1.3	-0.9	-0.6	-0.4
-70 to -60	-2.5	-2.4	-2.3	-2.2	-2.2	-2.1	-2.1	-2.0	-1.9	-1.8	-1.5	-1.5	-1.2	-0.9	-0.7

Coef. disp. form. (frac. eq.)(ref.)	
P1	1.18309052E-01
Q1	7.97713112E+01
P2	4.45527521E-02
Q2	2.07866430E-02
P3	3.25656493E-01
Q3	4.64629751E-03

Fitting error of disp. form. σ [1E-6]		
	Visible	Infrared
Power ser. eq.	0.4	3.3
Frac. eq. (ref.)	0.5	3.3

Prod. Freq. (A to D)	C

Similar glass type			
OHARA	S-LAL12	HOYA	LAC12
CDGM	H-LaK5A	SCHOTT	N-LAK12

2022-7-1	StP, AP, SP
2019-4-1	Transmittance
2018-4-1	Prod. Freq.

J-LAK13

n_d = 1.693500 n_e = 1.696606

ν_d = 53.21 ν_e = 52.96

Glass code (d)
694532
Glass code (e)
697530

Spectral l.	Refractive idx
2.058	1.66203
1.970	1.66360
1.530	1.67073
1.129	1.67697
1.064	1.67809
t	1.67903
s	1.68261
A'	1.685063
r	1.687310
C	1.689551
C'	1.690178
He-Ne	1.690764
D	1.693384
d	1.693500
e	1.696606
F	1.702585
F'	1.703332
g	1.709727
h	1.715682
0.389	1.719326
i	1.725887

Partial dispersion	
F-C	0.013034
F'-C'	0.013154
C-t	0.010526
C-A'	0.004488
d-C	0.003949
e-C	0.007055
g-d	0.016227
g-F	0.007142
h-g	0.005955
i-g	0.016160
C'-t	0.011153
e-C'	0.006428
F'-e	0.006726
i-F'	0.022555

Relative partial dispersion	
C-t／F-C	0.8076
C-A'／F-C	0.3443
d-C／F-C	0.3030
e-C／F-C	0.5413
g-d／F-C	1.2450
g-F／F-C	0.5480
h-g／F-C	0.4569
i-g／F-C	1.2398
C'-t／F'-C'	0.8479
e-C'／F'-C'	0.4887
F'-e／F'-C'	0.5113
i-F'／F'-C'	1.7147

Deviation of relative partial disp.	
ΔPdC	0.0018
ΔPgF	−0.0071

Internal CC (80%/5%)
348/282
Color Code (80%/5%)
365/285
CCI

B	0.00
G	0.33
R	0.33

Thermal properties	
CTE(−30,70) [1E-7/℃]	60
CTE(100,300) [1E-7/℃]	74
Tg [℃]	619
At [℃]	653
StP [℃]	589
AP [℃]	611
SP [℃]	711
Ht cndct. [W/m·K]	0.876
Sp. heat [kJ/kg·K]	0.599
Ht diffus. [1E-6 m2/sec]	0.396

Chemical properties [class]	
Acid res. (surface)	5
Alkaline detergent res.	4
Climate resistance	1
Water res. (powder)	1
Acid res. (powder)	4

Mechanical properties	
Knoop hardness	618 (6)
Abrasion hardness	124
Young's mod. [GPa]	102.3
Shear mod. [GPa]	39.6
Poisson's ratio	0.292
Stress optical coef. [1E-5 nm/cm／Pa]	2.26

Internal trans. (10mm)	
λ [nm]	τ
280	0.04
290	0.09
300	0.17
310	0.29
320	0.43
330	0.58
340	0.71
350	0.82
360	0.89
370	0.934
380	0.960
390	0.974
400	0.982
420	0.990
440	0.992
460	0.994
480	0.996
500	0.997
550	0.998
600	0.998
650	0.998
700	0.998
800	0.998
900	0.998
1000	0.998
1200	0.999
1400	0.993
1600	0.993
1800	0.981
2000	0.958
2200	0.87
2400	0.65

Specific gravity
3.69

Coef. disp. form. (pwr ser.)	
A0	2.81256049E+00
A1	−1.23338559E-02
A2	−1.46274016E-04
A3	1.96331804E-02
A4	3.19216380E-04
A5	3.67504765E-06
A6	2.77132755E-07
A7	0.00000000E+00
A8	0.00000000E+00

Relative Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90 (ref.)	4.3	4.4	4.6	4.8	4.9	5.1	5.1	5.1	5.4	5.6	6.1	6.1	6.7	−	−
60 to 80 (ref.)	4.2	4.3	4.5	4.6	4.8	4.9	5.0	5.0	5.2	5.4	5.9	6.0	6.5	−	−
40 to 60	4.1	4.1	4.3	4.5	4.6	4.7	4.8	4.8	5.0	5.2	5.7	5.7	6.3	−	−
20 to 40	3.9	4.0	4.2	4.3	4.5	4.6	4.6	4.7	4.9	5.1	5.5	5.6	6.1	−	−
0 to 20	3.9	3.9	4.1	4.2	4.4	4.5	4.5	4.6	4.7	4.9	5.4	5.4	5.9	−	−
−20 to 0	3.8	3.9	4.1	4.2	4.3	4.4	4.5	4.5	4.7	4.9	5.3	5.3	5.8	−	−
−40 to −20	3.9	3.9	4.1	4.2	4.3	4.5	4.5	4.5	4.7	4.9	5.2	5.3	5.7	−	−
−60 to −40 (ref.)	4.0	4.1	4.2	4.3	4.5	4.6	4.6	4.6	4.8	5.0	5.3	5.4	5.8	−	−
−70 to −60 (ref.)	4.2	4.2	4.4	4.5	4.6	4.7	4.8	4.8	4.9	5.1	5.5	5.5	5.9	−	−

Absolute Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90	3.3	3.4	3.6	3.7	3.9	4.0	4.1	4.1	4.3	4.5	5.0	5.1	5.6	−	−
60 to 80	3.1	3.1	3.3	3.5	3.6	3.8	3.8	3.9	4.1	4.3	4.7	4.8	5.3	−	−
40 to 60	2.8	2.8	3.0	3.2	3.3	3.5	3.5	3.5	3.7	3.9	4.4	4.4	5.0	−	−
20 to 40	2.5	2.6	2.7	2.9	3.0	3.1	3.2	3.2	3.4	3.6	4.0	4.1	4.6	−	−
0 to 20	2.2	2.3	2.4	2.6	2.7	2.8	2.9	2.9	3.1	3.2	3.6	3.7	4.2	−	−
−20 to 0	1.9	2.0	2.1	2.3	2.4	2.5	2.5	2.6	2.7	2.9	3.3	3.3	3.8	−	−
−40 to −20	1.6	1.7	1.8	2.0	2.1	2.2	2.2	2.2	2.4	2.6	2.9	3.0	3.4	−	−
−60 to −40	1.3	1.4	1.5	1.6	1.8	1.9	1.9	1.9	2.1	2.2	2.6	2.6	3.0	−	−
−70 to −60	1.1	1.2	1.3	1.4	1.5	1.6	1.6	1.7	1.8	2.0	2.3	2.3	2.7	−	−

Coef. disp. form. (frac. eq.)(ref.)	
P1	1.16019105E-01
Q1	7.26275723E+01
P2	6.52063855E-02
Q2	1.91186180E-02
P3	3.11433626E-01
Q3	4.17724888E-03

Fitting error of disp. form. σ [1E-6]		
	Visible	Infrared
Power ser. eq.	0.4	2.6
Frac. eq. (ref.)	0.4	2.6

Prod. Freq. (A to D)	C

Similar glass type			
OHARA	S-LAL13	HOYA	LAC13
CDGM	H-LaK6A	SCHOTT	−

2022-7-1	StP, AP, SP
2019-4-1	Transmittance
2018-4-1	Prod. Freq.

J-LAK14

n_d = 1.696800 n_e = 1.699792

ν_d = 55.52 ν_e = 55.30

Glass code (d)
697555
Glass code (e)
700553

Spectral l.	Refractive idx
2.058	1.66396
1.970	1.66573
1.530	1.67367
1.129	1.68037
1.064	1.68155
t	1.68251
s	1.68615
A'	1.688581
r	1.690789
C	1.692974
C'	1.693585
He-Ne	1.694153
D	1.696688
d	1.696800
e	1.699792
F	1.705525
F'	1.706239
g	1.712340
h	1.718001
0.389	1.721457
i	1.727665

Coef. disp. form. (pwr ser.)	
A0	2.82679870E+00
A1	-1.40346783E-02
A2	-1.70936348E-04
A3	1.89011366E-02
A4	2.75933670E-04
A5	5.15919094E-06
A6	9.87059817E-08
A7	0.00000000E+00
A8	0.00000000E+00

Partial dispersion	
F-C	0.012551
F'-C'	0.012654
C-t	0.010465
C-A'	0.004393
d-C	0.003826
e-C	0.006818
g-d	0.015540
g-F	0.006815
h-g	0.005661
i-g	0.015325
C'-t	0.011076
e-C'	0.006207
F'-e	0.006447
i-F'	0.021426

Relative partial dispersion	
C-t／F-C	0.8338
C-A'／F-C	0.3500
d-C／F-C	0.3048
e-C／F-C	0.5432
g-d／F-C	1.2381
g-F／F-C	0.5430
h-g／F-C	0.4510
i-g／F-C	1.2210
C'-t／F'-C'	0.8753
e-C'／F'-C'	0.4905
F'-e／F'-C'	0.5095
i-F'／F'-C'	1.6932

Deviation of relative partial disp.	
ΔPdC	0.0026
ΔPgF	-0.0082

Internal CC (80%/5%)
349/281
Color Code (80%/5%)
370/285

CCI	
B	0.00
G	0.46
R	0.46

Thermal properties	
CTE(-30,70) [1E-7/℃]	56
CTE(100,300) [1E-7/℃]	70
Tg [℃]	662
At [℃]	686
StP [℃]	619
AP [℃]	645
SP [℃]	739
Ht cndct. [W/m･K]	0.971
Sp. heat [kJ/kg･K]	0.610
Ht diffus. [1E-6 m2/sec]	0.437

Chemical properties [class]	
Acid res. (surface)	5
Alkaline detergent res.	4
Climate resistance	2
Water res. (powder)	2
Acid res. (powder)	4

Mechanical properties	
Knoop hardness	644 (6)
Abrasion hardness	114
Young's mod. [GPa]	109.0
Shear mod. [GPa]	42.3
Poisson's ratio	0.289
Stress optical coef. [1E-5 nm/cm／Pa]	1.90

Internal trans. (10mm)	
λ [nm]	τ
280	0.05
290	0.10
300	0.17
310	0.28
320	0.42
330	0.57
340	0.70
350	0.81
360	0.88
370	0.927
380	0.954
390	0.969
400	0.978
420	0.987
440	0.991
460	0.994
480	0.996
500	0.997
550	0.999
600	0.998
650	0.999
700	0.998
800	0.997
900	0.995
1000	0.996
1200	0.998
1400	0.997
1600	0.992
1800	0.980
2000	0.958
2200	0.88
2400	0.61

Specific gravity
3.63

Relative Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90 (ref.)	3.1	3.2	3.3	3.5	3.6	3.7	3.7	3.8	3.9	4.1	4.4	4.5	4.9	5.3	5.6
60 to 80 (ref.)	3.0	3.1	3.2	3.3	3.5	3.6	3.6	3.6	3.8	4.0	4.3	4.4	4.8	5.2	5.4
40 to 60	2.9	3.0	3.1	3.2	3.3	3.4	3.5	3.5	3.6	3.8	4.2	4.2	4.6	5.0	5.2
20 to 40	2.8	2.9	3.0	3.1	3.2	3.3	3.4	3.4	3.5	3.7	4.0	4.1	4.4	4.8	5.1
0 to 20	2.8	2.8	3.0	3.1	3.2	3.3	3.3	3.3	3.5	3.6	3.9	4.0	4.3	4.7	5.0
-20 to 0	2.8	2.8	3.0	3.1	3.2	3.3	3.3	3.3	3.4	3.6	3.9	3.9	4.3	4.7	4.9
-40 to -20	2.8	2.9	3.0	3.1	3.2	3.3	3.3	3.4	3.5	3.6	3.9	4.0	4.3	4.7	4.9
-60 to -40 (ref.)	3.0	3.0	3.2	3.3	3.4	3.5	3.5	3.5	3.6	3.8	4.1	4.1	4.5	4.8	5.0
-70 to -60 (ref.)	3.2	3.2	3.4	3.5	3.6	3.7	3.7	3.7	3.8	4.0	4.3	4.3	4.6	5.0	5.2

Absolute Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90	2.1	2.1	2.3	2.4	2.5	2.6	2.7	2.7	2.8	3.0	3.4	3.4	3.8	4.2	4.5
60 to 80	1.9	1.9	2.1	2.2	2.3	2.4	2.5	2.5	2.6	2.8	3.1	3.2	3.6	4.0	4.2
40 to 60	1.6	1.7	1.8	1.9	2.0	2.1	2.2	2.2	2.3	2.5	2.8	2.9	3.3	3.6	3.9
20 to 40	1.4	1.4	1.6	1.7	1.8	1.9	1.9	1.9	2.1	2.2	2.5	2.6	2.9	3.3	3.5
0 to 20	1.1	1.1	1.3	1.4	1.5	1.6	1.6	1.6	1.8	1.9	2.2	2.3	2.6	3.0	3.2
-20 to 0	0.8	0.9	1.0	1.1	1.2	1.3	1.3	1.4	1.5	1.6	1.9	2.0	2.3	2.6	2.9
-40 to -20	0.6	0.6	0.7	0.8	0.9	1.0	1.0	1.1	1.2	1.3	1.6	1.6	2.0	2.3	2.5
-60 to -40	0.3	0.4	0.5	0.6	0.7	0.7	0.8	0.8	0.9	1.0	1.3	1.3	1.7	2.0	2.2
-70 to -60	0.1	0.2	0.3	0.4	0.4	0.5	0.6	0.6	0.7	0.8	1.1	1.1	1.4	1.7	1.9

Coef. disp. form. (frac. eq.)(ref.)	
P1	1.29541724E-01
Q1	7.14831691E+01
P2	9.73740252E-02
Q2	1.55700037E-02
P3	2.81115754E-01
Q3	3.25551411E-03

Fitting error of disp. form. σ [1E-6]		
	Visible	Infrared
Power ser. eq.	0.7	4.0
Frac. eq. (ref.)	0.7	4.1

Prod. Freq. (A to D)	A

Similar glass type			
OHARA	S-LAL14	HOYA	LAC14
CDGM	H-LAK51A	SCHOTT	N-LAK14

2022-7-1	StP, AP, SP
2019-4-1	Transmittance
2015-4-1	Color Code, Prod. Freq., Similar glass type

HIKARI GLASS CO., LTD.

J-LAK18

n_d = 1.729160 n_e = 1.732343

ν_d = 54.61 ν_e = 54.39

Glass code (d)
729546
Glass code (e)
732544

Spectral l.	Refractive idx
2.058	1.69519
1.970	1.69698
1.530	1.70502
1.129	1.71188
1.064	1.71309
t	1.71409
s	1.71789
A'	1.720449
r	1.722782
C	1.725097
C'	1.725745
He-Ne	1.726348
D	1.729041
d	1.729160
e	1.732343
F	1.738449
F'	1.739210
g	1.745716
h	1.751757
0.389	1.755445
i	1.762072

Partial dispersion	
F-C	0.013352
F'-C'	0.013465
C-t	0.011009
C-A'	0.004648
d-C	0.004063
e-C	0.007246
g-d	0.016556
g-F	0.007267
h-g	0.006041
i-g	0.016356
C'-t	0.011657
e-C'	0.006598
F'-e	0.006867
i-F'	0.022862

Relative partial dispersion	
C-t／F-C	0.8245
C-A'／F-C	0.3481
d-C／F-C	0.3043
e-C／F-C	0.5427
g-d／F-C	1.2400
g-F／F-C	0.5443
h-g／F-C	0.4524
i-g／F-C	1.2250
C'-t／F'-C'	0.8657
e-C'／F'-C'	0.4900
F'-e／F'-C'	0.5100
i-F'／F'-C'	1.6979

Deviation of relative partial disp.	
ΔPdC	0.0024
ΔPgF	−0.0085

Internal CC (80%/5%)
343/278
Color Code (80%/5%)
365/280

CCI	
B	0.00
G	0.34
R	0.35

Thermal properties	
CTE(−30,70) [1E-7/℃]	56
CTE(100,300) [1E-7/℃]	70
Tg [℃]	668
At [℃]	694
StP [℃]	619
AP [℃]	647
SP [℃]	742
Ht cndct. [W/m·K]	0.876
Sp. heat [kJ/kg·K]	0.525
Ht diffus. [1E-6 m2/sec]	0.400

Chemical properties [class]	
Acid res. (surface)	5
Alkaline detergent res.	3
Climate resistance	1
Water res. (powder)	1
Acid res. (powder)	4

Mechanical properties	
Knoop hardness	738 (7)
Abrasion hardness	68
Young's mod. [GPa]	118.7
Shear mod. [GPa]	46.0
Poisson's ratio	0.292
Stress optical coef. [1E-5 nm/cm／Pa]	1.68

Internal trans. (10mm)	
λ [nm]	τ
280	0.06
290	0.15
300	0.25
310	0.34
320	0.52
330	0.67
340	0.77
350	0.85
360	0.908
370	0.943
380	0.964
390	0.976
400	0.983
420	0.990
440	0.993
460	0.995
480	0.997
500	0.998
550	0.999
600	0.999
650	0.999
700	0.999
800	0.997
900	0.996
1000	0.996
1200	0.996
1400	0.992
1600	0.988
1800	0.979
2000	0.953
2200	0.87
2400	0.60

Specific gravity
4.17

Coef. disp. form. (pwr ser.)	
A0	2.93263885E+00
A1	−1.42564324E-02
A2	−1.92506617E-04
A3	2.06017616E-02
A4	2.93008969E-04
A5	6.61918495E-06
A6	7.33494598E-08
A7	0.00000000E+00
A8	0.00000000E+00

Relative Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90 (ref.)	3.5	3.6	3.7	3.9	4.0	4.1	4.2	4.2	4.4	4.6	4.9	5.0	5.4	5.8	6.1
60 to 80 (ref.)	3.4	3.5	3.7	3.8	3.9	4.0	4.0	4.1	4.2	4.4	4.8	4.8	5.3	5.7	6.0
40 to 60	3.3	3.3	3.5	3.6	3.7	3.9	3.9	3.9	4.1	4.3	4.6	4.7	5.1	5.5	5.8
20 to 40	3.2	3.2	3.4	3.5	3.6	3.8	3.8	3.8	4.0	4.2	4.5	4.6	5.0	5.4	5.6
0 to 20	3.1	3.2	3.3	3.5	3.6	3.7	3.7	3.8	3.9	4.1	4.4	4.5	4.9	5.3	5.5
−20 to 0	3.1	3.2	3.3	3.5	3.6	3.7	3.7	3.8	3.9	4.1	4.4	4.5	4.8	5.2	5.5
−40 to −20	3.2	3.2	3.4	3.5	3.6	3.7	3.8	3.8	3.9	4.1	4.4	4.5	4.9	5.2	5.5
−60 to −40 (ref.)	3.4	3.4	3.6	3.7	3.8	3.9	3.9	4.0	4.1	4.3	4.6	4.6	5.0	5.4	5.6
−70 to −60 (ref.)	3.6	3.6	3.8	3.9	4.0	4.1	4.1	4.2	4.3	4.5	4.8	4.8	5.2	5.6	5.8

Absolute Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90	2.5	2.5	2.7	2.8	2.9	3.1	3.1	3.1	3.3	3.5	3.8	3.9	4.3	4.7	5.0
60 to 80	2.3	2.3	2.5	2.6	2.7	2.8	2.9	2.9	3.1	3.2	3.6	3.7	4.1	4.5	4.7
40 to 60	2.0	2.0	2.2	2.3	2.4	2.6	2.6	2.6	2.8	2.9	3.3	3.3	3.7	4.1	4.4
20 to 40	1.7	1.8	1.9	2.0	2.2	2.3	2.3	2.3	2.5	2.6	3.0	3.0	3.4	3.8	4.1
0 to 20	1.4	1.5	1.6	1.8	1.9	2.0	2.0	2.0	2.2	2.4	2.7	2.7	3.1	3.5	3.7
−20 to 0	1.2	1.2	1.4	1.5	1.6	1.7	1.7	1.8	1.9	2.1	2.4	2.4	2.8	3.2	3.4
−40 to −20	0.9	0.9	1.1	1.2	1.3	1.4	1.4	1.5	1.6	1.8	2.1	2.1	2.5	2.8	3.1
−60 to −40	0.6	0.7	0.8	0.9	1.0	1.1	1.2	1.2	1.3	1.5	1.8	1.8	2.1	2.5	2.7
−70 to −60	0.4	0.5	0.6	0.7	0.8	0.9	0.9	1.0	1.1	1.2	1.5	1.6	1.9	2.2	2.5

Coef. disp. form. (frac. eq.)(ref.)	
P1	1.18293410E-01
Q1	6.70082181E+01
P2	7.73335459E-02
Q2	1.69418126E-02
P3	3.14497232E-01
Q3	3.89398254E-03

Fitting error of disp. form. σ [1E-6]	Visible	Infrared
Power ser. eq.	0.6	6.6
Frac. eq. (ref.)	0.7	7.0

Prod. Freq. (A to D)	B

Similar glass type			
OHARA	S-LAL18	HOYA	TAC8
CDGM	H-LaK52	SCHOTT	N-LAK34

2022-7-1	StP, AP, SP
2019-4-1	Transmittance
2016-4-1	Prod. Freq.

HIKARI GLASS CO., LTD.

J-LAK01

n_d = 1.640000 n_e = 1.642536

ν_d = 60.20 ν_e = 59.99

Glass code (d)
640602
Glass code (e)
643600

Spectral l.	Refractive idx
2.058	1.61017
1.970	1.61186
1.530	1.61943
1.129	1.62567
1.064	1.62673
t	1.62760
s	1.63083
A'	1.632955
r	1.634863
C	1.636739
C'	1.637261
He-Ne	1.637746
D	1.639905
d	1.640000
e	1.642536
F	1.647371
F'	1.647972
g	1.653088
h	1.657818
0.389	1.660696
i	1.665852

Partial dispersion	
F-C	0.010632
F'-C'	0.010711
C-t	0.009136
C-A'	0.003784
d-C	0.003261
e-C	0.005797
g-d	0.013088
g-F	0.005717
h-g	0.004730
i-g	0.012764
C'-t	0.009658
e-C'	0.005275
F'-e	0.005436
i-F'	0.017880

Relative partial dispersion	
C-t／F-C	0.8593
C-A'／F-C	0.3559
d-C／F-C	0.3067
e-C／F-C	0.5452
g-d／F-C	1.2310
g-F／F-C	0.5377
h-g／F-C	0.4449
i-g／F-C	1.2005
C'-t／F'-C'	0.9017
e-C'／F'-C'	0.4925
F'-e／F'-C'	0.5075
i-F'／F'-C'	1.6693

Deviation of relative partial disp.	
ΔPdC	0.0023
ΔPgF	−0.0056

Internal CC (80%/5%)
357/297
Color Code (80%/5%)
370/300

CCI	
B	0.00
G	0.44
R	0.39

Thermal properties	
CTE(−30,70) [1E-7/℃]	60
CTE(100,300) [1E-7/℃]	77
Tg [℃]	655
At [℃]	679
StP [℃]	610
AP [℃]	638
SP [℃]	736
Ht cndct. [W/m·K]	1.170
Sp. heat [kJ/kg·K]	0.775
Ht diffus. [1E-6 m2/sec]	0.501

Chemical properties [class]	
Acid res. (surface)	6
Alkaline detergent res.	4
Climate resistance	4
Water res. (powder)	4
Acid res. (powder)	4

Mechanical properties	
Knoop hardness	622 (6)
Abrasion hardness	92
Young's mod. [GPa]	131.6
Shear mod. [GPa]	49.7
Poisson's ratio	0.323
Stress optical coef. [1E-5 nm/cm／Pa]	2.22

Internal trans. (10mm)	
λ [nm]	τ
280	–
290	0.03
300	0.07
310	0.15
320	0.28
330	0.44
340	0.60
350	0.74
360	0.84
370	0.904
380	0.942
390	0.963
400	0.976
420	0.987
440	0.991
460	0.993
480	0.996
500	0.997
550	0.998
600	0.996
650	0.997
700	0.997
800	0.996
900	0.996
1000	0.997
1200	0.998
1400	0.993
1600	0.990
1800	0.976
2000	0.955
2200	0.87
2400	0.62

Specific gravity
3.01

Coef. disp. form. (pwr ser.)	
A0	2.64746203E+00
A1	−1.31056736E-02
A2	−1.66347533E-04
A3	1.55169536E-02
A4	1.92870468E-04
A5	4.84379496E-06
A6	−7.97499057E-09
A7	0.00000000E+00
A8	0.00000000E+00

Relative Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90 (ref.)	2.9	2.9	3.0	3.1	3.2	3.3	3.4	3.4	3.5	3.7	4.0	4.0	4.4	4.8	5.0
60 to 80 (ref.)	2.8	2.8	2.9	3.0	3.1	3.2	3.2	3.3	3.4	3.5	3.9	3.9	4.3	4.6	4.8
40 to 60	2.7	2.7	2.8	2.9	3.0	3.1	3.1	3.1	3.2	3.4	3.7	3.7	4.1	4.4	4.6
20 to 40	2.6	2.6	2.7	2.8	2.9	3.0	3.0	3.0	3.1	3.3	3.6	3.6	3.9	4.2	4.4
0 to 20	2.5	2.5	2.6	2.7	2.8	2.9	2.9	2.9	3.0	3.2	3.5	3.5	3.8	4.1	4.3
−20 to 0	2.5	2.5	2.6	2.7	2.8	2.8	2.9	2.9	3.0	3.1	3.4	3.4	3.7	4.0	4.2
−40 to −20	2.5	2.6	2.6	2.7	2.8	2.9	2.9	2.9	3.0	3.2	3.4	3.5	3.7	4.0	4.2
−60 to −40 (ref.)	2.7	2.7	2.8	2.9	2.9	3.0	3.0	3.1	3.2	3.3	3.5	3.6	3.8	4.1	4.3
−70 to −60 (ref.)	2.9	2.9	3.0	3.0	3.1	3.2	3.2	3.2	3.3	3.4	3.7	3.7	4.0	4.3	4.4

Absolute Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90	1.9	1.9	2.0	2.1	2.2	2.3	2.3	2.4	2.5	2.7	3.0	3.0	3.4	3.7	3.9
60 to 80	1.7	1.7	1.8	1.9	2.0	2.1	2.1	2.2	2.3	2.4	2.7	2.8	3.1	3.5	3.6
40 to 60	1.4	1.5	1.5	1.6	1.7	1.8	1.8	1.9	2.0	2.1	2.4	2.5	2.8	3.1	3.3
20 to 40	1.2	1.2	1.3	1.4	1.4	1.5	1.6	1.6	1.7	1.8	2.1	2.1	2.5	2.8	2.9
0 to 20	0.9	0.9	1.0	1.1	1.2	1.3	1.3	1.3	1.4	1.5	1.8	1.8	2.1	2.4	2.6
−20 to 0	0.6	0.6	0.7	0.8	0.9	1.0	1.0	1.0	1.1	1.2	1.5	1.5	1.8	2.1	2.2
−40 to −20	0.4	0.4	0.4	0.5	0.6	0.7	0.7	0.7	0.8	0.9	1.2	1.2	1.5	1.7	1.9
−60 to −40	0.1	0.1	0.2	0.2	0.3	0.4	0.4	0.4	0.5	0.6	0.8	0.9	1.1	1.4	1.5
−70 to −60	−0.1	−0.1	0.0	0.0	0.1	0.2	0.2	0.2	0.3	0.4	0.6	0.6	0.9	1.1	1.3

Coef. disp. form. (frac. eq.)(ref.)	
P1	1.29784042E-01
Q1	7.09731124E+01
P2	7.95375652E-02
Q2	1.51159467E-02
P3	2.74972273E-01
Q3	3.44195443E-03

Fitting error of disp. form. σ [1E-6]		
	Visible	Infrared
Power ser. eq.	0.4	1.3
Frac. eq. (ref.)	0.4	1.5

Prod. Freq. (A to D)	C

Similar glass type			
OHARA	S-BSM81	HOYA	LACL60
CDGM	H-LaK4L	SCHOTT	N-LAK21

2022-7-1	StP, AP, SP
2019-4-1	Transmittance
2018-4-1	Prod. Freq.

J-LAK02

n_d = 1.670000 n_e = 1.672786

ν_d = 57.35 ν_e = 57.12

Glass code (d)
670574
Glass code (e)
673571

Spectral l.	Refractive idx
2.058	1.64015
1.970	1.64172
1.530	1.64880
1.129	1.65483
1.064	1.65589
t	1.65677
s	1.66011
A'	1.662360
r	1.664409
C	1.666440
C'	1.667008
He-Ne	1.667537
D	1.669896
d	1.670000
e	1.672786
F	1.678123
F'	1.678787
g	1.684465
h	1.689730
0.389	1.692942
i	1.698708

Coef. disp. form. (pwr ser.)	
A0	2.74008995E+00
A1	-1.20461104E-02
A2	-1.75410927E-04
A3	1.76614454E-02
A4	1.89317290E-04
A5	1.04494737E-05
A6	-1.62215193E-07
A7	0.00000000E+00
A8	0.00000000E+00

Partial dispersion	
F-C	0.011683
F'-C'	0.011779
C-t	0.009670
C-A'	0.004080
d-C	0.003560
e-C	0.006346
g-d	0.014465
g-F	0.006342
h-g	0.005265
i-g	0.014243
C'-t	0.010238
e-C'	0.005778
F'-e	0.006001
i-F'	0.019921

Relative partial dispersion	
C-t／F-C	0.8277
C-A'／F-C	0.3492
d-C／F-C	0.3047
e-C／F-C	0.5432
g-d／F-C	1.2381
g-F／F-C	0.5428
h-g／F-C	0.4507
i-g／F-C	1.2191
C'-t／F'-C'	0.8692
e-C'／F'-C'	0.4905
F'-e／F'-C'	0.5095
i-F'／F'-C'	1.6912

Deviation of relative partial disp.	
ΔPdC	0.0016
ΔPgF	-0.0053

Internal CC (80%/5%)
343/278
Color Code (80%/5%)
360/280

CCI	
B	0.00
G	0.43
R	0.43

Thermal properties	
CTE(-30,70) [1E-7/℃]	63
CTE(100,300) [1E-7/℃]	78
Tg [℃]	645
At [℃]	675
StP [℃]	599
AP [℃]	629
SP [℃]	730
Ht cndct. [W/m･K]	0.788
Sp. heat [kJ/kg･K]	0.532
Ht diffus. [1E-6 m2/sec]	0.395

Chemical properties [class]	
Acid res. (surface)	5
Alkaline detergent res.	4
Climate resistance	2
Water res. (powder)	3
Acid res. (powder)	5

Mechanical properties	
Knoop hardness	631 (6)
Abrasion hardness	139
Young's mod. [GPa]	96.6
Shear mod. [GPa]	37.6
Poisson's ratio	0.283
Stress optical coef. [1E-5 nm/cm／Pa]	1.87

Internal trans. (10mm)	
λ [nm]	τ
280	0.06
290	0.13
300	0.25
310	0.39
320	0.54
330	0.67
340	0.78
350	0.86
360	0.914
370	0.946
380	0.965
390	0.975
400	0.981
420	0.986
440	0.988
460	0.992
480	0.994
500	0.996
550	0.998
600	0.997
650	0.998
700	0.999
800	0.998
900	0.997
1000	0.997
1200	0.997
1400	0.992
1600	0.988
1800	0.975
2000	0.954
2200	0.86
2400	0.65

Specific gravity
3.75

Relative Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90 (ref.)	1.4	1.4	1.5	1.7	1.8	1.9	1.9	2.0	2.1	2.3	2.6	2.6	3.0	3.4	3.6
60 to 80 (ref.)	1.3	1.3	1.5	1.6	1.7	1.8	1.8	1.9	2.0	2.2	2.5	2.5	2.9	3.2	3.5
40 to 60	1.2	1.3	1.4	1.5	1.6	1.7	1.7	1.8	1.9	2.1	2.4	2.4	2.8	3.1	3.3
20 to 40	1.2	1.2	1.3	1.4	1.5	1.6	1.7	1.7	1.8	2.0	2.3	2.3	2.7	3.0	3.2
0 to 20	1.2	1.2	1.3	1.4	1.5	1.6	1.6	1.7	1.8	1.9	2.2	2.3	2.6	2.9	3.1
-20 to 0	1.2	1.2	1.4	1.5	1.5	1.6	1.7	1.7	1.8	1.9	2.2	2.3	2.6	2.9	3.1
-40 to -20	1.3	1.3	1.5	1.6	1.6	1.7	1.8	1.8	1.9	2.0	2.3	2.3	2.6	2.9	3.1
-60 to -40 (ref.)	1.5	1.5	1.6	1.7	1.8	1.9	1.9	2.0	2.1	2.2	2.5	2.5	2.8	3.1	3.3
-70 to -60 (ref.)	1.7	1.8	1.9	2.0	2.0	2.1	2.2	2.2	2.3	2.4	2.7	2.7	3.0	3.3	3.5

Absolute Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90	0.4	0.4	0.5	0.6	0.8	0.9	0.9	0.9	1.1	1.2	1.5	1.6	1.9	2.3	2.5
60 to 80	0.2	0.2	0.4	0.5	0.6	0.7	0.7	0.7	0.9	1.0	1.3	1.4	1.7	2.1	2.3
40 to 60	0.0	0.0	0.1	0.2	0.3	0.4	0.5	0.5	0.6	0.8	1.1	1.1	1.4	1.8	2.0
20 to 40	-0.3	-0.2	-0.1	0.0	0.1	0.2	0.2	0.2	0.4	0.5	0.8	0.8	1.2	1.5	1.7
0 to 20	-0.5	-0.4	-0.3	-0.2	-0.1	0.0	0.0	0.0	0.1	0.3	0.5	0.6	0.9	1.2	1.4
-20 to 0	-0.7	-0.7	-0.5	-0.5	-0.4	-0.3	-0.3	-0.2	-0.1	0.0	0.3	0.3	0.6	0.9	1.1
-40 to -20	-0.9	-0.9	-0.8	-0.7	-0.6	-0.5	-0.5	-0.5	-0.4	-0.2	0.0	0.0	0.3	0.6	0.8
-60 to -40	-1.2	-1.1	-1.0	-0.9	-0.8	-0.8	-0.7	-0.7	-0.6	-0.5	-0.3	-0.2	0.0	0.3	0.5
-70 to -60	-1.3	-1.3	-1.2	-1.1	-1.0	-0.9	-0.9	-0.9	-0.8	-0.7	-0.5	-0.4	-0.2	0.1	0.3

Coef. disp. form. (frac. eq.)(ref.)	
P1	1.16396191E-01
Q1	7.13715725E+01
P2	2.60772282E-02
Q2	2.34562516E-02
P3	3.41070979E-01
Q3	5.05461332E-03

Fitting error of disp. form. σ [1E-6]		
	Visible	Infrared
Power ser. eq.	0.5	9.8
Frac. eq. (ref.)	0.7	10.2

Prod. Freq. (A to D)	D

Similar glass type			
OHARA	-	HOYA	-
CDGM	-	SCHOTT	-

2022-7-1	StP, AP, SP, Prod. Freq.
2019-4-1	Transmittance
2018-4-1	Prod. Freq.

HIKARI GLASS CO., LTD.

J-LAK04

n_d = 1.651000 n_e = 1.653760

ν_d = 56.24 ν_e = 55.98

Glass code (d)
651562
Glass code (e)
654560

Spectral l.	Refractive idx
2.058	1.62280
1.970	1.62421
1.530	1.63062
1.129	1.63623
1.064	1.63724
t	1.63808
s	1.64129
A'	1.643482
r	1.645487
C	1.647485
C'	1.648044
He-Ne	1.648566
D	1.650897
d	1.651000
e	1.653760
F	1.659061
F'	1.659722
g	1.665373
h	1.670621
0.389	1.673825
i	1.679580

Partial dispersion	
F-C	0.011576
F'-C'	0.011678
C-t	0.009409
C-A'	0.004003
d-C	0.003515
e-C	0.006275
g-d	0.014373
g-F	0.006312
h-g	0.005248
i-g	0.014207
C'-t	0.009968
e-C'	0.005716
F'-e	0.005962
i-F'	0.019858

Relative partial dispersion	
C-t／F-C	0.8128
C-A'／F-C	0.3458
d-C／F-C	0.3036
e-C／F-C	0.5421
g-d／F-C	1.2416
g-F／F-C	0.5453
h-g／F-C	0.4534
i-g／F-C	1.2273
C'-t／F'-C'	0.8536
e-C'／F'-C'	0.4895
F'-e／F'-C'	0.5105
i-F'／F'-C'	1.7005

Deviation of relative partial disp.	
ΔPdC	0.0011
ΔPgF	−0.0047

Internal CC (80%/5%)
346/296
Color Code (80%/5%)
360/300
CCI
B −
G −
R −

Thermal properties	
CTE(−30,70) [1E-7/℃]	66
CTE(100,300) [1E-7/℃]	83
Tg [℃]	647
At [℃]	687
StP [℃]	−
AP [℃]	−
SP [℃]	−
Ht cndct. [W/m·K]	0.979
Sp. heat [kJ/kg·K]	0.636
Ht diffus. [1E-6 m2/sec]	0.471

Chemical properties [class]	
Acid res. (surface)	6
Alkaline detergent res.	4
Climate resistance	2
Water res. (powder)	2
Acid res. (powder)	4

Mechanical properties	
Knoop hardness	612 (6)
Abrasion hardness	96
Young's mod. [GPa]	100.2
Shear mod. [GPa]	39.0
Poisson's ratio	0.284
Stress optical coef. [1E-5 nm/cm／Pa]	2.04

Internal trans. (10mm)	
λ [nm]	τ
280	−
290	0.02
300	0.08
310	0.19
320	0.37
330	0.57
340	0.73
350	0.84
360	0.914
370	0.953
380	0.974
390	0.984
400	0.990
420	0.995
440	0.996
460	0.996
480	0.997
500	0.998
550	0.999
600	0.999
650	0.998
700	0.997
800	0.993
900	0.998
1000	0.997
1200	0.999
1400	0.997
1600	0.992
1800	0.978
2000	0.964
2200	0.900
2400	0.79

Specific gravity
3.27

Coef. disp. form. (pwr ser.)	
A0	2.67775568E+00
A1	−1.09363526E-02
A2	−1.12368235E-04
A3	1.71233781E-02
A4	2.57310134E-04
A5	2.54752519E-06
A6	1.89782794E-07
A7	0.00000000E+00
A8	0.00000000E+00

Relative Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90 (ref.)	3.2	3.2	3.3	3.5	3.6	3.7	3.8	3.8	4.0	4.2	4.6	4.6	5.1	5.6	5.8
60 to 80 (ref.)	3.1	3.1	3.3	3.4	3.5	3.6	3.7	3.7	3.9	4.1	4.5	4.5	5.0	5.4	5.7
40 to 60	3.0	3.0	3.2	3.3	3.4	3.5	3.6	3.6	3.7	3.9	4.3	4.4	4.8	5.2	5.5
20 to 40	2.9	2.9	3.1	3.2	3.3	3.4	3.5	3.5	3.7	3.8	4.2	4.2	4.7	5.1	5.3
0 to 20	2.9	2.9	3.0	3.2	3.3	3.4	3.4	3.4	3.6	3.8	4.1	4.2	4.5	4.9	5.2
−20 to 0	2.9	2.9	3.1	3.2	3.3	3.4	3.4	3.4	3.6	3.7	4.1	4.1	4.5	4.9	5.1
−40 to −20	3.0	3.0	3.1	3.2	3.3	3.5	3.5	3.5	3.6	3.8	4.1	4.2	4.5	4.9	5.1
−60 to −40 (ref.)	3.2	3.2	3.3	3.4	3.5	3.6	3.6	3.7	3.8	3.9	4.2	4.3	4.6	5.0	5.2
−70 to −60 (ref.)	3.4	3.4	3.5	3.6	3.7	3.8	3.8	3.9	4.0	4.1	4.4	4.5	4.8	5.1	5.3

Absolute Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90	2.2	2.2	2.3	2.5	2.6	2.7	2.8	2.8	3.0	3.1	3.5	3.6	4.1	4.5	4.8
60 to 80	2.0	2.0	2.2	2.3	2.4	2.5	2.6	2.6	2.8	2.9	3.3	3.4	3.8	4.2	4.5
40 to 60	1.7	1.8	1.9	2.0	2.1	2.3	2.3	2.3	2.5	2.7	3.0	3.1	3.5	3.9	4.2
20 to 40	1.5	1.5	1.7	1.8	1.9	2.0	2.0	2.1	2.2	2.4	2.7	2.8	3.2	3.6	3.8
0 to 20	1.3	1.3	1.4	1.5	1.6	1.7	1.8	1.8	1.9	2.1	2.4	2.5	2.9	3.2	3.5
−20 to 0	1.0	1.1	1.2	1.3	1.4	1.5	1.5	1.5	1.7	1.8	2.1	2.2	2.5	2.9	3.1
−40 to −20	0.8	0.8	0.9	1.0	1.1	1.2	1.2	1.3	1.4	1.5	1.8	1.9	2.2	2.6	2.7
−60 to −40	0.6	0.6	0.7	0.8	0.9	1.0	1.0	1.0	1.1	1.3	1.5	1.6	1.9	2.2	2.4
−70 to −60	0.4	0.4	0.5	0.6	0.7	0.8	0.8	0.8	0.9	1.1	1.3	1.4	1.7	2.0	2.1

Coef. disp. form. (frac. eq.)(ref.)	
P1	1.21788068E-01
Q1	8.13149626E+01
P2	7.22172241E-02
Q2	1.69321714E-02
P3	2.86455337E-01
Q3	3.94241726E-03

Fitting error of disp. form. σ [1E-6]		
	Visible	Infrared
Power ser. eq.	0.4	4.0
Frac. eq. (ref.)	0.4	4.0

Prod. Freq. (A to D)	D

Similar glass type			
OHARA	S-LAL54	HOYA	−
CDGM	H-LaK10	SCHOTT	N-LAK22

2022-7-1	Prod. Freq.
2019-4-1	Transmittance
2018-4-1	Prod. Freq.

J-LAK06

n_d = 1.677900 n_e = 1.681085

ν_d = 50.67 ν_e = 50.39

Glass code (d)
678507
Glass code (e)
681504

Spectral l.	Refractive idx
2.058	1.64833
1.970	1.64966
1.530	1.65584
1.129	1.66150
1.064	1.66256
t	1.66345
s	1.66693
A'	1.669359
r	1.671612
C	1.673877
C'	1.674514
He-Ne	1.675110
D	1.677781
d	1.677900
e	1.681085
F	1.687256
F'	1.688030
g	1.694688
h	1.700934
0.389	1.704781
i	1.711758

Coef. disp. form. (pwr ser.)	
A0	2.75830673E+00
A1	-1.04979587E-02
A2	-8.63280601E-05
A3	1.98026568E-02
A4	3.88736963E-04
A5	-3.98876195E-07
A6	8.98869177E-07
A7	0.00000000E+00
A8	0.00000000E+00

Partial dispersion	
F-C	0.013379
F'-C'	0.013516
C-t	0.010432
C-A'	0.004518
d-C	0.004023
e-C	0.007208
g-d	0.016788
g-F	0.007432
h-g	0.006246
i-g	0.017070
C'-t	0.011069
e-C'	0.006571
F'-e	0.006945
i-F'	0.023728

Relative partial dispersion	
C-t／F-C	0.7797
C-A'／F-C	0.3377
d-C／F-C	0.3007
e-C／F-C	0.5388
g-d／F-C	1.2548
g-F／F-C	0.5555
h-g／F-C	0.4669
i-g／F-C	1.2759
C'-t／F'-C'	0.8190
e-C'／F'-C'	0.4862
F'-e／F'-C'	0.5138
i-F'／F'-C'	1.7555

Deviation of relative partial disp.	
ΔPdC	0.0006
ΔPgF	−0.0038

Internal CC (80%/5%)
366/335
Color Code (80%/5%)
380/340
CCI

B	−
G	−
R	−

Thermal properties	
CTE(−30,70) [1E-7/℃]	63
CTE(100,300) [1E-7/℃]	75
Tg [℃]	650
At [℃]	690
StP [℃]	−
AP [℃]	−
SP [℃]	−
Ht cndct. [W/m·K]	0.843
Sp. heat [kJ/kg·K]	0.522
Ht diffus. [1E-6 m2/sec]	0.419

Chemical properties [class]	
Acid res. (surface)	6
Alkaline detergent res.	3
Climate resistance	1
Water res. (powder)	1
Acid res. (powder)	4

Mechanical properties	
Knoop hardness	523 (5)
Abrasion hardness	138
Young's mod. [GPa]	89.5
Shear mod. [GPa]	34.9
Poisson's ratio	0.281
Stress optical coef. [1E-5 nm/cm／Pa]	2.33

Internal trans. (10mm)	
λ [nm]	τ
280	−
290	−
300	−
310	−
320	−
330	0.01
340	0.16
350	0.47
360	0.71
370	0.85
380	0.913
390	0.949
400	0.967
420	0.982
440	0.987
460	0.989
480	0.992
500	0.994
550	0.996
600	0.995
650	0.995
700	0.995
800	0.991
900	0.997
1000	0.995
1200	0.997
1400	0.993
1600	0.992
1800	0.985
2000	0.974
2200	0.933
2400	0.82

Specific gravity
3.83

Relative Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90 (ref.)	3.4	3.4	3.4	3.8	3.9	4.1	4.1	4.2	4.4	4.6	5.1	5.2	5.7	6.3	6.7
60 to 80 (ref.)	3.2	3.3	3.3	3.6	3.8	3.9	4.0	4.0	4.2	4.5	4.9	5.0	5.5	6.1	6.5
40 to 60	3.0	3.1	3.1	3.5	3.6	3.7	3.8	3.8	4.0	4.2	4.7	4.8	5.3	5.8	6.2
20 to 40	2.9	3.0	3.0	3.3	3.4	3.6	3.6	3.6	3.8	4.1	4.5	4.5	5.0	5.5	5.9
0 to 20	2.8	2.9	2.9	3.2	3.3	3.4	3.5	3.5	3.7	3.9	4.3	4.4	4.8	5.3	5.7
−20 to 0	2.8	2.8	2.8	3.1	3.2	3.4	3.4	3.4	3.6	3.8	4.2	4.2	4.7	5.1	5.5
−40 to −20	2.8	2.8	2.8	3.1	3.2	3.4	3.4	3.4	3.6	3.8	4.2	4.2	4.6	5.0	5.4
−60 to −40 (ref.)	2.9	3.0	3.0	3.2	3.3	3.4	3.5	3.5	3.7	3.8	4.2	4.2	4.6	5.0	5.4
−70 to −60 (ref.)	3.0	3.1	3.1	3.4	3.5	3.6	3.6	3.6	3.8	4.0	4.3	4.4	4.7	5.1	5.4

Absolute Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90	2.3	2.4	2.4	2.8	2.9	3.0	3.1	3.1	3.3	3.6	4.1	4.1	4.7	5.2	5.7
60 to 80	2.1	2.2	2.2	2.5	2.6	2.8	2.8	2.9	3.1	3.3	3.8	3.8	4.4	4.9	5.3
40 to 60	1.8	1.9	1.9	2.2	2.3	2.5	2.5	2.5	2.7	2.9	3.4	3.4	3.9	4.5	4.8
20 to 40	1.5	1.5	1.5	1.9	2.0	2.1	2.1	2.2	2.4	2.6	3.0	3.1	3.5	4.0	4.4
0 to 20	1.2	1.2	1.2	1.5	1.6	1.8	1.8	1.8	2.0	2.2	2.6	2.7	3.1	3.6	3.9
−20 to 0	0.9	0.9	0.9	1.2	1.3	1.4	1.5	1.5	1.7	1.9	2.2	2.3	2.7	3.1	3.5
−40 to −20	0.5	0.6	0.6	0.9	1.0	1.1	1.1	1.1	1.3	1.5	1.8	1.9	2.3	2.7	3.0
−60 to −40	0.2	0.3	0.3	0.5	0.6	0.7	0.8	0.8	0.9	1.1	1.5	1.5	1.9	2.2	2.5
−70 to −60	0.0	0.1	0.1	0.3	0.4	0.5	0.5	0.5	0.7	0.8	1.2	1.2	1.5	1.9	2.2

Coef. disp. form. (frac. eq.)(ref.)	
P1	1.21365270E-01
Q1	8.80127306E+01
P2	1.94847920E-02
Q2	3.35885569E-02
P3	3.50024335E-01
Q3	5.68536774E-03

Fitting error of disp. form. σ [1E-6]		
	Visible	Infrared
Power ser. eq.	0.4	2.6
Frac. eq. (ref.)	0.6	2.2

Prod. Freq. (A to D)	D

Similar glass type			
OHARA	−	HOYA	−
CDGM	−	SCHOTT	−

2020-4-1	Similar glass type
2019-4-1	Transmittance
2018-4-1	Prod. Freq.

J-LAK09

n_d = 1.734000 n_e = 1.737395

ν_d = 51.51 ν_e = 51.28

Glass code (d)
734515
Glass code (e)
737513

Spectral l.	Refractive idx
2.058	1.69915
1.970	1.70092
1.530	1.70893
1.129	1.71586
1.064	1.71710
t	1.71813
s	1.72207
A'	1.724765
r	1.727227
C	1.729680
C'	1.730367
He-Ne	1.731008
D	1.733873
d	1.734000
e	1.737395
F	1.743930
F'	1.744746
g	1.751739
h	1.758257
0.389	1.762247
i	1.769439

Partial dispersion	
F-C	0.014250
F'-C'	0.014379
C-t	0.011553
C-A'	0.004915
d-C	0.004320
e-C	0.007715
g-d	0.017739
g-F	0.007809
h-g	0.006518
i-g	0.017700
C'-t	0.012240
e-C'	0.007028
F'-e	0.007351
i-F'	0.024693

Relative partial dispersion	
C-t／F-C	0.8107
C-A'／F-C	0.3449
d-C／F-C	0.3032
e-C／F-C	0.5414
g-d／F-C	1.2448
g-F／F-C	0.5480
h-g／F-C	0.4574
i-g／F-C	1.2421
C'-t／F'-C'	0.8512
e-C'／F'-C'	0.4888
F'-e／F'-C'	0.5112
i-F'／F'-C'	1.7173

Deviation of relative partial disp.	
ΔPdC	0.0027
ΔPgF	−0.0099

Internal CC (80%/5%)
346/287
Color Code (80%/5%)
370/290
CCI

B	0.00
G	0.34
R	0.36

Thermal properties	
CTE(−30,70) [1E-7/℃]	49
CTE(100,300) [1E-7/℃]	63
Tg [℃]	640
At [℃]	670
StP [℃]	596
AP [℃]	625
SP [℃]	727
Ht cndct. [W/m·K]	0.851
Sp. heat [kJ/kg·K]	0.546
Ht diffus. [1E-6 m2/sec]	0.389

Chemical properties [class]	
Acid res. (surface)	2
Alkaline detergent res.	1
Climate resistance	1
Water res. (powder)	1
Acid res. (powder)	4

Mechanical properties	
Knoop hardness	666 (7)
Abrasion hardness	70
Young's mod. [GPa]	97.7
Shear mod. [GPa]	37.7
Poisson's ratio	0.297
Stress optical coef. [1E-5 nm/cm／Pa]	2.23

Internal trans. (10mm)	
λ [nm]	τ
280	0.03
290	0.07
300	0.19
310	0.35
320	0.50
330	0.64
340	0.76
350	0.84
360	0.900
370	0.938
380	0.961
390	0.974
400	0.981
420	0.989
440	0.992
460	0.994
480	0.995
500	0.997
550	0.997
600	0.998
650	0.998
700	0.998
800	0.997
900	0.996
1000	0.997
1200	0.998
1400	0.993
1600	0.989
1800	0.975
2000	0.949
2200	0.86
2400	0.60

Specific gravity
4

Coef. disp. form. (pwr ser.)	
A0	2.94471329E+00
A1	−1.39489672E-02
A2	−2.08989528E-04
A3	2.21246396E-02
A4	2.96283761E-04
A5	1.28986233E-05
A6	−4.34524857E-08
A7	0.00000000E+00
A8	0.00000000E+00

Relative Δn/ΔT [1E-6/℃]															
Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90 (ref.)	5.7	5.7	5.9	6.1	6.2	6.4	6.4	6.5	6.7	6.9	7.4	7.4	8.0	8.5	8.8
60 to 80 (ref.)	5.6	5.6	5.8	5.9	6.1	6.2	6.2	6.3	6.5	6.7	7.2	7.3	7.8	8.3	8.6
40 to 60	5.4	5.4	5.6	5.7	5.9	6.0	6.1	6.1	6.3	6.5	7.0	7.0	7.5	8.0	8.3
20 to 40	5.3	5.3	5.5	5.6	5.7	5.9	5.9	5.9	6.1	6.3	6.8	6.8	7.3	7.8	8.1
0 to 20	5.2	5.2	5.4	5.5	5.6	5.7	5.8	5.8	6.0	6.2	6.6	6.7	7.1	7.6	7.9
−20 to 0	5.1	5.2	5.3	5.4	5.5	5.7	5.7	5.8	5.9	6.1	6.5	6.6	7.0	7.5	7.7
−40 to −20	5.1	5.1	5.3	5.4	5.6	5.7	5.7	5.8	5.9	6.1	6.5	6.6	7.0	7.4	7.7
−60 to −40 (ref.)	5.3	5.3	5.4	5.6	5.7	5.8	5.8	5.9	6.0	6.2	6.6	6.6	7.0	7.4	7.7
−70 to −60 (ref.)	5.4	5.5	5.6	5.7	5.8	5.9	6.0	6.0	6.2	6.4	6.7	6.8	7.2	7.5	7.8

Absolute Δn/ΔT [1E-6/℃]															
Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90	4.6	4.7	4.9	5.0	5.1	5.3	5.3	5.4	5.6	5.8	6.3	6.3	6.9	7.4	7.7
60 to 80	4.4	4.4	4.6	4.8	4.9	5.0	5.1	5.1	5.3	5.5	6.0	6.1	6.6	7.1	7.4
40 to 60	4.1	4.1	4.3	4.4	4.6	4.7	4.7	4.8	5.0	5.2	5.6	5.7	6.2	6.6	7.0
20 to 40	3.8	3.8	4.0	4.1	4.2	4.4	4.4	4.4	4.6	4.8	5.2	5.3	5.8	6.2	6.5
0 to 20	3.5	3.5	3.7	3.8	3.9	4.0	4.1	4.1	4.3	4.5	4.9	4.9	5.4	5.8	6.1
−20 to 0	3.2	3.2	3.3	3.4	3.6	3.7	3.7	3.8	3.9	4.1	4.5	4.5	5.0	5.4	5.7
−40 to −20	2.8	2.9	3.0	3.1	3.2	3.3	3.4	3.4	3.6	3.8	4.1	4.2	4.6	5.0	5.2
−60 to −40	2.5	2.6	2.7	2.8	2.9	3.0	3.0	3.1	3.2	3.4	3.7	3.8	4.2	4.5	4.8
−70 to −60	2.3	2.3	2.4	2.5	2.6	2.8	2.8	2.8	3.0	3.1	3.5	3.5	3.9	4.2	4.5

Coef. disp. form. (frac. eq.)(ref.)	
P1	1.14720056E-01
Q1	6.62725947E+01
P2	3.41846070E-02
Q2	2.44930862E-02
P3	3.59153591E-01
Q3	5.17125611E-03

Fitting error of disp. form. σ [1E-6]		
	Visible	Infrared
Power ser. eq.	0.5	5.1
Frac. eq. (ref.)	0.7	5.4

Prod. Freq. (A to D)	C

Similar glass type			
OHARA	S-LAL59	HOYA	TAC4
CDGM	H-LaK54	SCHOTT	−

2022-7-1	StP, AP, SP
2019-4-1	Transmittance
2018-4-1	Prod. Freq.

HIKARI GLASS CO., LTD.

J-LAK011

n_d = 1.741000 n_e = 1.744347

ν_d = 52.77 ν_e = 52.53

Glass code (d)
741528
Glass code (e)
744525

Spectral l.	Refractive idx
2.058	1.70674
1.970	1.70848
1.530	1.71632
1.129	1.72312
1.064	1.72434
t	1.72536
s	1.72924
A'	1.731896
r	1.734323
C	1.736741
C'	1.737418
He-Ne	1.738050
D	1.740875
d	1.741000
e	1.744347
F	1.750784
F'	1.751588
g	1.758468
h	1.764870
0.389	1.768784
i	1.775829

Partial dispersion	
F-C	0.014043
F'-C'	0.014170
C-t	0.011384
C-A'	0.004845
d-C	0.004259
e-C	0.007606
g-d	0.017468
g-F	0.007684
h-g	0.006402
i-g	0.017361
C'-t	0.012061
e-C'	0.006929
F'-e	0.007241
i-F'	0.024241

Relative partial dispersion	
C-t／F-C	0.8107
C-A'／F-C	0.3450
d-C／F-C	0.3033
e-C／F-C	0.5416
g-d／F-C	1.2439
g-F／F-C	0.5472
h-g／F-C	0.4559
i-g／F-C	1.2363
C'-t／F'-C'	0.8512
e-C'／F'-C'	0.4890
F'-e／F'-C'	0.5110
i-F'／F'-C'	1.7107

Deviation of relative partial disp.	
ΔPdC	0.0023
ΔPgF	−0.0086

Internal CC (80%/5%)
346/276
Color Code (80%/5%)
370/280

CCI	
B	0.00
G	0.37
R	0.37

Thermal properties	
CTE(−30,70) [1E-7/℃]	53
CTE(100,300) [1E-7/℃]	68
Tg [℃]	655
At [℃]	685
StP [℃]	609
AP [℃]	638
SP [℃]	739
Ht cndct. [W/m·K]	0.910
Sp. heat [kJ/kg·K]	0.540
Ht diffus. [1E-6 m2/sec]	0.403

Chemical properties [class]	
Acid res. (surface)	6
Alkaline detergent res.	3
Climate resistance	1
Water res. (powder)	1
Acid res. (powder)	4

Mechanical properties	
Knoop hardness	635 (6)
Abrasion hardness	50
Young's mod. [GPa]	101.8
Shear mod. [GPa]	39.2
Poisson's ratio	0.299
Stress optical coef. [1E-5 nm/cm／Pa]	1.82

Internal trans. (10mm)	
λ [nm]	τ
280	0.07
290	0.16
300	0.25
310	0.35
320	0.50
330	0.64
340	0.75
350	0.83
360	0.900
370	0.935
380	0.959
390	0.973
400	0.981
420	0.989
440	0.992
460	0.995
480	0.997
500	0.998
550	0.999
600	0.999
650	0.999
700	0.998
800	0.999
900	0.999
1000	0.999
1200	0.999
1400	0.994
1600	0.994
1800	0.981
2000	0.952
2200	0.87
2400	0.62

Specific gravity
4.19

Coef. disp. form. (pwr ser.)	
A0	2.96970289E+00
A1	−1.38160772E-02
A2	−1.88539623E-04
A3	2.18448120E-02
A4	3.20709012E-04
A5	8.12772786E-06
A6	7.94854532E-08
A7	0.00000000E+00
A8	0.00000000E+00

Relative Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90 (ref.)	4.7	4.8	4.9	5.1	5.2	5.4	5.4	5.5	5.7	5.9	6.3	6.4	6.9	7.5	7.8
60 to 80 (ref.)	4.6	4.7	4.9	5.0	5.1	5.3	5.3	5.4	5.6	5.8	6.2	6.3	6.8	7.3	7.6
40 to 60	4.5	4.5	4.7	4.9	5.0	5.2	5.2	5.2	5.4	5.6	6.1	6.1	6.6	7.1	7.4
20 to 40	4.4	4.5	4.6	4.8	4.9	5.1	5.1	5.1	5.3	5.5	5.9	6.0	6.5	6.9	7.3
0 to 20	4.4	4.4	4.6	4.7	4.9	5.0	5.0	5.1	5.2	5.4	5.8	5.9	6.4	6.8	7.1
−20 to 0	4.4	4.4	4.6	4.7	4.9	5.0	5.0	5.1	5.2	5.4	5.8	5.9	6.3	6.8	7.1
−40 to −20	4.5	4.5	4.7	4.8	4.9	5.1	5.1	5.1	5.3	5.5	5.8	5.9	6.3	6.8	7.1
−60 to −40 (ref.)	4.6	4.7	4.9	5.0	5.1	5.2	5.3	5.3	5.4	5.6	6.0	6.0	6.5	6.9	7.2
−70 to −60 (ref.)	4.8	4.9	5.1	5.2	5.3	5.4	5.5	5.5	5.6	5.8	6.2	6.2	6.6	7.1	7.3

Absolute Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90	3.6	3.7	3.9	4.0	4.2	4.3	4.4	4.4	4.6	4.8	5.2	5.3	5.8	6.3	6.7
60 to 80	3.4	3.5	3.7	3.8	4.0	4.1	4.1	4.2	4.4	4.6	5.0	5.1	5.6	6.1	6.4
40 to 60	3.2	3.2	3.4	3.6	3.7	3.8	3.9	3.9	4.1	4.3	4.7	4.8	5.2	5.7	6.0
20 to 40	2.9	3.0	3.2	3.3	3.4	3.5	3.6	3.6	3.8	4.0	4.4	4.4	4.9	5.4	5.7
0 to 20	2.7	2.7	2.9	3.0	3.1	3.3	3.3	3.3	3.5	3.7	4.1	4.1	4.6	5.0	5.3
−20 to 0	2.4	2.5	2.6	2.7	2.9	3.0	3.0	3.1	3.2	3.4	3.8	3.8	4.2	4.7	5.0
−40 to −20	2.1	2.2	2.4	2.5	2.6	2.7	2.7	2.8	2.9	3.1	3.4	3.5	3.9	4.3	4.6
−60 to −40	1.9	1.9	2.1	2.2	2.3	2.4	2.5	2.5	2.6	2.8	3.1	3.2	3.6	4.0	4.2
−70 to −60	1.7	1.7	1.9	2.0	2.1	2.2	2.2	2.3	2.4	2.6	2.9	2.9	3.3	3.7	4.0

Coef. disp. form. (frac. eq.)(ref.)	
P1	1.13952119E-01
Q1	6.75478386E+01
P2	7.11110326E-02
Q2	1.82745831E-02
P3	3.25258407E-01
Q3	4.14014530E-03

Fitting error of disp. form. σ [1E-6]		
	Visible	Infrared
Power ser. eq.	0.6	4.5
Frac. eq. (ref.)	0.7	4.4

Prod. Freq. (A to D)	A

Similar glass type			
OHARA	S-LAL61	HOYA	TAC2
CDGM	H-LaK61	SCHOTT	−

2022-7-1	StP, AP, SP
2019-4-1	Transmittance
2015-4-1	Color Code, Prod. Freq.

HIKARI GLASS CO., LTD.

J-LASKH2

n_d = 1.755000 n_e = 1.758438

ν_d = 52.34 ν_e = 52.10

Glass code (d)
755523
Glass code (e)
758521

Spectral l.	Refractive idx
2.058	1.72014
1.970	1.72189
1.530	1.72981
1.129	1.73670
1.064	1.73794
t	1.73898
s	1.74294
A'	1.745658
r	1.748146
C	1.750628
C'	1.751323
He-Ne	1.751971
D	1.754872
d	1.755000
e	1.758438
F	1.765054
F'	1.765879
g	1.772953
h	1.779538
0.389	1.783566
i	1.790817

Coef. disp. form. (pwr ser.)	
A0	3.01618042E+00
A1	-1.39280117E-02
A2	-2.04284446E-04
A3	2.27027519E-02
A4	3.17846393E-04
A5	1.01400049E-05
A6	3.63521536E-08
A7	0.00000000E+00
A8	0.00000000E+00

Partial dispersion	
F-C	0.014426
F'-C'	0.014556
C-t	0.011653
C-A'	0.004970
d-C	0.004372
e-C	0.007810
g-d	0.017953
g-F	0.007899
h-g	0.006585
i-g	0.017864
C'-t	0.012348
e-C'	0.007115
F'-e	0.007441
i-F'	0.024938

Relative partial dispersion	
C-t／F-C	0.8078
C-A'／F-C	0.3445
d-C／F-C	0.3031
e-C／F-C	0.5414
g-d／F-C	1.2445
g-F／F-C	0.5476
h-g／F-C	0.4565
i-g／F-C	1.2383
C'-t／F'-C'	0.8483
e-C'／F'-C'	0.4888
F'-e／F'-C'	0.5112
i-F'／F'-C'	1.7132

Deviation of relative partial disp.	
ΔPdC	0.0022
ΔPgF	-0.0090

Internal CC (80%/5%)
344/274
Color Code (80%/5%)
370/275
CCI

B	0.00
G	0.35
R	0.35

Thermal properties	
CTE(-30,70) [1E-7/℃]	61
CTE(100,300) [1E-7/℃]	72
Tg [℃]	670
At [℃]	697
StP [℃]	627
AP [℃]	654
SP [℃]	747
Ht cndct. [W/m･K]	0.823
Sp. heat [kJ/kg･K]	0.510
Ht diffus. [1E-6 m2/sec]	0.377

Chemical properties [class]	
Acid res. (surface)	4
Alkaline detergent res.	2
Climate resistance	1
Water res. (powder)	1
Acid res. (powder)	4

Mechanical properties	
Knoop hardness	678 (7)
Abrasion hardness	62
Young's mod. [GPa]	118.8
Shear mod. [GPa]	45.8
Poisson's ratio	0.297
Stress optical coef. [1E-5 nm/cm／Pa]	1.60

Internal trans. (10mm)	
λ [nm]	τ
280	0.08
290	0.16
300	0.27
310	0.37
320	0.52
330	0.66
340	0.76
350	0.84
360	0.900
370	0.938
380	0.961
390	0.974
400	0.983
420	0.990
440	0.993
460	0.995
480	0.997
500	0.998
550	0.999
600	0.999
650	0.999
700	0.999
800	0.998
900	0.997
1000	0.997
1200	0.998
1400	0.993
1600	0.988
1800	0.974
2000	0.947
2200	0.86
2400	0.61

Specific gravity
4.29

Relative Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90 (ref.)	3.9	3.9	4.1	4.3	4.4	4.5	4.6	4.6	4.8	5.0	5.5	5.6	6.1	6.7	7.0
60 to 80 (ref.)	3.8	3.8	4.0	4.1	4.3	4.4	4.4	4.5	4.7	4.9	5.3	5.4	6.0	6.5	6.8
40 to 60	3.6	3.7	3.8	4.0	4.1	4.2	4.3	4.3	4.5	4.7	5.1	5.2	5.7	6.2	6.5
20 to 40	3.5	3.5	3.7	3.8	4.0	4.1	4.1	4.2	4.3	4.5	5.0	5.0	5.5	6.0	6.3
0 to 20	3.4	3.5	3.6	3.8	3.9	4.0	4.0	4.1	4.2	4.4	4.8	4.9	5.4	5.8	6.1
-20 to 0	3.4	3.4	3.6	3.7	3.8	4.0	4.0	4.0	4.2	4.4	4.7	4.8	5.3	5.7	5.9
-40 to -20	3.5	3.5	3.6	3.8	3.9	4.0	4.0	4.1	4.2	4.4	4.7	4.8	5.2	5.7	5.9
-60 to -40 (ref.)	3.6	3.6	3.8	3.9	4.0	4.1	4.2	4.2	4.3	4.5	4.8	4.9	5.3	5.7	5.9
-70 to -60 (ref.)	3.8	3.8	4.0	4.1	4.2	4.3	4.3	4.4	4.5	4.7	5.0	5.0	5.5	5.8	6.0

Absolute Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90	2.8	2.9	3.0	3.2	3.3	3.5	3.5	3.5	3.7	3.9	4.4	4.5	5.0	5.6	5.8
60 to 80	2.6	2.6	2.8	2.9	3.1	3.2	3.3	3.3	3.5	3.7	4.1	4.2	4.7	5.2	5.5
40 to 60	2.3	2.3	2.5	2.6	2.8	2.9	2.9	3.0	3.1	3.3	3.8	3.8	4.3	4.8	5.1
20 to 40	2.0	2.0	2.2	2.3	2.5	2.6	2.6	2.7	2.8	3.0	3.4	3.5	4.0	4.4	4.7
0 to 20	1.7	1.7	1.9	2.0	2.1	2.3	2.3	2.3	2.5	2.7	3.0	3.1	3.6	4.0	4.2
-20 to 0	1.4	1.5	1.6	1.7	1.8	1.9	2.0	2.0	2.2	2.3	2.7	2.7	3.2	3.6	3.8
-40 to -20	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.7	1.8	2.0	2.3	2.4	2.8	3.2	3.4
-60 to -40	0.9	0.9	1.0	1.1	1.2	1.3	1.3	1.4	1.5	1.6	2.0	2.0	2.4	2.8	3.0
-70 to -60	0.6	0.6	0.8	0.9	1.0	1.1	1.1	1.1	1.2	1.4	1.7	1.7	2.1	2.5	2.7

Coef. disp. form. (frac. eq.)(ref.)	
P1	1.09833774E-01
Q1	6.56037326E+01
P2	4.70337592E-02
Q2	2.11653374E-02
P3	3.54937207E-01
Q3	4.78614953E-03

Fitting error of disp. form. σ [1E-6]		
	Visible	Infrared
Power ser. eq.	0.5	6.7
Frac. eq. (ref.)	0.6	6.7

Prod. Freq. (A to D)	A

Similar glass type			
OHARA	S-LAH97	HOYA	TAC6
CDGM	H-LaK53B	SCHOTT	N-LAK33B

2023-9-1	Prod. Freq.
2022-7-1	StP, AP, SP
2020-4-1	Similar glass type, chemical properties

HIKARI GLASS CO., LTD.

J-LAF2

n_d = 1.744000 n_e = 1.747948

ν_d = 44.81 ν_e = 44.54

Glass code (d)
744448
Glass code (e)
748445

Spectral l.	Refractive idx
2.058	1.70914
1.970	1.71064
1.530	1.71761
1.129	1.72413
1.064	1.72537
t	1.72642
s	1.73058
A'	1.733521
r	1.736267
C	1.739042
C'	1.739825
He-Ne	1.740557
D	1.743853
d	1.744000
e	1.747948
F	1.755647
F'	1.756617
g	1.765006
h	1.772952
0.389	1.777884
i	1.786912

Partial dispersion	
F-C	0.016605
F'-C'	0.016792
C-t	0.012624
C-A'	0.005521
d-C	0.004958
e-C	0.008906
g-d	0.021006
g-F	0.009359
h-g	0.007946
i-g	0.021906
C'-t	0.013407
e-C'	0.008123
F'-e	0.008669
i-F'	0.030295

Relative partial dispersion	
C-t／F-C	0.7603
C-A'／F-C	0.3325
d-C／F-C	0.2986
e-C／F-C	0.5363
g-d／F-C	1.2650
g-F／F-C	0.5636
h-g／F-C	0.4785
i-g／F-C	1.3192
C'-t／F'-C'	0.7984
e-C'／F'-C'	0.4837
F'-e／F'-C'	0.5163
i-F'／F'-C'	1.8041

Deviation of relative partial disp.	
ΔPdC	0.0012
ΔPgF	−0.0056

Internal CC (80%/5%)
372/338
Color Code (80%/5%)
390/340
CCI

B	0.00
G	0.82
R	0.83

Thermal properties	
CTE(-30,70) [1E-7/℃]	58
CTE(100,300) [1E-7/℃]	73
Tg [℃]	620
At [℃]	650
StP [℃]	569
AP [℃]	602
SP [℃]	717
Ht cndct. [W/m·K]	0.778
Sp. heat [kJ/kg·K]	0.511
Ht diffus. [1E-6 m2/sec]	0.366

Chemical properties [class]	
Acid res. (surface)	5
Alkaline detergent res.	2
Climate resistance	1
Water res. (powder)	1
Acid res. (powder)	4

Mechanical properties	
Knoop hardness	607 (6)
Abrasion hardness	118
Young's mod. [GPa]	97.4
Shear mod. [GPa]	37.6
Poisson's ratio	0.297
Stress optical coef. [1E-5 nm/cm／Pa]	2.32

Internal trans. (10mm)	
λ [nm]	τ
280	–
290	–
300	–
310	–
320	–
330	–
340	0.08
350	0.30
360	0.58
370	0.77
380	0.88
390	0.929
400	0.956
420	0.978
440	0.986
460	0.991
480	0.994
500	0.996
550	0.997
600	0.997
650	0.997
700	0.998
800	0.999
900	0.999
1000	0.999
1200	0.999
1400	0.997
1600	0.993
1800	0.986
2000	0.970
2200	0.922
2400	0.76

Specific gravity
4.16

Coef. disp. form. (pwr ser.)	
A0	2.96796358E+00
A1	−1.19454184E-02
A2	−1.21022641E-04
A3	2.50950364E-02
A4	5.91997830E-04
A5	−3.88364981E-06
A6	2.08885425E-06
A7	0.00000000E+00
A8	0.00000000E+00

Relative Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90 (ref.)	5.2	5.2	5.4	5.6	5.9	6.1	6.2	6.2	6.5	6.8	7.4	7.5	8.4	9.2	9.7
60 to 80 (ref.)	5.0	5.0	5.3	5.5	5.7	5.9	6.0	6.0	6.3	6.6	7.2	7.3	8.1	8.9	9.4
40 to 60	4.8	4.8	5.0	5.2	5.5	5.7	5.7	5.8	6.0	6.3	6.9	7.0	7.8	8.6	9.0
20 to 40	4.6	4.6	4.8	5.1	5.3	5.5	5.5	5.6	5.8	6.1	6.7	6.8	7.5	8.3	8.7
0 to 20	4.5	4.5	4.7	4.9	5.1	5.3	5.4	5.4	5.6	5.9	6.5	6.5	7.3	8.0	8.4
−20 to 0	4.4	4.4	4.6	4.8	5.0	5.2	5.2	5.3	5.5	5.8	6.3	6.4	7.1	7.8	8.2
−40 to −20	4.4	4.4	4.6	4.8	5.0	5.2	5.2	5.2	5.5	5.7	6.2	6.3	7.0	7.7	8.0
−60 to −40 (ref.)	4.5	4.5	4.7	4.8	5.0	5.2	5.3	5.3	5.5	5.7	6.2	6.3	7.0	7.6	7.9
−70 to −60 (ref.)	4.6	4.6	4.8	5.0	5.2	5.3	5.4	5.4	5.6	5.8	6.3	6.4	7.0	7.7	8.0

Absolute Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90	4.1	4.1	4.3	4.6	4.8	5.0	5.1	5.1	5.4	5.7	6.3	6.4	7.3	8.1	8.5
60 to 80	3.8	3.9	4.1	4.3	4.5	4.7	4.8	4.8	5.1	5.4	6.0	6.1	6.9	7.7	8.2
40 to 60	3.5	3.5	3.7	3.9	4.1	4.3	4.4	4.5	4.7	5.0	5.6	5.7	6.4	7.2	7.6
20 to 40	3.1	3.2	3.3	3.6	3.8	4.0	4.0	4.1	4.3	4.6	5.1	5.2	6.0	6.7	7.1
0 to 20	2.8	2.8	3.0	3.2	3.4	3.6	3.6	3.7	3.9	4.1	4.7	4.8	5.5	6.2	6.6
−20 to 0	2.4	2.4	2.6	2.8	3.0	3.2	3.2	3.3	3.5	3.7	4.3	4.3	5.0	5.7	6.1
−40 to −20	2.1	2.1	2.3	2.4	2.6	2.8	2.8	2.9	3.1	3.3	3.8	3.9	4.6	5.2	5.5
−60 to −40	1.7	1.7	1.9	2.1	2.2	2.4	2.5	2.5	2.7	2.9	3.4	3.4	4.1	4.7	5.0
−70 to −60	1.5	1.5	1.6	1.8	2.0	2.1	2.2	2.2	2.4	2.6	3.1	3.1	3.7	4.3	4.6

Coef. disp. form. (frac. eq.)(ref.)	
P1	1.03643520E-01
Q1	7.22792806E+01
P2	1.60518064E-02
Q2	4.20912167E-02
P3	3.80053566E-01
Q3	6.33681438E-03

Fitting error of disp. form. σ [1E-6]		
	Visible	Infrared
Power ser. eq.	0.7	4.7
Frac. eq. (ref.)	0.6	7.2

Prod. Freq. (A to D)	C

Similar glass type			
OHARA	S-LAM2	HOYA	LAF2
CDGM	H-LaF3B	SCHOTT	N-LAF2

2022-7-1	StP, AP, SP
2019-4-1	Transmittance
2015-4-1	Color Code, Similar glass type

HIKARI GLASS CO., LTD.

J-LAF3

n_d = 1.717000 n_e = 1.720556

ν_d = 47.98 ν_e = 47.71

Glass code (d)
717480
Glass code (e)
721477

Spectral l.	Refractive idx
2.058	1.68438
1.970	1.68584
1.530	1.69261
1.129	1.69881
1.064	1.69998
t	1.70095
s	1.70480
A'	1.707495
r	1.709998
C	1.712517
C'	1.713226
He-Ne	1.713889
D	1.716868
d	1.717000
e	1.720556
F	1.727462
F'	1.728330
g	1.735809
h	1.742854
0.389	1.747207
i	1.755135

Partial dispersion	
F-C	0.014945
F'-C'	0.015104
C-t	0.011564
C-A'	0.005022
d-C	0.004483
e-C	0.008039
g-d	0.018809
g-F	0.008347
h-g	0.007045
i-g	0.019326
C'-t	0.012273
e-C'	0.007330
F'-e	0.007774
i-F'	0.026805

Relative partial dispersion	
C-t／F-C	0.7738
C-A'／F-C	0.3360
d-C／F-C	0.3000
e-C／F-C	0.5379
g-d／F-C	1.2585
g-F／F-C	0.5585
h-g／F-C	0.4714
i-g／F-C	1.2931
C'-t／F'-C'	0.8126
e-C'／F'-C'	0.4853
F'-e／F'-C'	0.5147
i-F'／F'-C'	1.7747

Deviation of relative partial disp.	
ΔPdC	0.0011
ΔPgF	−0.0053

Internal CC (80%/5%)
365/333
Color Code (80%/5%)
380/335

CCI	
B	0.00
G	0.56
R	0.55

Thermal properties	
CTE(−30,70) [1E-7/℃]	61
CTE(100,300) [1E-7/℃]	79
Tg [℃]	640
At [℃]	681
StP [℃]	595
AP [℃]	628
SP [℃]	746
Ht cndct. [W/m·K]	0.767
Sp. heat [kJ/kg·K]	0.516
Ht diffus. [1E-6 m2/sec]	0.378

Chemical properties [class]	
Acid res. (surface)	5
Alkaline detergent res.	2
Climate resistance	1
Water res. (powder)	2
Acid res. (powder)	4

Mechanical properties	
Knoop hardness	526 (5)
Abrasion hardness	131
Young's mod. [GPa]	99.0
Shear mod. [GPa]	38.4
Poisson's ratio	0.291
Stress optical coef. [1E-5 nm/cm／Pa]	2.00

Internal trans. (10mm)	
λ [nm]	τ
280	–
290	–
300	–
310	–
320	–
330	0.02
340	0.16
350	0.45
360	0.71
370	0.86
380	0.925
390	0.957
400	0.973
420	0.985
440	0.990
460	0.993
480	0.995
500	0.997
550	0.999
600	0.998
650	0.998
700	0.998
800	0.997
900	0.995
1000	0.996
1200	0.998
1400	0.993
1600	0.993
1800	0.986
2000	0.970
2200	0.921
2400	0.77

Specific gravity
3.93

Coef. disp. form. (pwr ser.)	
A0	2.88297779E+00
A1	−1.15922463E-02
A2	−1.15749419E-04
A3	2.24704179E-02
A4	4.75179381E-04
A5	−1.96471810E-06
A6	1.41116684E-06
A7	0.00000000E+00
A8	0.00000000E+00

Relative Δn/ΔT [1E-6/℃]															
Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90 (ref.)	3.7	3.7	3.9	4.1	4.2	4.4	4.5	4.5	4.8	5.0	5.6	5.7	6.4	7.1	7.5
60 to 80 (ref.)	3.6	3.6	3.8	4.0	4.1	4.3	4.4	4.4	4.6	4.9	5.4	5.5	6.2	6.8	7.3
40 to 60	3.4	3.5	3.7	3.8	4.0	4.2	4.2	4.2	4.5	4.7	5.2	5.3	5.9	6.6	7.0
20 to 40	3.4	3.4	3.6	3.7	3.9	4.0	4.1	4.1	4.3	4.6	5.1	5.1	5.7	6.4	6.7
0 to 20	3.3	3.3	3.5	3.7	3.8	4.0	4.0	4.0	4.2	4.5	4.9	5.0	5.6	6.2	6.5
−20 to 0	3.3	3.3	3.5	3.6	3.8	3.9	4.0	4.0	4.2	4.4	4.9	4.9	5.5	6.1	6.4
−40 to −20	3.4	3.4	3.6	3.7	3.8	4.0	4.0	4.1	4.2	4.4	4.9	4.9	5.5	6.0	6.3
−60 to −40 (ref.)	3.5	3.6	3.7	3.9	4.0	4.1	4.2	4.2	4.4	4.6	5.0	5.0	5.5	6.0	6.3
−70 to −60 (ref.)	3.7	3.8	3.9	4.0	4.2	4.3	4.3	4.4	4.5	4.7	5.1	5.2	5.7	6.2	6.5

Absolute Δn/ΔT [1E-6/℃]															
Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90	2.6	2.7	2.8	3.0	3.2	3.4	3.4	3.5	3.7	3.9	4.5	4.6	5.3	5.9	6.4
60 to 80	2.4	2.5	2.6	2.8	3.0	3.1	3.2	3.2	3.5	3.7	4.2	4.3	5.0	5.6	6.1
40 to 60	2.2	2.2	2.4	2.5	2.7	2.8	2.9	2.9	3.1	3.4	3.9	4.0	4.6	5.2	5.6
20 to 40	1.9	1.9	2.1	2.2	2.4	2.6	2.6	2.6	2.8	3.1	3.6	3.6	4.2	4.8	5.2
0 to 20	1.6	1.7	1.8	2.0	2.1	2.3	2.3	2.3	2.5	2.7	3.2	3.3	3.8	4.4	4.8
−20 to 0	1.4	1.4	1.5	1.7	1.8	2.0	2.0	2.0	2.2	2.4	2.9	2.9	3.5	4.0	4.3
−40 to −20	1.1	1.1	1.3	1.4	1.5	1.7	1.7	1.7	1.9	2.1	2.5	2.6	3.1	3.6	3.9
−60 to −40	0.8	0.9	1.0	1.1	1.2	1.4	1.4	1.4	1.6	1.8	2.2	2.2	2.7	3.2	3.5
−70 to −60	0.6	0.7	0.8	0.9	1.0	1.1	1.2	1.2	1.4	1.5	1.9	2.0	2.4	2.9	3.1

Coef. disp. form. (frac. eq.)(ref.)	
P1	1.07530916E-01
Q1	7.45015661E+01
P2	1.48535752E-02
Q2	3.95541614E-02
P3	3.70747892E-01
Q3	6.11229540E-03

Fitting error of disp. form. σ [1E-6]		
	Visible	Infrared
Power ser. eq.	0.6	4.2
Frac. eq. (ref.)	0.6	4.8

Prod. Freq. (A to D)	C

Similar glass type			
OHARA	S-LAM3	HOYA	LAF3
CDGM	H-LaF2	SCHOTT	–

2022-7-1	StP, AP, SP
2019-4-1	Transmittance
2018-4-1	Prod. Freq.

HIKARI GLASS CO., LTD.

J-LAF7

n_d = 1.749500 n_e = 1.754533

ν_d = 35.25 ν_e = 34.99

Glass code (d)
750353
Glass code (e)
755350

Spectral l.	Refractive idx
2.058	1.70948
1.970	1.71102
1.530	1.71826
1.129	1.72539
1.064	1.72681
t	1.72801
s	1.73292
A'	1.736472
r	1.739834
C	1.743271
C'	1.744248
He-Ne	1.745164
D	1.749314
d	1.749500
e	1.754533
F	1.764535
F'	1.765812
g	1.777040
h	1.787997
0.389	1.794980
i	–

Partial dispersion	
F-C	0.021264
F'-C'	0.021564
C-t	0.015256
C-A'	0.006799
d-C	0.006229
e-C	0.011262
g-d	0.027540
g-F	0.012505
h-g	0.010957
i-g	–
C'-t	0.016234
e-C'	0.010285
F'-e	0.011279
i-F'	–

Relative partial dispersion	
C-t／F-C	0.7175
C-A'／F-C	0.3197
d-C／F-C	0.2929
e-C／F-C	0.5296
g-d／F-C	1.2951
g-F／F-C	0.5881
h-g／F-C	0.5153
i-g／F-C	–
C'-t／F'-C'	0.7528
e-C'／F'-C'	0.4770
F'-e／F'-C'	0.5230
i-F'／F'-C'	–

Deviation of relative partial disp.	
ΔPdC	−0.0002
ΔPgF	0.0029

Internal CC (80%/5%)
393/355
Color Code (80%/5%)
420/355

CCI	
B	0.00
G	2.62
R	2.64

Thermal properties	
CTE(−30,70) [1E-7/℃]	73
CTE(100,300) [1E-7/℃]	88
Tg [℃]	587
At [℃]	631
StP [℃]	–
AP [℃]	–
SP [℃]	–
Ht cndct. [W/m·K]	0.820
Sp. heat [kJ/kg·K]	0.552
Ht diffus. [1E-6 m2/sec]	0.411

Chemical properties [class]	
Acid res. (surface)	5
Alkaline detergent res.	2
Climate resistance	1
Water res. (powder)	2
Acid res. (powder)	4

Mechanical properties	
Knoop hardness	540 (5)
Abrasion hardness	149
Young's mod. [GPa]	91.5
Shear mod. [GPa]	35.5
Poisson's ratio	0.288
Stress optical coef. [1E-5 nm/cm／Pa]	2.64

Internal trans. (10mm)	
λ [nm]	τ
280	–
290	–
300	–
310	–
320	–
330	–
340	–
350	0.01
360	0.13
370	0.39
380	0.62
390	0.77
400	0.86
420	0.935
440	0.962
460	0.975
480	0.983
500	0.988
550	0.995
600	0.995
650	0.995
700	0.996
800	0.999
900	0.999
1000	0.999
1200	0.999
1400	0.997
1600	0.995
1800	0.985
2000	0.967
2200	0.917
2400	0.78

Specific gravity
3.62

Coef. disp. form. (pwr ser.)	
A0	2.96739544E+00
A1	−1.18139418E-02
A2	−1.33628078E-04
A3	3.10749099E-02
A4	6.54571893E-04
A5	9.85567905E-05
A6	−8.83112540E-06
A7	8.38843732E-07
A8	0.00000000E+00

Relative Δn/ΔT [1E-6/℃]															
Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90 (ref.)	2.2	2.3	2.6	2.9	3.2	3.4	3.5	3.6	3.9	4.4	5.4	5.5	6.7	8.2	9.2
60 to 80 (ref.)	2.1	2.2	2.5	2.8	3.0	3.3	3.3	3.4	3.8	4.2	5.1	5.3	6.5	7.8	8.8
40 to 60	2.0	2.0	2.3	2.6	2.8	3.1	3.1	3.2	3.5	4.0	4.8	5.0	6.1	7.4	8.3
20 to 40	1.8	1.9	2.2	2.4	2.7	2.9	3.0	3.0	3.4	3.7	4.6	4.7	5.8	7.0	7.9
0 to 20	1.8	1.8	2.1	2.3	2.6	2.8	2.8	2.9	3.2	3.6	4.4	4.5	5.5	6.7	7.5
−20 to 0	1.7	1.8	2.1	2.3	2.5	2.7	2.8	2.8	3.1	3.5	4.2	4.3	5.3	6.4	7.1
−40 to −20	1.8	1.9	2.1	2.3	2.5	2.7	2.8	2.8	3.1	3.4	4.1	4.2	5.1	6.2	6.9
−60 to −40 (ref.)	1.9	2.0	2.2	2.4	2.6	2.8	2.9	2.9	3.2	3.5	4.2	4.3	5.1	6.0	6.7
−70 to −60 (ref.)	2.1	2.2	2.4	2.6	2.8	3.0	3.0	3.1	3.3	3.6	4.3	4.4	5.2	6.0	6.7

Absolute Δn/ΔT [1E-6/℃]															
Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90	1.2	1.3	1.6	1.8	2.1	2.3	2.4	2.5	2.8	3.3	4.2	4.4	5.6	7.0	8.0
60 to 80	0.9	1.0	1.3	1.6	1.8	2.1	2.2	2.2	2.6	3.0	3.9	4.0	5.2	6.6	7.5
40 to 60	0.6	0.7	1.0	1.3	1.5	1.7	1.8	1.9	2.2	2.6	3.5	3.6	4.7	6.0	6.9
20 to 40	0.3	0.4	0.7	0.9	1.2	1.4	1.5	1.5	1.8	2.2	3.0	3.2	4.2	5.4	6.3
0 to 20	0.1	0.1	0.4	0.6	0.8	1.0	1.1	1.2	1.5	1.8	2.6	2.7	3.7	4.8	5.6
−20 to 0	−0.2	−0.2	0.1	0.3	0.5	0.7	0.8	0.8	1.1	1.4	2.2	2.3	3.2	4.3	5.0
−40 to −20	−0.5	−0.5	−0.2	0.0	0.2	0.4	0.4	0.5	0.7	1.0	1.7	1.8	2.7	3.7	4.4
−60 to −40	−0.8	−0.8	−0.5	−0.4	−0.2	0.0	0.1	0.1	0.4	0.7	1.3	1.4	2.2	3.1	3.7
−70 to −60	−1.0	−1.0	−0.8	−0.6	−0.4	−0.3	−0.2	−0.2	0.1	0.4	1.0	1.0	1.8	2.7	3.3

Coef. disp. form. (frac. eq.)(ref.)	
P1	1.05222300E-01
Q1	7.33807652E+01
P2	1.94995885E-02
Q2	5.42288787E-02
P3	3.76585353E-01
Q3	7.16474338E-03

Fitting error of disp. form. σ [1E-6]		
	Visible	Infrared
Power ser. eq.	0.6	7.0
Frac. eq. (ref.)	1.2	8.6

Prod. Freq. (A to D)	C

Similar glass type			
OHARA	S-LAM7,S-NBH51	HOYA	E-LAF7
CDGM	H-LaF4	SCHOTT	N-LAF7

2019-4-1	Transmittance
2018-4-1	Prod. Freq.
2016-4-1	Similar glass type

HIKARI GLASS CO., LTD.

J-LAF01

n_d = 1.700000 n_e = 1.703462

ν_d = 48.11 ν_e = 47.82

Glass code (d)
700481
Glass code (e)
703478

Spectral l.	Refractive idx
2.058	1.66933
1.970	1.67064
1.530	1.67675
1.129	1.68250
1.064	1.68359
t	1.68452
s	1.68819
A'	1.690785
r	1.693203
C	1.695645
C'	1.696333
He-Ne	1.696977
D	1.699871
d	1.700000
e	1.703462
F	1.710196
F'	1.711043
g	1.718350
h	1.725242
0.389	1.729503
i	–

Partial dispersion	
F-C	0.014551
F'-C'	0.014710
C-t	0.011126
C-A'	0.004860
d-C	0.004355
e-C	0.007817
g-d	0.018350
g-F	0.008154
h-g	0.006892
i-g	–
C'-t	0.011814
e-C'	0.007129
F'-e	0.007581
i-F'	–

Relative partial dispersion	
C-t／F-C	0.7646
C-A'／F-C	0.3340
d-C／F-C	0.2993
e-C／F-C	0.5372
g-d／F-C	1.2611
g-F／F-C	0.5604
h-g／F-C	0.4736
i-g／F-C	–
C'-t／F'-C'	0.8031
e-C'／F'-C'	0.4846
F'-e／F'-C'	0.5154
i-F'／F'-C'	–

Deviation of relative partial disp.	
ΔPdC	0.0004
ΔPgF	−0.0033

Internal CC (80%/5%)
369/336
Color Code (80%/5%)
385/335
CCI

B	0.00
G	0.66
R	0.63

Thermal properties	
CTE(−30,70) [1E-7/℃]	73
CTE(100,300) [1E-7/℃]	85
Tg [℃]	657
At [℃]	693
StP [℃]	615
AP [℃]	650
SP [℃]	776
Ht cndct. [W/m·K]	0.811
Sp. heat [kJ/kg·K]	0.545
Ht diffus. [1E-6 m2/sec]	0.403

Chemical properties [class]	
Acid res. (surface)	6
Alkaline detergent res.	3
Climate resistance	1
Water res. (powder)	1
Acid res. (powder)	4

Mechanical properties	
Knoop hardness	575 (6)
Abrasion hardness	155
Young's mod. [GPa]	96.1
Shear mod. [GPa]	37.3
Poisson's ratio	0.287
Stress optical coef. [1E-5 nm/cm／Pa]	1.80

Internal trans. (10mm)	
λ [nm]	τ
280	–
290	–
300	–
310	–
320	–
330	0.01
340	0.11
350	0.36
360	0.64
370	0.82
380	0.902
390	0.944
400	0.966
420	0.983
440	0.988
460	0.991
480	0.994
500	0.996
550	0.998
600	0.996
650	0.996
700	0.997
800	0.996
900	0.995
1000	0.995
1200	0.995
1400	0.994
1600	0.989
1800	0.980
2000	0.966
2200	0.925
2400	0.81

Specific gravity
3.68

Coef. disp. form. (pwr ser.)	
A0	2.82684251E+00
A1	−1.03793494E-02
A2	−7.59583803E-05
A3	2.16620460E-02
A4	4.72548975E-04
A5	−2.58637501E-06
A6	1.43317138E-06
A7	0.00000000E+00
A8	0.00000000E+00

Relative Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90 (ref.)	2.0	2.1	2.2	2.5	2.6	2.8	2.8	2.9	3.1	3.4	3.9	4.0	4.6	–	–
60 to 80 (ref.)	1.9	2.0	2.2	2.4	2.5	2.7	2.7	2.8	3.0	3.2	3.8	3.8	4.5	–	–
40 to 60	1.8	1.9	2.1	2.2	2.4	2.5	2.6	2.6	2.8	3.1	3.6	3.7	4.3	–	–
20 to 40	1.7	1.8	2.0	2.1	2.3	2.5	2.5	2.5	2.7	3.0	3.5	3.5	4.1	–	–
0 to 20	1.7	1.8	2.0	2.1	2.2	2.4	2.4	2.5	2.7	2.9	3.4	3.4	4.0	–	–
−20 to 0	1.7	1.8	2.0	2.1	2.2	2.4	2.4	2.5	2.6	2.9	3.3	3.4	3.9	–	–
−40 to −20	1.8	1.9	2.0	2.2	2.3	2.4	2.5	2.5	2.7	2.9	3.3	3.4	3.9	–	–
−60 to −40 (ref.)	2.0	2.0	2.2	2.3	2.5	2.6	2.6	2.7	2.8	3.0	3.5	3.5	4.0	–	–
−70 to −60 (ref.)	2.2	2.2	2.4	2.5	2.7	2.8	2.8	2.9	3.0	3.2	3.6	3.7	4.2	–	–

Absolute Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90	1.0	1.0	1.2	1.4	1.6	1.7	1.8	1.8	2.0	2.3	2.8	2.9	3.5	–	–
60 to 80	0.8	0.8	1.1	1.2	1.4	1.5	1.6	1.6	1.8	2.1	2.6	2.7	3.3	–	–
40 to 60	0.5	0.6	0.8	0.9	1.1	1.3	1.3	1.3	1.5	1.8	2.3	2.3	2.9	–	–
20 to 40	0.3	0.3	0.5	0.7	0.8	1.0	1.0	1.1	1.3	1.5	2.0	2.0	2.6	–	–
0 to 20	0.0	0.1	0.3	0.4	0.6	0.7	0.7	0.8	1.0	1.2	1.6	1.7	2.2	–	–
−20 to 0	−0.2	−0.2	0.0	0.2	0.3	0.4	0.5	0.5	0.7	0.9	1.3	1.4	1.9	–	–
−40 to −20	−0.5	−0.4	−0.2	−0.1	0.0	0.1	0.2	0.2	0.4	0.6	1.0	1.0	1.5	–	–
−60 to −40	−0.7	−0.7	−0.5	−0.4	−0.2	−0.1	−0.1	−0.1	0.1	0.3	0.7	0.7	1.2	–	–
−70 to −60	−0.9	−0.8	−0.7	−0.6	−0.5	−0.3	−0.3	−0.3	−0.1	0.1	0.4	0.5	0.9	–	–

Coef. disp. form. (frac. eq.)(ref.)	
P1	1.24405553E-01
Q1	9.40421199E+01
P2	1.85633188E-02
Q2	3.72381886E-02
P3	3.59893584E-01
Q3	5.90236401E-03

Fitting error of disp. form. σ [1E-6]		
	Visible	Infrared
Power ser. eq.	0.5	3.3
Frac. eq. (ref.)	0.7	2.7

Prod. Freq. (A to D)	C

Similar glass type			
OHARA	–	HOYA	–
CDGM	H-LaF51	SCHOTT	–

2022-7-1	StP, AP, SP
2020-4-1	Similar glass type
2019-4-1	Transmittance

J-LAF02

n_d = 1.720000 n_e = 1.723923

ν_d = 43.61 ν_e = 43.33

Glass code (d)
720436
Glass code (e)
724433

Spectral l.	Refractive idx
2.058	1.68740
1.970	1.68868
1.530	1.69475
1.129	1.70067
1.064	1.70184
t	1.70283
s	1.70681
A'	1.709672
r	1.712362
C	1.715094
C'	1.715867
He-Ne	1.716590
D	1.719855
d	1.720000
e	1.723923
F	1.731604
F'	1.732574
g	1.740986
h	1.748991
0.389	1.753979
i	1.763154

Partial dispersion	
F-C	0.016510
F'-C'	0.016707
C-t	0.012269
C-A'	0.005422
d-C	0.004906
e-C	0.008829
g-d	0.020986
g-F	0.009382
h-g	0.008005
i-g	0.022168
C'-t	0.013042
e-C'	0.008056
F'-e	0.008651
i-F'	0.030580

Relative partial dispersion	
C-t／F-C	0.7431
C-A'／F-C	0.3284
d-C／F-C	0.2972
e-C／F-C	0.5348
g-d／F-C	1.2711
g-F／F-C	0.5683
h-g／F-C	0.4849
i-g／F-C	1.3427
C'-t／F'-C'	0.7806
e-C'／F'-C'	0.4822
F'-e／F'-C'	0.5178
i-F'／F'-C'	1.8304

Deviation of relative partial disp.	
ΔPdC	0.0003
ΔPgF	−0.0029

Internal CC (80%/5%)
369/339
Color Code (80%/5%)
385/340

CCI	
B	0.00
G	0.79
R	0.79

Thermal properties	
CTE(−30,70) [1E-7/℃]	68
CTE(100,300) [1E-7/℃]	83
Tg [℃]	577
At [℃]	626
StP [℃]	538
AP [℃]	575
SP [℃]	716
Ht cndct. [W/m·K]	0.838
Sp. heat [kJ/kg·K]	0.560
Ht diffus. [1E-6 m2/sec]	0.386

Chemical properties [class]	
Acid res. (surface)	4
Alkaline detergent res.	2
Climate resistance	1
Water res. (powder)	2
Acid res. (powder)	4

Mechanical properties	
Knoop hardness	534 (5)
Abrasion hardness	184
Young's mod. [GPa]	98.9
Shear mod. [GPa]	38.4
Poisson's ratio	0.287
Stress optical coef. [1E-5 nm/cm／Pa]	2.33

Internal trans. (10mm)	
λ [nm]	τ
280	–
290	–
300	–
310	–
320	–
330	–
340	0.07
350	0.34
360	0.65
370	0.82
380	0.900
390	0.939
400	0.960
420	0.979
440	0.986
460	0.990
480	0.993
500	0.995
550	0.997
600	0.997
650	0.997
700	0.998
800	0.997
900	0.997
1000	0.997
1200	0.998
1400	0.995
1600	0.992
1800	0.984
2000	0.972
2200	0.941
2400	0.86

Specific gravity
3.88

Coef. disp. form. (pwr ser.)	
A0	2.88586901E+00
A1	−1.02242298E-02
A2	−5.73302650E-05
A3	2.43594329E-02
A4	6.71639978E-04
A5	−1.38459487E-05
A6	2.96139784E-06
A7	0.00000000E+00
A8	0.00000000E+00

Relative Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90 (ref.)	4.8	4.8	5.0	5.3	5.5	5.7	5.8	5.8	6.1	6.4	7.1	7.2	8.1	9.0	9.6
60 to 80 (ref.)	4.7	4.7	5.0	5.2	5.4	5.6	5.6	5.7	6.0	6.3	7.0	7.1	7.9	8.8	9.4
40 to 60	4.6	4.6	4.8	5.0	5.2	5.4	5.5	5.5	5.8	6.1	6.8	6.9	7.7	8.5	9.1
20 to 40	4.5	4.5	4.7	4.9	5.1	5.3	5.3	5.4	5.6	5.9	6.6	6.7	7.5	8.3	8.8
0 to 20	4.4	4.4	4.6	4.8	5.0	5.2	5.3	5.3	5.5	5.8	6.4	6.5	7.3	8.1	8.6
−20 to 0	4.4	4.4	4.6	4.8	5.0	5.2	5.2	5.3	5.5	5.8	6.4	6.4	7.2	7.9	8.4
−40 to −20	4.5	4.5	4.7	4.8	5.0	5.2	5.2	5.3	5.5	5.8	6.3	6.4	7.1	7.9	8.3
−60 to −40 (ref.)	4.6	4.6	4.8	5.0	5.2	5.3	5.4	5.4	5.6	5.9	6.4	6.5	7.2	7.9	8.3
−70 to −60 (ref.)	4.8	4.8	5.0	5.2	5.3	5.5	5.5	5.6	5.8	6.1	6.6	6.7	7.3	8.0	8.4

Absolute Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90	3.8	3.8	4.0	4.2	4.4	4.6	4.7	4.8	5.0	5.4	6.1	6.2	7.0	7.9	8.5
60 to 80	3.5	3.6	3.8	4.0	4.2	4.4	4.5	4.5	4.8	5.1	5.8	5.9	6.7	7.6	8.1
40 to 60	3.3	3.3	3.5	3.7	3.9	4.1	4.2	4.2	4.5	4.8	5.4	5.5	6.3	7.2	7.7
20 to 40	3.0	3.0	3.2	3.4	3.6	3.8	3.9	3.9	4.1	4.4	5.1	5.1	5.9	6.7	7.2
0 to 20	2.7	2.8	2.9	3.1	3.3	3.5	3.5	3.6	3.8	4.1	4.7	4.8	5.5	6.3	6.8
−20 to 0	2.4	2.5	2.7	2.8	3.0	3.2	3.2	3.3	3.5	3.8	4.3	4.4	5.1	5.9	6.3
−40 to −20	2.2	2.2	2.4	2.5	2.7	2.9	2.9	3.0	3.2	3.4	4.0	4.1	4.8	5.4	5.9
−60 to −40	1.9	1.9	2.1	2.2	2.4	2.6	2.6	2.7	2.9	3.1	3.6	3.7	4.4	5.0	5.4
−70 to −60	1.7	1.7	1.9	2.0	2.2	2.3	2.4	2.4	2.6	2.8	3.3	3.4	4.1	4.7	5.1

Coef. disp. form. (frac. eq.)(ref.)	
P1	1.05823487E-01
Q1	8.48047843E+01
P2	1.47351472E-02
Q2	4.55784241E-02
P3	3.71185501E-01
Q3	6.60196546E-03

Fitting error of disp. form. σ [1E-6]		
	Visible	Infrared
Power ser. eq.	0.8	5.5
Frac. eq. (ref.)	1.0	5.7

Prod. Freq. (A to D)	D

Similar glass type			
OHARA	–	HOYA	–
CDGM	H-LaF62	SCHOTT	–

2022-7-1	StP, AP, SP
2020-4-1	Similar glass type
2019-4-1	Transmittance

J-LAF04

n_d = 1.757000 n_e = 1.760764

ν_d = 47.86 ν_e = 47.62

Glass code (d)
757479
Glass code (e)
761476

Spectral l.	Refractive idx
2.058	1.72026
1.970	1.72204
1.530	1.73016
1.129	1.73733
1.064	1.73864
t	1.73973
s	1.74396
A'	1.746868
r	1.749551
C	1.752239
C'	1.752994
He-Ne	1.753699
D	1.756860
d	1.757000
e	1.760764
F	1.768055
F'	1.768969
g	1.776843
h	1.784245
0.389	1.788810
i	–

Partial dispersion	
F-C	0.015816
F'-C'	0.015975
C-t	0.012506
C-A'	0.005371
d-C	0.004761
e-C	0.008525
g-d	0.019843
g-F	0.008788
h-g	0.007402
i-g	–
C'-t	0.013261
e-C'	0.007770
F'-e	0.008205
i-F'	–

Relative partial dispersion	
C-t／F-C	0.7907
C-A'／F-C	0.3396
d-C／F-C	0.3010
e-C／F-C	0.5390
g-d／F-C	1.2546
g-F／F-C	0.5556
h-g／F-C	0.4680
i-g／F-C	–
C'-t／F'-C'	0.8301
e-C'／F'-C'	0.4864
F'-e／F'-C'	0.5136
i-F'／F'-C'	–

Deviation of relative partial disp.	
ΔPdC	0.0022
ΔPgF	−0.0084

Internal CC (80%/5%)
364/329
Color Code (80%/5%)
385/330

CCI	
B	0.00
G	0.63
R	0.65

Thermal properties	
CTE(−30,70) [1E-7/℃]	54
CTE(100,300) [1E-7/℃]	68
Tg [℃]	648
At [℃]	675
StP [℃]	–
AP [℃]	–
SP [℃]	–
Ht cndct. [W/m·K]	0.844
Sp. heat [kJ/kg·K]	0.512
Ht diffus. [1E-6 m2/sec]	0.405

Chemical properties [class]	
Acid res. (surface)	4
Alkaline detergent res.	2
Climate resistance	1
Water res. (powder)	1
Acid res. (powder)	4

Mechanical properties	
Knoop hardness	645 (6)
Abrasion hardness	76
Young's mod. [GPa]	114.4
Shear mod. [GPa]	44.2
Poisson's ratio	0.295
Stress optical coef. [1E-5 nm/cm／Pa]	1.93

Internal trans. (10mm)	
λ [nm]	τ
280	–
290	–
300	–
310	–
320	–
330	0.07
340	0.26
350	0.53
360	0.74
370	0.86
380	0.919
390	0.952
400	0.969
420	0.984
440	0.990
460	0.993
480	0.996
500	0.997
550	0.999
600	0.999
650	0.999
700	0.999
800	0.997
900	0.995
1000	0.995
1200	0.996
1400	0.993
1600	0.989
1800	0.978
2000	0.957
2200	0.88
2400	0.64

Specific gravity
4.07

Coef. disp. form. (pwr ser.)	
A0	3.01765567E+00
A1	−1.44029325E-02
A2	−1.73403131E-04
A3	2.41938931E-02
A4	5.02913780E-04
A5	−1.18295424E-07
A6	1.26171561E-06
A7	0.00000000E+00
A8	0.00000000E+00

Relative Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90 (ref.)	4.6	4.7	4.8	5.0	5.2	5.3	5.4	5.4	5.7	5.9	6.5	6.6	7.3	–	–
60 to 80 (ref.)	4.4	4.5	4.7	4.9	5.0	5.2	5.2	5.3	5.5	5.7	6.3	6.4	7.1	–	–
40 to 60	4.3	4.3	4.5	4.7	4.8	5.0	5.0	5.1	5.3	5.5	6.0	6.1	6.8	–	–
20 to 40	4.1	4.2	4.4	4.5	4.7	4.8	4.8	4.9	5.1	5.3	5.8	5.9	6.5	–	–
0 to 20	4.0	4.1	4.3	4.4	4.5	4.7	4.7	4.7	4.9	5.1	5.6	5.7	6.3	–	–
−20 to 0	4.0	4.0	4.2	4.3	4.5	4.6	4.6	4.7	4.8	5.0	5.5	5.5	6.1	–	–
−40 to −20	4.0	4.1	4.2	4.3	4.4	4.6	4.6	4.6	4.8	5.0	5.4	5.5	6.0	–	–
−60 to −40 (ref.)	4.1	4.2	4.3	4.4	4.5	4.7	4.7	4.7	4.9	5.1	5.5	5.5	6.0	–	–
−70 to −60 (ref.)	4.3	4.3	4.5	4.6	4.7	4.8	4.8	4.9	5.0	5.2	5.6	5.6	6.1	–	–

Absolute Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90	3.5	3.6	3.8	3.9	4.1	4.3	4.3	4.3	4.6	4.8	5.4	5.5	6.2	–	–
60 to 80	3.3	3.3	3.5	3.7	3.8	4.0	4.0	4.1	4.3	4.5	5.1	5.2	5.8	–	–
40 to 60	3.0	3.0	3.2	3.3	3.5	3.6	3.7	3.7	3.9	4.2	4.7	4.7	5.4	–	–
20 to 40	2.6	2.7	2.9	3.0	3.1	3.3	3.3	3.4	3.5	3.8	4.3	4.3	4.9	–	–
0 to 20	2.3	2.4	2.5	2.7	2.8	2.9	3.0	3.0	3.2	3.4	3.8	3.9	4.5	–	–
−20 to 0	2.0	2.0	2.2	2.3	2.4	2.6	2.6	2.6	2.8	3.0	3.4	3.5	4.0	–	–
−40 to −20	1.7	1.7	1.9	2.0	2.1	2.2	2.2	2.3	2.4	2.6	3.0	3.1	3.6	–	–
−60 to −40	1.4	1.4	1.5	1.6	1.7	1.8	1.9	1.9	2.0	2.2	2.6	2.6	3.1	–	–
−70 to −60	1.1	1.2	1.3	1.4	1.5	1.6	1.6	1.6	1.8	1.9	2.3	2.3	2.8	–	–

Coef. disp. form. (frac. eq.)(ref.)	
P1	1.15921577E-01
Q1	6.78156111E+01
P2	2.43802201E-02
Q2	3.30454930E-02
P3	3.77727144E-01
Q3	5.55046977E-03

Fitting error of disp. form. σ [1E-6]		
	Visible	Infrared
Power ser. eq.	0.5	4.0
Frac. eq. (ref.)	0.6	5.0

Prod. Freq. (A to D)	D

Similar glass type			
OHARA	S-LAM54	HOYA	–
CDGM	H-LaF6LA	SCHOTT	–

2019-4-1	Transmittance
2018-4-1	Prod. Freq.
2015-4-1	Color Code

HIKARI GLASS CO., LTD.

J-LAF05

n_d = 1.762000 n_e = 1.766511

ν_d = 40.11 ν_e = 39.85

Glass code (d)
762401
Glass code (e)
767399

Spectral l.	Refractive idx
2.058	1.72631
1.970	1.72760
1.530	1.73385
1.129	1.74018
1.064	1.74145
t	1.74254
s	1.74699
A'	1.750213
r	1.753266
C	1.756381
C'	1.757264
He-Ne	1.758092
D	1.761833
d	1.762000
e	1.766511
F	1.775377
F'	1.776499
g	1.786251
h	1.795554
0.389	1.801358
i	1.812041

Coef. disp. form. (pwr ser.)	
A0	3.01897142E+00
A1	-1.06135241E-02
A2	-3.56215294E-05
A3	2.84177137E-02
A4	8.43869366E-04
A5	-1.12827377E-05
A6	3.11337221E-06
A7	0.00000000E+00
A8	0.00000000E+00

Partial dispersion	
F-C	0.018996
F'-C'	0.019235
C-t	0.013839
C-A'	0.006168
d-C	0.005619
e-C	0.010130
g-d	0.024251
g-F	0.010874
h-g	0.009303
i-g	0.025790
C'-t	0.014722
e-C'	0.009247
F'-e	0.009988
i-F'	0.035542

Relative partial dispersion	
C-t／F-C	0.7285
C-A'／F-C	0.3247
d-C／F-C	0.2958
e-C／F-C	0.5333
g-d／F-C	1.2766
g-F／F-C	0.5724
h-g／F-C	0.4897
i-g／F-C	1.3577
C'-t／F'-C'	0.7654
e-C'／F'-C'	0.4807
F'-e／F'-C'	0.5193
i-F'／F'-C'	1.8478

Deviation of relative partial disp.	
ΔPdC	0.0005
ΔPgF	-0.0046

Internal CC (80%/5%)
365/332
Color Code (80%/5%)
390/330

CCI	
B	-
G	-
R	-

Thermal properties	
CTE(-30,70) [1E-7/℃]	63
CTE(100,300) [1E-7/℃]	78
Tg [℃]	606
At [℃]	645
StP [℃]	565
AP [℃]	600
SP [℃]	727
Ht cndct. [W/m･K]	0.960
Sp. heat [kJ/kg･K]	0.577
Ht diffus. [1E-6 m2/sec]	0.422

Chemical properties [class]	
Acid res. (surface)	5
Alkaline detergent res.	2
Climate resistance	1
Water res. (powder)	1
Acid res. (powder)	4

Mechanical properties	
Knoop hardness	406 (4)
Abrasion hardness	109
Young's mod. [GPa]	116.3
Shear mod. [GPa]	47.3
Poisson's ratio	0.228
Stress optical coef. [1E-5 nm/cm／Pa]	2.85

Internal trans. (10mm)	
λ [nm]	τ
280	-
290	-
300	-
310	-
320	-
330	0.02
340	0.25
350	0.55
360	0.74
370	0.85
380	0.907
390	0.939
400	0.958
420	0.974
440	0.981
460	0.985
480	0.989
500	0.991
550	0.993
600	0.994
650	0.993
700	0.992
800	0.989
900	0.995
1000	0.994
1200	0.996
1400	0.995
1600	0.991
1800	0.986
2000	0.978
2200	0.959
2400	0.87

Specific gravity
3.94

Relative Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90 (ref.)	8.0	8.1	8.3	8.6	8.9	9.2	9.3	9.3	9.7	10.2	11.1	11.2	12.3	13.5	14.2
60 to 80 (ref.)	7.8	7.9	8.2	8.4	8.7	9.0	9.1	9.1	9.5	9.9	10.8	11.0	12.1	13.2	13.9
40 to 60	7.6	7.7	7.9	8.2	8.4	8.7	8.8	8.9	9.2	9.6	10.5	10.6	11.7	12.8	13.4
20 to 40	7.4	7.5	7.7	8.0	8.2	8.5	8.6	8.6	9.0	9.4	10.2	10.3	11.4	12.4	13.0
0 to 20	7.3	7.3	7.6	7.8	8.1	8.3	8.4	8.5	8.8	9.2	10.0	10.1	11.1	12.1	12.7
-20 to 0	7.2	7.2	7.5	7.7	7.9	8.2	8.2	8.3	8.6	9.0	9.8	9.9	10.8	11.8	12.4
-40 to -20	7.1	7.2	7.4	7.7	7.9	8.1	8.2	8.3	8.6	8.9	9.7	9.8	10.7	11.6	12.2
-60 to -40 (ref.)	7.2	7.3	7.5	7.7	7.9	8.2	8.2	8.3	8.6	8.9	9.7	9.8	10.6	11.5	12.1
-70 to -60 (ref.)	7.4	7.4	7.6	7.8	8.1	8.3	8.3	8.4	8.7	9.0	9.7	9.8	10.7	11.5	12.1

Absolute Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90	6.9	7.0	7.3	7.5	7.8	8.1	8.2	8.3	8.6	9.1	10.0	10.1	11.2	12.3	13.1
60 to 80	6.6	6.7	7.0	7.2	7.5	7.8	7.9	7.9	8.3	8.7	9.6	9.7	10.8	11.9	12.6
40 to 60	6.3	6.3	6.6	6.9	7.1	7.4	7.5	7.5	7.9	8.3	9.2	9.3	10.3	11.4	12.0
20 to 40	5.9	6.0	6.2	6.5	6.7	7.0	7.0	7.1	7.4	7.8	8.7	8.8	9.8	10.8	11.4
0 to 20	5.5	5.6	5.8	6.1	6.3	6.6	6.6	6.7	7.0	7.4	8.2	8.3	9.3	10.2	10.9
-20 to 0	5.2	5.2	5.5	5.7	5.9	6.2	6.2	6.3	6.6	7.0	7.7	7.8	8.7	9.7	10.3
-40 to -20	4.8	4.9	5.1	5.3	5.5	5.7	5.8	5.9	6.2	6.5	7.2	7.3	8.2	9.1	9.7
-60 to -40	4.4	4.5	4.7	4.9	5.1	5.3	5.4	5.5	5.7	6.1	6.8	6.9	7.7	8.6	9.1
-70 to -60	4.2	4.2	4.4	4.6	4.8	5.0	5.1	5.1	5.4	5.7	6.4	6.5	7.3	8.1	8.7

Coef. disp. form. (frac. eq.)(ref.)	
P1	1.12020693E-01
Q1	9.19206483E+01
P2	2.91343182E-02
Q2	3.83429496E-02
P3	3.73059130E-01
Q3	6.25915395E-03

Fitting error of disp. form. σ [1E-6]		
	Visible	Infrared
Power ser. eq.	0.5	7.2
Frac. eq. (ref.)	1.2	9.0

Prod. Freq. (A to D)	C

Similar glass type			
OHARA	S-LAM55	HOYA	-
CDGM	H-LaF55	SCHOTT	-

2022-7-1	StP, AP, SP
2020-4-1	chemical properties
2019-4-1	Transmittance

HIKARI GLASS CO., LTD.

J-LAF09

n_d = 1.697000 n_e = 1.700423

ν_d = 48.45 ν_e = 48.17

Glass code (d)
697485
Glass code (e)
700482

Spectral l.	Refractive idx
2.058	1.66612
1.970	1.66748
1.530	1.67375
1.129	1.67958
1.064	1.68068
t	1.68161
s	1.68528
A'	1.687864
r	1.690266
C	1.692687
C'	1.693369
He-Ne	1.694007
D	1.696873
d	1.697000
e	1.700423
F	1.707073
F'	1.707909
g	1.715111
h	1.721892
0.389	1.726081
i	–

Partial dispersion	
F-C	0.014386
F'-C'	0.014540
C-t	0.011076
C-A'	0.004823
d-C	0.004313
e-C	0.007736
g-d	0.018111
g-F	0.008038
h-g	0.006781
i-g	–
C'-t	0.011758
e-C'	0.007054
F'-e	0.007486
i-F'	–

Internal CC (80%/5%)
367/337
Color Code (80%/5%)
385/340
CCI

B	–
G	–
R	–

Thermal properties	
CTE(-30,70) [1E-7/℃]	69
CTE(100,300) [1E-7/℃]	83
Tg [℃]	629
At [℃]	678
StP [℃]	–
AP [℃]	–
SP [℃]	–
Ht cndct. [W/m·K]	0.886
Sp. heat [kJ/kg·K]	0.560
Ht diffus. [1E-6 m2/sec]	0.422

Internal trans. (10mm)	
λ [nm]	τ
280	–
290	–
300	–
310	–
320	–
330	–
340	0.11
350	0.43
360	0.69
370	0.84
380	0.910
390	0.944
400	0.962
420	0.977
440	0.980
460	0.984
480	0.988
500	0.990
550	0.993
600	0.992
650	0.991
700	0.992
800	0.991
900	0.993
1000	0.991
1200	0.995
1400	0.993
1600	0.990
1800	0.983
2000	0.974
2200	0.940
2400	0.85

Coef. disp. form. (pwr ser.)	
A0	2.81748246E+00
A1	-1.05788235E-02
A2	-1.00459117E-04
A3	2.14941409E-02
A4	4.33668886E-04
A5	3.15386350E-07
A6	1.19012861E-06
A7	0.00000000E+00
A8	0.00000000E+00

Relative partial dispersion	
C-t／F-C	0.7699
C-A'／F-C	0.3353
d-C／F-C	0.2998
e-C／F-C	0.5377
g-d／F-C	1.2589
g-F／F-C	0.5587
h-g／F-C	0.4714
i-g／F-C	–
C'-t／F'-C'	0.8087
e-C'／F'-C'	0.4851
F'-e／F'-C'	0.5149
i-F'／F'-C'	–

Deviation of relative partial disp.	
ΔPdC	0.0007
ΔPgF	-0.0043

Chemical properties [class]	
Acid res. (surface)	4
Alkaline detergent res.	1
Climate resistance	1
Water res. (powder)	1
Acid res. (powder)	3

Mechanical properties	
Knoop hardness	590 (6)
Abrasion hardness	125
Young's mod. [GPa]	98.4
Shear mod. [GPa]	38.4
Poisson's ratio	0.281
Stress optical coef. [1E-5 nm/cm／Pa]	1.92

Specific gravity
3.74

Relative Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90 (ref.)	2.7	2.7	2.8	3.0	3.2	3.3	3.4	3.4	3.6	3.9	4.5	4.6	5.4	6.4	–
60 to 80 (ref.)	2.5	2.6	2.8	2.9	3.0	3.2	3.2	3.3	3.5	3.7	4.3	4.4	5.2	6.1	–
40 to 60	2.4	2.5	2.6	2.7	2.9	3.0	3.1	3.1	3.3	3.5	4.1	4.1	4.9	5.8	–
20 to 40	2.3	2.4	2.5	2.6	2.7	2.9	2.9	3.0	3.1	3.4	3.9	3.9	4.6	5.5	–
0 to 20	2.2	2.3	2.4	2.5	2.7	2.8	2.8	2.8	3.0	3.2	3.7	3.8	4.4	5.2	–
-20 to 0	2.2	2.3	2.4	2.5	2.6	2.7	2.8	2.8	3.0	3.2	3.6	3.7	4.3	5.0	–
-40 to -20	2.3	2.3	2.4	2.5	2.6	2.8	2.8	2.8	3.0	3.1	3.6	3.6	4.2	4.9	–
-60 to -40 (ref.)	2.4	2.5	2.6	2.7	2.8	2.9	2.9	2.9	3.1	3.2	3.6	3.7	4.2	4.9	–
-70 to -60 (ref.)	2.6	2.7	2.8	2.9	2.9	3.0	3.1	3.1	3.2	3.4	3.7	3.8	4.3	5.0	–

Absolute Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90	1.6	1.7	1.8	2.0	2.1	2.3	2.3	2.4	2.6	2.8	3.4	3.5	4.3	5.3	–
60 to 80	1.4	1.5	1.6	1.8	1.9	2.0	2.1	2.1	2.3	2.6	3.1	3.2	4.0	4.9	–
40 to 60	1.1	1.2	1.3	1.5	1.6	1.7	1.8	1.8	2.0	2.2	2.7	2.8	3.5	4.4	–
20 to 40	0.9	0.9	1.0	1.2	1.3	1.4	1.4	1.5	1.7	1.9	2.4	2.4	3.1	4.0	–
0 to 20	0.6	0.6	0.8	0.9	1.0	1.1	1.1	1.2	1.3	1.5	2.0	2.0	2.7	3.5	–
-20 to 0	0.3	0.3	0.5	0.6	0.7	0.8	0.8	0.8	1.0	1.2	1.6	1.7	2.3	3.0	–
-40 to -20	0.0	0.1	0.2	0.3	0.4	0.5	0.5	0.5	0.7	0.8	1.2	1.3	1.8	2.5	–
-60 to -40	-0.3	-0.2	-0.1	0.0	0.1	0.1	0.2	0.2	0.3	0.5	0.8	0.9	1.4	2.0	–
-70 to -60	-0.5	-0.4	-0.3	-0.3	-0.2	-0.1	-0.1	0.0	0.1	0.2	0.5	0.6	1.1	1.7	–

Coef. disp. form. (frac. eq.)(ref.)	
P1	1.13255310E-01
Q1	8.32858494E+01
P2	1.63055541E-02
Q2	3.79087968E-02
P3	3.60955138E-01
Q3	6.03412046E-03

Fitting error of disp. form. σ [1E-6]		
	Visible	Infrared
Power ser. eq.	0.6	6.7
Frac. eq. (ref.)	0.6	7.6

Prod. Freq. (A to D)	D

Similar glass type			
OHARA	–	HOYA	–
CDGM	–	SCHOTT	–

2020-4-1	Similar glass type
2019-4-1	Transmittance
2018-4-1	Prod. Freq.

J-LAF010

n_d = 1.743200 n_e = 1.746793

ν_d = 49.26 ν_e = 49.02

Glass code (d)
743493
Glass code (e)
747490

Spectral l.	Refractive idx
2.058	1.70838
1.970	1.71005
1.530	1.71766
1.129	1.72442
1.064	1.72567
t	1.72670
s	1.73073
A'	1.733512
r	1.736078
C	1.738649
C'	1.739371
He-Ne	1.740045
D	1.743066
d	1.743200
e	1.746793
F	1.753737
F'	1.754607
g	1.762074
h	1.769060
0.389	1.773349
i	1.781104

Coef. disp. form. (pwr ser.)	
A0	2.97218511E+00
A1	-1.32235298E-02
A2	-1.74821942E-04
A3	2.33639677E-02
A4	3.84261692E-04
A5	9.20777694E-06
A6	3.19655312E-07
A7	0.00000000E+00
A8	0.00000000E+00

Partial dispersion	
F-C	0.015088
F'-C'	0.015236
C-t	0.011947
C-A'	0.005137
d-C	0.004551
e-C	0.008144
g-d	0.018874
g-F	0.008337
h-g	0.006986
i-g	0.019030
C'-t	0.012669
e-C'	0.007422
F'-e	0.007814
i-F'	0.026497

Relative partial dispersion	
C-t／F-C	0.7918
C-A'／F-C	0.3405
d-C／F-C	0.3016
e-C／F-C	0.5398
g-d／F-C	1.2509
g-F／F-C	0.5526
h-g／F-C	0.4630
i-g／F-C	1.2613
C'-t／F'-C'	0.8315
e-C'／F'-C'	0.4871
F'-e／F'-C'	0.5129
i-F'／F'-C'	1.7391

Deviation of relative partial disp.	
ΔPdC	0.0022
ΔPgF	-0.0092

Internal CC (80%/5%)
354/301
Color Code (80%/5%)
375/300
CCI

B	0.00
G	0.50
R	0.48

Thermal properties	
CTE(-30,70) [1E-7/℃]	49
CTE(100,300) [1E-7/℃]	63
Tg [℃]	597
At [℃]	627
StP [℃]	550
AP [℃]	578
SP [℃]	679
Ht cndct. [W/m･K]	0.820
Sp. heat [kJ/kg･K]	0.542
Ht diffus. [1E-6 m2/sec]	0.365

Chemical properties [class]	
Acid res. (surface)	5
Alkaline detergent res.	4
Climate resistance	1
Water res. (powder)	1
Acid res. (powder)	4

Mechanical properties	
Knoop hardness	585 (6)
Abrasion hardness	64
Young's mod. [GPa]	106.8
Shear mod. [GPa]	40.8
Poisson's ratio	0.308
Stress optical coef. [1E-5 nm/cm／Pa]	2.63

Internal trans. (10mm)	
λ [nm]	τ
280	–
290	–
300	0.04
310	0.16
320	0.32
330	0.50
340	0.64
350	0.76
360	0.85
370	0.911
380	0.945
390	0.965
400	0.976
420	0.986
440	0.990
460	0.993
480	0.996
500	0.998
550	0.998
600	0.998
650	0.998
700	0.998
800	0.996
900	0.994
1000	0.996
1200	0.998
1400	0.997
1600	0.992
1800	0.983
2000	0.958
2200	0.89
2400	0.65

Specific gravity
4.15

Relative Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90 (ref.)	7.8	7.9	8.1	8.3	8.5	8.7	8.7	8.8	9.0	9.3	10.0	10.0	10.8	11.5	11.9
60 to 80 (ref.)	7.7	7.7	8.0	8.1	8.3	8.5	8.6	8.6	8.9	9.1	9.8	9.8	10.6	11.2	11.7
40 to 60	7.5	7.5	7.8	7.9	8.1	8.3	8.3	8.4	8.6	8.9	9.5	9.6	10.3	10.9	11.3
20 to 40	7.3	7.4	7.6	7.8	7.9	8.1	8.2	8.2	8.4	8.7	9.3	9.3	10.0	10.6	11.0
0 to 20	7.2	7.3	7.5	7.6	7.8	8.0	8.0	8.1	8.3	8.5	9.1	9.1	9.8	10.4	10.8
-20 to 0	7.2	7.2	7.4	7.5	7.7	7.9	7.9	8.0	8.2	8.4	8.9	9.0	9.6	10.2	10.6
-40 to -20	7.2	7.2	7.4	7.5	7.7	7.9	7.9	7.9	8.1	8.4	8.9	8.9	9.5	10.1	10.4
-60 to -40 (ref.)	7.3	7.3	7.5	7.6	7.8	7.9	8.0	8.0	8.2	8.4	8.9	9.0	9.5	10.1	10.4
-70 to -60 (ref.)	7.4	7.5	7.6	7.8	7.9	8.1	8.1	8.2	8.3	8.6	9.0	9.1	9.6	10.2	10.5

Absolute Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90	6.8	6.8	7.0	7.2	7.4	7.6	7.7	7.7	8.0	8.3	8.9	8.9	9.7	10.4	10.8
60 to 80	6.5	6.6	6.8	7.0	7.1	7.3	7.4	7.4	7.7	8.0	8.6	8.6	9.3	10.0	10.4
40 to 60	6.2	6.2	6.4	6.6	6.8	7.0	7.0	7.1	7.3	7.6	8.1	8.2	8.9	9.5	9.9
20 to 40	5.9	5.9	6.1	6.3	6.4	6.6	6.6	6.7	6.9	7.2	7.7	7.8	8.4	9.1	9.4
0 to 20	5.5	5.6	5.7	5.9	6.1	6.2	6.3	6.3	6.5	6.8	7.3	7.4	8.0	8.6	8.9
-20 to 0	5.2	5.2	5.4	5.6	5.7	5.9	5.9	6.0	6.2	6.4	6.9	7.0	7.6	8.1	8.5
-40 to -20	4.9	4.9	5.1	5.2	5.3	5.5	5.5	5.6	5.8	6.0	6.5	6.5	7.1	7.7	8.0
-60 to -40	4.5	4.6	4.7	4.8	5.0	5.1	5.2	5.2	5.4	5.6	6.1	6.1	6.7	7.2	7.5
-70 to -60	4.3	4.3	4.4	4.6	4.7	4.9	4.9	4.9	5.1	5.3	5.8	5.8	6.3	6.8	7.1

Coef. disp. form. (frac. eq.)(ref.)	
P1	1.13189864E-01
Q1	7.01648764E+01
P2	3.86205423E-02
Q2	2.54497766E-02
P3	3.58049310E-01
Q3	5.15734963E-03

Fitting error of disp. form. σ [1E-6]		
	Visible	Infrared
Power ser. eq.	0.4	5.1
Frac. eq. (ref.)	0.5	5.3

Prod. Freq. (A to D)	C

Similar glass type			
OHARA	S-LAM60	HOYA	NBF1
CDGM	H-LaF53	SCHOTT	N-LAF35

2022-7-1	StP, AP, SP
2019-4-1	Transmittance
2018-4-1	Prod. Freq.

HIKARI GLASS CO., LTD.

J-LAF016

n_d = 1.801000 n_e = 1.806432

ν_d = 34.92 ν_e = 34.68

Glass code (d)
801349
Glass code (e)
806347

Spectral l.	Refractive idx
2.058	1.75702
1.970	1.75875
1.530	1.76688
1.129	1.77479
1.064	1.77635
t	1.77767
s	1.78303
A'	1.786896
r	1.790544
C	1.794267
C'	1.795323
He-Ne	1.796314
D	1.800800
d	1.801000
e	1.806432
F	1.817203
F'	1.818577
g	1.830628
h	1.842343
0.389	1.849780
i	–

Partial dispersion	
F-C	0.022936
F'-C'	0.023254
C-t	0.016596
C-A'	0.007371
d-C	0.006733
e-C	0.012165
g-d	0.029628
g-F	0.013425
h-g	0.011715
i-g	–
C'-t	0.017652
e-C'	0.011109
F'-e	0.012145
i-F'	–

Relative partial dispersion	
C-t／F-C	0.7236
C-A'／F-C	0.3214
d-C／F-C	0.2936
e-C／F-C	0.5304
g-d／F-C	1.2918
g-F／F-C	0.5853
h-g／F-C	0.5108
i-g／F-C	–
C'-t／F'-C'	0.7591
e-C'／F'-C'	0.4777
F'-e／F'-C'	0.5223
i-F'／F'-C'	–

Deviation of relative partial disp.	
ΔPdC	0.0006
ΔPgF	−0.0004

Internal CC (80%/5%)
387/350
Color Code (80%/5%)
435/350
CCI

B	0.00
G	2.52
R	2.64

Thermal properties	
CTE(−30,70) [1E-7/℃]	62
CTE(100,300) [1E-7/℃]	75
Tg [℃]	632
At [℃]	671
StP [℃]	588
AP [℃]	620
SP [℃]	733
Ht cndct. [W/m·K]	1.010
Sp. heat [kJ/kg·K]	0.603
Ht diffus. [1E-6 m2/sec]	0.462

Chemical properties [class]	
Acid res. (surface)	1
Alkaline detergent res.	1
Climate resistance	1
Water res. (powder)	2
Acid res. (powder)	3

Mechanical properties	
Knoop hardness	649 (6)
Abrasion hardness	93
Young's mod. [GPa]	112.5
Shear mod. [GPa]	43.7
Poisson's ratio	0.288
Stress optical coef. [1E-5 nm/cm／Pa]	2.47

Internal trans. (10mm)	
λ [nm]	τ
280	–
290	–
300	–
310	–
320	–
330	–
340	–
350	0.04
360	0.25
370	0.53
380	0.73
390	0.83
400	0.88
420	0.932
440	0.956
460	0.969
480	0.979
500	0.985
550	0.995
600	0.996
650	0.997
700	0.998
800	0.998
900	0.997
1000	0.998
1200	0.999
1400	0.999
1600	0.994
1800	0.987
2000	0.972
2200	0.924
2400	0.77

Specific gravity
3.63

Coef. disp. form. (pwr ser.)	
A0	3.13977744E+00
A1	−1.36971027E-02
A2	−1.62026634E-04
A3	3.48771551E-02
A4	5.87991861E-04
A5	1.35087453E-04
A6	−1.23042975E-05
A7	9.55959268E-07
A8	0.00000000E+00

Relative Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90 (ref.)	5.1	5.2	5.5	5.8	6.0	6.3	6.4	6.5	6.8	7.3	8.2	8.4	9.6	11.0	12.0
60 to 80 (ref.)	4.9	5.0	5.3	5.6	5.8	6.1	6.2	6.2	6.6	7.0	8.0	8.1	9.3	10.7	11.6
40 to 60	4.6	4.7	5.1	5.3	5.5	5.8	5.9	5.9	6.3	6.7	7.6	7.7	8.9	10.2	11.1
20 to 40	4.4	4.5	4.8	5.1	5.3	5.5	5.6	5.7	6.0	6.4	7.3	7.4	8.5	9.8	10.7
0 to 20	4.3	4.4	4.6	4.9	5.1	5.3	5.4	5.4	5.8	6.1	7.0	7.1	8.2	9.4	10.2
−20 to 0	4.2	4.2	4.5	4.7	4.9	5.2	5.2	5.3	5.6	5.9	6.7	6.8	7.9	9.0	9.9
−40 to −20	4.1	4.2	4.5	4.7	4.9	5.1	5.1	5.2	5.5	5.8	6.6	6.7	7.7	8.8	9.6
−60 to −40 (ref.)	4.2	4.2	4.5	4.7	4.9	5.1	5.1	5.2	5.5	5.8	6.5	6.6	7.6	8.6	9.4
−70 to −60 (ref.)	4.3	4.4	4.6	4.8	5.0	5.2	5.2	5.3	5.6	5.9	6.6	6.7	7.6	8.6	9.4

Absolute Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90	4.0	4.1	4.4	4.7	4.9	5.2	5.3	5.3	5.7	6.1	7.1	7.2	8.5	9.9	10.9
60 to 80	3.7	3.8	4.1	4.4	4.6	4.9	4.9	5.0	5.4	5.8	6.7	6.8	8.0	9.4	10.4
40 to 60	3.3	3.4	3.7	3.9	4.2	4.4	4.5	4.6	4.9	5.3	6.2	6.3	7.5	8.8	9.7
20 to 40	2.9	3.0	3.3	3.5	3.7	4.0	4.0	4.1	4.4	4.8	5.7	5.8	6.9	8.1	9.0
0 to 20	2.5	2.6	2.9	3.1	3.3	3.5	3.6	3.7	4.0	4.3	5.1	5.2	6.3	7.5	8.4
−20 to 0	2.1	2.2	2.5	2.7	2.9	3.1	3.1	3.2	3.5	3.8	4.6	4.7	5.7	6.9	7.7
−40 to −20	1.7	1.8	2.0	2.2	2.4	2.6	2.7	2.8	3.0	3.4	4.1	4.2	5.1	6.2	7.0
−60 to −40	1.3	1.4	1.6	1.8	2.0	2.2	2.3	2.3	2.6	2.9	3.6	3.7	4.6	5.6	6.4
−70 to −60	1.0	1.1	1.3	1.5	1.7	1.9	1.9	2.0	2.2	2.5	3.2	3.3	4.1	5.1	5.9

Coef. disp. form. (frac. eq.)(ref.)	
P1	1.24953414E-01
Q1	7.94266552E+01
P2	2.27890133E-02
Q2	5.07623993E-02
P3	3.93600073E-01
Q3	6.96293926E-03

Fitting error of disp. form. σ [1E-6]		
	Visible	Infrared
Power ser. eq.	0.6	1.9
Frac. eq. (ref.)	1.1	2.2

Prod. Freq. (A to D)	B

Similar glass type			
OHARA	S-LAM66	HOYA	–
CDGM	H-ZLaF66	SCHOTT	N-LASF45

2022-7-1	StP, AP, SP
2019-4-1	Transmittance
2015-4-1	Color Code

HIKARI GLASS CO., LTD.

J-LAF016HS

n_d = 1.801000 n_e = 1.806432

ν_d = 34.92 ν_e = 34.68

Glass code (d)
801349
Glass code (e)
806347

Spectral l.	Refractive idx
2.058	1.75702
1.970	1.75875
1.530	1.76688
1.129	1.77479
1.064	1.77635
t	1.77767
s	1.78303
A'	1.786896
r	1.790544
C	1.794267
C'	1.795323
He-Ne	1.796314
D	1.800800
d	1.801000
e	1.806432
F	1.817203
F'	1.818577
g	1.830628
h	1.842343
0.389	1.849780
i	–

Partial dispersion	
F-C	0.022936
F'-C'	0.023254
C-t	0.016596
C-A'	0.007371
d-C	0.006733
e-C	0.012165
g-d	0.029628
g-F	0.013425
h-g	0.011715
i-g	–
C'-t	0.017652
e-C'	0.011109
F'-e	0.012145
i-F'	–

Relative partial dispersion	
C-t／F-C	0.7236
C-A'／F-C	0.3214
d-C／F-C	0.2936
e-C／F-C	0.5304
g-d／F-C	1.2918
g-F／F-C	0.5853
h-g／F-C	0.5108
i-g／F-C	–
C'-t／F'-C'	0.7591
e-C'／F'-C'	0.4777
F'-e／F'-C'	0.5223
i-F'／F'-C'	–

Deviation of relative partial disp.	
ΔPdC	0.0006
ΔPgF	−0.0004

Internal CC (80%/5%)
380/350
Color Code (80%/5%)
420/350

CCI	
B	0.00
G	1.72
R	1.78

Thermal properties	
CTE(−30,70) [1E-7/℃]	62
CTE(100,300) [1E-7/℃]	75
Tg [℃]	632
At [℃]	671
StP [℃]	588
AP [℃]	620
SP [℃]	733
Ht cndct. [W/m·K]	1.010
Sp. heat [kJ/kg·K]	0.603
Ht diffus. [1E-6 m2/sec]	0.462

Chemical properties [class]	
Acid res. (surface)	1
Alkaline detergent res.	1
Climate resistance	1
Water res. (powder)	2
Acid res. (powder)	3

Mechanical properties	
Knoop hardness	649 (6)
Abrasion hardness	93
Young's mod. [GPa]	112.5
Shear mod. [GPa]	43.7
Poisson's ratio	0.288
Stress optical coef. [1E-5 nm/cm／Pa]	2.47

Internal trans. (10mm)	
λ [nm]	τ
280	–
290	–
300	–
310	–
320	–
330	–
340	–
350	0.05
360	0.31
370	0.63
380	0.80
390	0.88
400	0.917
420	0.953
440	0.970
460	0.979
480	0.985
500	0.990
550	0.996
600	0.997
650	0.997
700	0.998
800	0.998
900	0.999
1000	0.998
1200	0.996
1400	0.992
1600	0.990
1800	0.989
2000	0.971
2200	0.915
2400	0.76

Specific gravity
3.63

Coef. disp. form. (pwr ser.)	
A0	3.13977744E+00
A1	−1.36971027E-02
A2	−1.62026634E-04
A3	3.48771551E-02
A4	5.87991861E-04
A5	1.35087453E-04
A6	−1.23042975E-05
A7	9.55959268E-07
A8	0.00000000E+00

Relative Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90 (ref.)	5.1	5.2	5.5	5.8	6.0	6.3	6.4	6.5	6.8	7.3	8.2	8.4	9.6	11.0	12.0
60 to 80 (ref.)	4.9	5.0	5.3	5.6	5.8	6.1	6.2	6.2	6.6	7.0	8.0	8.1	9.3	10.7	11.6
40 to 60	4.6	4.7	5.1	5.3	5.5	5.8	5.9	5.9	6.3	6.7	7.6	7.7	8.9	10.2	11.1
20 to 40	4.4	4.5	4.8	5.1	5.3	5.5	5.6	5.7	6.0	6.4	7.3	7.4	8.5	9.8	10.7
0 to 20	4.3	4.4	4.6	4.9	5.1	5.3	5.4	5.4	5.8	6.1	7.0	7.1	8.2	9.4	10.2
−20 to 0	4.2	4.2	4.5	4.7	4.9	5.2	5.2	5.3	5.6	5.9	6.7	6.8	7.9	9.0	9.9
−40 to −20	4.1	4.2	4.5	4.7	4.9	5.1	5.1	5.2	5.5	5.8	6.6	6.7	7.7	8.8	9.6
−60 to −40 (ref.)	4.2	4.2	4.5	4.7	4.9	5.1	5.1	5.2	5.5	5.8	6.5	6.6	7.6	8.6	9.4
−70 to −60 (ref.)	4.3	4.4	4.6	4.8	5.0	5.2	5.2	5.3	5.6	5.9	6.6	6.7	7.6	8.6	9.4

Absolute Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90	4.0	4.1	4.4	4.7	4.9	5.2	5.3	5.3	5.7	6.1	7.1	7.2	8.5	9.9	10.9
60 to 80	3.7	3.8	4.1	4.4	4.6	4.9	4.9	5.0	5.4	5.8	6.7	6.8	8.0	9.4	10.4
40 to 60	3.3	3.4	3.7	3.9	4.2	4.4	4.5	4.6	4.9	5.3	6.2	6.3	7.5	8.8	9.7
20 to 40	2.9	3.0	3.3	3.5	3.7	4.0	4.0	4.1	4.4	4.8	5.7	5.8	6.9	8.1	9.0
0 to 20	2.5	2.6	2.9	3.1	3.3	3.5	3.6	3.7	4.0	4.3	5.1	5.2	6.3	7.5	8.4
−20 to 0	2.1	2.2	2.5	2.7	2.9	3.1	3.1	3.2	3.5	3.8	4.6	4.7	5.7	6.9	7.7
−40 to −20	1.7	1.8	2.0	2.2	2.4	2.6	2.7	2.8	3.0	3.4	4.1	4.2	5.1	6.2	7.0
−60 to −40	1.3	1.4	1.6	1.8	2.0	2.2	2.3	2.3	2.6	2.9	3.6	3.7	4.6	5.6	6.4
−70 to −60	1.0	1.1	1.3	1.5	1.7	1.9	1.9	2.0	2.2	2.5	3.2	3.3	4.1	5.1	5.9

Coef. disp. form. (frac. eq.)(ref.)	
P1	1.24953414E-01
Q1	7.94266552E+01
P2	2.27890133E-02
Q2	5.07623993E-02
P3	3.93600073E-01
Q3	6.96293926E-03

Fitting error of disp. form. σ [1E-6]		
	Visible	Infrared
Power ser. eq.	0.6	1.9
Frac. eq. (ref.)	1.1	2.2

Prod. Freq. (A to D)	B

Similar glass type			
OHARA	S-LAM66	HOYA	–
CDGM	H-ZLaF66	SCHOTT	N-LASF45

2022-7-1	StP, AP, SP
2019-4-1	Transmittance
2017-4-1	1st edition

HIKARI GLASS CO., LTD.

J-LAFH3

n_d = 1.795040 n_e = 1.801577

ν_d = 28.69 ν_e = 28.46

Glass code (d)
795287
Glass code (e)
802285

Spectral l.	Refractive idx
2.058	1.74752
1.970	1.74911
1.530	1.75684
1.129	1.76493
1.064	1.76660
t	1.76804
s	1.77401
A'	1.778428
r	1.782664
C	1.787036
C'	1.788284
He-Ne	1.789457
D	1.794800
d	1.795040
e	1.801577
F	1.814745
F'	1.816445
g	1.831551
h	1.846613
0.389	1.856401
i	–

Partial dispersion	
F-C	0.027709
F'-C'	0.028161
C-t	0.018999
C-A'	0.008608
d-C	0.008004
e-C	0.014541
g-d	0.036511
g-F	0.016806
h-g	0.015062
i-g	–
C'-t	0.020247
e-C'	0.013293
F'-e	0.014868
i-F'	–

Relative partial dispersion	
C-t／F-C	0.6857
C-A'／F-C	0.3107
d-C／F-C	0.2889
e-C／F-C	0.5248
g-d／F-C	1.3177
g-F／F-C	0.6065
h-g／F-C	0.5436
i-g／F-C	–
C'-t／F'-C'	0.7190
e-C'／F'-C'	0.4720
F'-e／F'-C'	0.5280
i-F'／F'-C'	–

Deviation of relative partial disp.	
ΔPdC	−0.0013
ΔPgF	0.0103

Internal CC (80%/5%)
404/365
Color Code (80%/5%)
445/365

CCI	
B	0.00
G	4.28
R	4.39

Thermal properties	
CTE(−30,70) [1E-7/℃]	68
CTE(100,300) [1E-7/℃]	85
Tg [℃]	629
At [℃]	680
StP [℃]	588
AP [℃]	624
SP [℃]	758
Ht cndct. [W/m·K]	1.030
Sp. heat [kJ/kg·K]	0.615
Ht diffus. [1E-6 m2/sec]	0.463

Chemical properties [class]	
Acid res. (surface)	1
Alkaline detergent res.	1
Climate resistance	1
Water res. (powder)	1
Acid res. (powder)	2

Mechanical properties	
Knoop hardness	555 (6)
Abrasion hardness	149
Young's mod. [GPa]	98.5
Shear mod. [GPa]	38.8
Poisson's ratio	0.268
Stress optical coef. [1E-5 nm/cm／Pa]	2.91

Internal trans. (10mm)	
λ [nm]	τ
280	–
290	–
300	–
310	–
320	–
330	–
340	–
350	–
360	0.01
370	0.12
380	0.36
390	0.60
400	0.76
420	0.900
440	0.942
460	0.962
480	0.973
500	0.981
550	0.992
600	0.994
650	0.993
700	0.995
800	0.996
900	0.998
1000	0.998
1200	0.999
1400	0.997
1600	0.991
1800	0.984
2000	0.977
2200	0.938
2400	0.89

Specific gravity
3.61

Coef. disp. form. (pwr ser.)	
A0	3.10158920E+00
A1	−1.33474980E-02
A2	0.00000000E+00
A3	3.64605893E-02
A4	3.26400857E-03
A5	−6.24213023E-04
A6	1.40210775E-04
A7	−1.42247779E-05
A8	6.58468818E-07

Relative Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90 (ref.)	2.8	2.9	3.2	3.5	3.8	4.2	4.3	4.4	4.8	5.4	6.7	6.9	8.6	–	–
60 to 80 (ref.)	2.7	2.7	3.1	3.4	3.6	4.0	4.1	4.2	4.6	5.2	6.4	6.6	8.3	–	–
40 to 60	2.5	2.6	2.9	3.1	3.4	3.7	3.8	3.9	4.3	4.9	6.1	6.3	7.8	–	–
20 to 40	2.3	2.4	2.7	3.0	3.2	3.5	3.6	3.7	4.1	4.6	5.8	5.9	7.4	–	–
0 to 20	2.2	2.3	2.6	2.8	3.1	3.4	3.5	3.5	3.9	4.4	5.5	5.7	7.1	–	–
−20 to 0	2.2	2.3	2.5	2.8	3.0	3.3	3.3	3.4	3.8	4.3	5.3	5.4	6.8	–	–
−40 to −20	2.2	2.3	2.5	2.7	3.0	3.2	3.3	3.4	3.7	4.2	5.1	5.3	6.5	–	–
−60 to −40 (ref.)	2.3	2.4	2.6	2.8	3.1	3.3	3.4	3.4	3.8	4.2	5.1	5.2	6.4	–	–
−70 to −60 (ref.)	2.5	2.6	2.8	3.0	3.2	3.4	3.5	3.6	3.9	4.3	5.2	5.3	6.4	–	–

Absolute Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90	1.7	1.8	2.1	2.4	2.7	3.1	3.1	3.2	3.7	4.3	5.6	5.8	7.5	–	–
60 to 80	1.5	1.6	1.9	2.2	2.4	2.8	2.9	2.9	3.4	3.9	5.2	5.4	7.0	–	–
40 to 60	1.1	1.2	1.5	1.8	2.1	2.4	2.5	2.5	3.0	3.5	4.7	4.9	6.4	–	–
20 to 40	0.8	0.9	1.2	1.4	1.7	2.0	2.1	2.1	2.6	3.1	4.2	4.3	5.8	–	–
0 to 20	0.5	0.6	0.8	1.1	1.3	1.6	1.7	1.7	2.1	2.6	3.7	3.8	5.2	–	–
−20 to 0	0.2	0.2	0.5	0.7	0.9	1.2	1.3	1.3	1.7	2.2	3.2	3.3	4.6	–	–
−40 to −20	−0.2	−0.1	0.1	0.3	0.6	0.8	0.9	1.0	1.3	1.7	2.7	2.8	4.0	–	–
−60 to −40	−0.5	−0.4	−0.2	0.0	0.2	0.4	0.5	0.6	0.9	1.3	2.2	2.3	3.4	–	–
−70 to −60	−0.7	−0.7	−0.5	−0.3	−0.1	0.1	0.2	0.3	0.6	0.9	1.8	1.9	3.0	–	–

Coef. disp. form. (frac. eq.)(ref.)	
P1	1.06417888E-01
Q1	7.52701722E+01
P2	2.36574681E-02
Q2	6.01210432E-02
P3	3.87982841E-01
Q3	8.15560229E-03

Fitting error of disp. form. σ [1E-6]		
	Visible	Infrared
Power ser. eq.	1.0	7.7
Frac. eq. (ref.)	1.8	10.6

Prod. Freq. (A to D)	B

Similar glass type			
OHARA	–	HOYA	–
CDGM	–	SCHOTT	–

2022-7-1	StP, AP, SP
2019-4-1	Transmittance
2018-4-1	Prod. Freq.

J-LAFH3HS

n_d = 1.795040 n_e = 1.801577

ν_d = 28.69 ν_e = 28.46

Glass code (d)
795287
Glass code (e)
802285

Spectral l.	Refractive idx
2.058	1.74752
1.970	1.74911
1.530	1.75684
1.129	1.76493
1.064	1.76660
t	1.76804
s	1.77401
A'	1.778428
r	1.782664
C	1.787036
C'	1.788284
He-Ne	1.789457
D	1.794800
d	1.795040
e	1.801577
F	1.814745
F'	1.816445
g	1.831551
h	1.846613
0.389	1.856401
i	–

Partial dispersion	
F-C	0.027709
F'-C'	0.028161
C-t	0.018999
C-A'	0.008608
d-C	0.008004
e-C	0.014541
g-d	0.036511
g-F	0.016806
h-g	0.015062
i-g	–
C'-t	0.020247
e-C'	0.013293
F'-e	0.014868
i-F'	–

Relative partial dispersion	
C-t／F-C	0.6857
C-A'／F-C	0.3107
d-C／F-C	0.2889
e-C／F-C	0.5248
g-d／F-C	1.3177
g-F／F-C	0.6065
h-g／F-C	0.5436
i-g／F-C	–
C'-t／F'-C'	0.7190
e-C'／F'-C'	0.4720
F'-e／F'-C'	0.5280
i-F'／F'-C'	–

Deviation of relative partial disp.	
ΔPdC	−0.0013
ΔPgF	0.0103

Internal CC (80%/5%)
392/363
Color Code (80%/5%)
430/365

CCI	
B	0.00
G	2.54
R	2.71

Thermal properties	
CTE(−30,70) [1E-7/℃]	68
CTE(100,300) [1E-7/℃]	85
Tg [℃]	629
At [℃]	680
StP [℃]	588
AP [℃]	624
SP [℃]	758
Ht cndct. [W/m·K]	1.030
Sp. heat [kJ/kg·K]	0.615
Ht diffus. [1E-6 m2/sec]	0.463

Chemical properties [class]	
Acid res. (surface)	1
Alkaline detergent res.	1
Climate resistance	1
Water res. (powder)	1
Acid res. (powder)	2

Mechanical properties	
Knoop hardness	555 (6)
Abrasion hardness	149
Young's mod. [GPa]	98.5
Shear mod. [GPa]	38.8
Poisson's ratio	0.268
Stress optical coef. [1E-5 nm/cm／Pa]	2.91

Internal trans. (10mm)	
λ [nm]	τ
280	–
290	–
300	–
310	–
320	–
330	–
340	–
350	–
360	0.02
370	0.24
380	0.58
390	0.79
400	0.88
420	0.938
440	0.960
460	0.971
480	0.979
500	0.984
550	0.992
600	0.995
650	0.996
700	0.997
800	0.998
900	0.999
1000	0.999
1200	0.999
1400	0.993
1600	0.992
1800	0.990
2000	0.977
2200	0.930
2400	0.87

Specific gravity
3.61

Coef. disp. form. (pwr ser.)	
A0	3.10158920E+00
A1	−1.33474980E-02
A2	0.00000000E+00
A3	3.64605893E-02
A4	3.26400857E-03
A5	−6.24213023E-04
A6	1.40210775E-04
A7	−1.42247779E-05
A8	6.58468818E-07

Relative Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90 (ref.)	2.8	2.9	3.2	3.5	3.8	4.2	4.3	4.4	4.8	5.4	6.7	6.9	8.6	–	–
60 to 80 (ref.)	2.7	2.7	3.1	3.4	3.6	4.0	4.1	4.2	4.6	5.2	6.4	6.6	8.3	–	–
40 to 60	2.5	2.6	2.9	3.1	3.4	3.7	3.8	3.9	4.3	4.9	6.1	6.3	7.8	–	–
20 to 40	2.3	2.4	2.7	3.0	3.2	3.5	3.6	3.7	4.1	4.6	5.8	5.9	7.4	–	–
0 to 20	2.2	2.3	2.6	2.8	3.1	3.4	3.5	3.5	3.9	4.4	5.5	5.7	7.1	–	–
−20 to 0	2.2	2.3	2.5	2.8	3.0	3.3	3.3	3.4	3.8	4.3	5.3	5.4	6.8	–	–
−40 to −20	2.2	2.3	2.5	2.7	3.0	3.2	3.3	3.4	3.7	4.2	5.1	5.3	6.5	–	–
−60 to −40 (ref.)	2.3	2.4	2.6	2.8	3.1	3.3	3.4	3.4	3.8	4.2	5.1	5.2	6.4	–	–
−70 to −60 (ref.)	2.5	2.6	2.8	3.0	3.2	3.4	3.5	3.6	3.9	4.3	5.2	5.3	6.4	–	–

Absolute Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90	1.7	1.8	2.1	2.4	2.7	3.1	3.1	3.2	3.7	4.3	5.6	5.8	7.5	–	–
60 to 80	1.5	1.6	1.9	2.2	2.4	2.8	2.9	2.9	3.4	3.9	5.2	5.4	7.0	–	–
40 to 60	1.1	1.2	1.5	1.8	2.1	2.4	2.5	2.5	3.0	3.5	4.7	4.9	6.4	–	–
20 to 40	0.8	0.9	1.2	1.4	1.7	2.0	2.1	2.1	2.6	3.1	4.2	4.3	5.8	–	–
0 to 20	0.5	0.6	0.8	1.1	1.3	1.6	1.7	1.7	2.1	2.6	3.7	3.8	5.2	–	–
−20 to 0	0.2	0.2	0.5	0.7	0.9	1.2	1.3	1.3	1.7	2.2	3.2	3.3	4.6	–	–
−40 to −20	−0.2	−0.1	0.1	0.3	0.6	0.8	0.9	1.0	1.3	1.7	2.7	2.8	4.0	–	–
−60 to −40	−0.5	−0.4	−0.2	0.0	0.2	0.4	0.5	0.6	0.9	1.3	2.2	2.3	3.4	–	–
−70 to −60	−0.7	−0.7	−0.5	−0.3	−0.1	0.1	0.2	0.3	0.6	0.9	1.8	1.9	3.0	–	–

Coef. disp. form. (frac. eq.)(ref.)	
P1	1.06417888E-01
Q1	7.52701722E+01
P2	2.36574681E-02
Q2	6.01210432E-02
P3	3.87982841E-01
Q3	8.15560229E-03

Fitting error of disp. form. σ [1E-6]		
	Visible	Infrared
Power ser. eq.	1.0	7.7
Frac. eq. (ref.)	1.8	10.6

Prod. Freq. (A to D)	B

Similar glass type			
OHARA	–	HOYA	–
CDGM	–	SCHOTT	–

2022-7-1	StP, AP, SP
2019-4-1	Transmittance
2018-4-1	Prod. Freq.

J-LASF01

n_d = 1.785900 n_e = 1.790131

ν_d = 44.17 ν_e = 43.92

Glass code (d)
786442
Glass code (e)
790439

Spectral l.	Refractive idx
2.058	1.74786
1.970	1.74953
1.530	1.75730
1.129	1.76447
1.064	1.76583
t	1.76697
s	1.77148
A'	1.774649
r	1.777602
C	1.780582
C'	1.781422
He-Ne	1.782208
D	1.785743
d	1.785900
e	1.790131
F	1.798375
F'	1.799413
g	1.808383
h	1.816867
0.389	1.822124
i	1.831728

Coef. disp. form. (pwr ser.)	
A0	3.10918831E+00
A1	-1.37763126E-02
A2	-1.30545613E-04
A3	2.74334291E-02
A4	6.51189638E-04
A5	-1.58159803E-06
A6	1.87919051E-06
A7	0.00000000E+00
A8	0.00000000E+00

Partial dispersion	
F-C	0.017793
F'-C'	0.017991
C-t	0.013612
C-A'	0.005933
d-C	0.005318
e-C	0.009549
g-d	0.022483
g-F	0.010008
h-g	0.008484
i-g	0.023345
C'-t	0.014452
e-C'	0.008709
F'-e	0.009282
i-F'	0.032315

Relative partial dispersion	
C-t／F-C	0.7650
C-A'／F-C	0.3334
d-C／F-C	0.2989
e-C／F-C	0.5367
g-d／F-C	1.2636
g-F／F-C	0.5625
h-g／F-C	0.4768
i-g／F-C	1.3120
C'-t／F'-C'	0.8033
e-C'／F'-C'	0.4841
F'-e／F'-C'	0.5159
i-F'／F'-C'	1.7962

Deviation of relative partial disp.	
ΔPdC	0.0017
ΔPgF	-0.0078

Internal CC (80%/5%)
364/318
Color Code (80%/5%)
395/320

CCI	
B	0.00
G	0.84
R	0.82

Thermal properties	
CTE(-30,70) [1E-7/℃]	59
CTE(100,300) [1E-7/℃]	76
Tg [℃]	617
At [℃]	648
StP [℃]	570
AP [℃]	599
SP [℃]	701
Ht cndct. [W/m･K]	0.888
Sp. heat [kJ/kg･K]	0.539
Ht diffus. [1E-6 m2/sec]	0.388

Chemical properties [class]	
Acid res. (surface)	4
Alkaline detergent res.	3
Climate resistance	1
Water res. (powder)	1
Acid res. (powder)	4

Mechanical properties	
Knoop hardness	621 (6)
Abrasion hardness	76
Young's mod. [GPa]	111.5
Shear mod. [GPa]	42.9
Poisson's ratio	0.300
Stress optical coef. [1E-5 nm/cm／Pa]	2.11

Internal trans. (10mm)	
λ [nm]	τ
280	–
290	–
300	–
310	–
320	0.08
330	0.25
340	0.46
350	0.63
360	0.76
370	0.85
380	0.907
390	0.941
400	0.960
420	0.978
440	0.985
460	0.990
480	0.993
500	0.996
550	0.999
600	0.998
650	0.998
700	0.998
800	0.998
900	0.998
1000	0.998
1200	0.999
1400	0.999
1600	0.994
1800	0.987
2000	0.966
2200	0.914
2400	0.71

Specific gravity
4.25

Relative Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90 (ref.)	5.0	5.1	5.3	5.5	5.7	5.9	5.9	6.0	6.2	6.5	7.2	7.3	8.1	8.9	9.3
60 to 80 (ref.)	4.8	4.9	5.2	5.3	5.5	5.7	5.7	5.8	6.0	6.3	7.0	7.1	7.9	8.7	9.1
40 to 60	4.6	4.7	4.9	5.1	5.3	5.4	5.5	5.5	5.8	6.1	6.7	6.8	7.6	8.3	8.8
20 to 40	4.4	4.5	4.8	4.9	5.1	5.2	5.3	5.3	5.6	5.9	6.5	6.6	7.4	8.1	8.5
0 to 20	4.3	4.4	4.6	4.8	4.9	5.1	5.1	5.2	5.4	5.7	6.3	6.4	7.1	7.8	8.2
-20 to 0	4.2	4.3	4.5	4.7	4.8	5.0	5.0	5.0	5.3	5.5	6.2	6.2	7.0	7.7	8.0
-40 to -20	4.2	4.2	4.5	4.6	4.8	4.9	5.0	5.0	5.2	5.5	6.1	6.2	6.9	7.6	7.9
-60 to -40 (ref.)	4.2	4.3	4.6	4.7	4.8	5.0	5.0	5.1	5.3	5.5	6.1	6.2	6.9	7.6	7.9
-70 to -60 (ref.)	4.4	4.5	4.7	4.8	5.0	5.1	5.2	5.2	5.4	5.7	6.2	6.3	7.0	7.6	8.0

Absolute Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90	3.9	4.0	4.3	4.4	4.6	4.8	4.8	4.9	5.1	5.4	6.1	6.2	7.0	7.7	8.2
60 to 80	3.6	3.7	4.0	4.1	4.3	4.5	4.5	4.6	4.8	5.1	5.8	5.9	6.7	7.4	7.8
40 to 60	3.3	3.4	3.6	3.8	3.9	4.1	4.1	4.2	4.4	4.7	5.3	5.4	6.2	6.9	7.3
20 to 40	2.9	3.0	3.2	3.4	3.5	3.7	3.7	3.8	4.0	4.3	4.9	5.0	5.8	6.5	6.9
0 to 20	2.5	2.6	2.8	3.0	3.1	3.3	3.3	3.4	3.6	3.9	4.5	4.6	5.3	6.0	6.4
-20 to 0	2.2	2.2	2.5	2.6	2.8	2.9	2.9	3.0	3.2	3.5	4.1	4.1	4.9	5.5	5.9
-40 to -20	1.8	1.9	2.1	2.2	2.4	2.5	2.6	2.6	2.8	3.1	3.6	3.7	4.4	5.0	5.4
-60 to -40	1.4	1.5	1.7	1.9	2.0	2.1	2.2	2.2	2.4	2.6	3.2	3.3	4.0	4.6	4.9
-70 to -60	1.1	1.2	1.4	1.6	1.7	1.8	1.9	1.9	2.1	2.3	2.9	3.0	3.6	4.2	4.6

Coef. disp. form. (frac. eq.)(ref.)	
P1	1.11014784E-01
Q1	7.11754946E+01
P2	2.40014797E-02
Q2	3.65054964E-02
P3	3.88792918E-01
Q3	5.94406203E-03

Fitting error of disp. form. σ [1E-6]		
	Visible	Infrared
Power ser. eq.	0.5	6.4
Frac. eq. (ref.)	0.6	7.4

Prod. Freq. (A to D)	B

Similar glass type			
OHARA	S-LAH51	HOYA	NBFD11
CDGM	H-LaF52	SCHOTT	N-LAF33

2022-7-1	StP, AP, SP
2019-4-1	Transmittance
2015-4-1	Color Code, Prod. Freq.

HIKARI GLASS CO., LTD.

J-LASF02

n_d = 1.799520 n_e = 1.804034

ν_d = 42.09 ν_e = 41.83

Glass code (d)
800421
Glass code (e)
804418

Spectral l.	Refractive idx
2.058	1.76084
1.970	1.76245
1.530	1.76995
1.129	1.77706
1.064	1.77843
t	1.77960
s	1.78427
A'	1.787593
r	1.790708
C	1.793865
C'	1.794756
He-Ne	1.795591
D	1.799353
d	1.799520
e	1.804034
F	1.812862
F'	1.813976
g	1.823628
h	1.832793
0.389	1.838492
i	1.848944

Partial dispersion	
F-C	0.018997
F'-C'	0.019220
C-t	0.014266
C-A'	0.006272
d-C	0.005655
e-C	0.010169
g-d	0.024108
g-F	0.010766
h-g	0.009165
i-g	0.025316
C'-t	0.015157
e-C'	0.009278
F'-e	0.009942
i-F'	0.034968

Relative partial dispersion	
C-t／F-C	0.7510
C-A'／F-C	0.3302
d-C／F-C	0.2977
e-C／F-C	0.5353
g-d／F-C	1.2690
g-F／F-C	0.5667
h-g／F-C	0.4824
i-g／F-C	1.3326
C'-t／F'-C'	0.7886
e-C'／F'-C'	0.4827
F'-e／F'-C'	0.5173
i-F'／F'-C'	1.8194

Deviation of relative partial disp.	
ΔPdC	0.0015
ΔPgF	−0.0070

Internal CC (80%/5%)
369/333
Color Code (80%/5%)
400/335

CCI	
B	0.00
G	1.02
R	1.07

Thermal properties	
CTE(−30,70) [1E-7/℃]	53
CTE(100,300) [1E-7/℃]	71
Tg [℃]	598
At [℃]	630
StP [℃]	553
AP [℃]	580
SP [℃]	684
Ht cndct. [W/m·K]	0.850
Sp. heat [kJ/kg·K]	0.518
Ht diffus. [1E-6 m2/sec]	0.363

Chemical properties [class]	
Acid res. (surface)	4
Alkaline detergent res.	2
Climate resistance	1
Water res. (powder)	2
Acid res. (powder)	4

Mechanical properties	
Knoop hardness	586 (6)
Abrasion hardness	64
Young's mod. [GPa]	109.1
Shear mod. [GPa]	41.6
Poisson's ratio	0.310
Stress optical coef. [1E-5 nm/cm／Pa]	2.23

Internal trans. (10mm)	
λ [nm]	τ
280	–
290	–
300	–
310	–
320	–
330	0.02
340	0.16
350	0.42
360	0.66
370	0.81
380	0.89
390	0.927
400	0.950
420	0.972
440	0.982
460	0.987
480	0.992
500	0.995
550	0.998
600	0.999
650	0.998
700	0.999
800	0.998
900	0.996
1000	0.996
1200	0.997
1400	0.995
1600	0.990
1800	0.981
2000	0.964
2200	0.914
2400	0.72

Specific gravity
4.51

Coef. disp. form. (pwr ser.)	
A0	3.15037829E+00
A1	−1.26701101E-02
A2	−1.84342080E-04
A3	3.01788791E-02
A4	4.35495344E-04
A5	5.91055881E-05
A6	−3.81755339E-06
A7	2.51546253E-07
A8	0.00000000E+00

Relative Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90 (ref.)	7.9	8.0	8.2	8.5	8.7	9.0	9.1	9.1	9.5	9.8	10.7	10.8	11.8	12.8	13.4
60 to 80 (ref.)	7.7	7.8	8.1	8.3	8.5	8.8	8.8	8.9	9.2	9.6	10.4	10.5	11.5	12.5	13.1
40 to 60	7.5	7.6	7.8	8.1	8.3	8.5	8.6	8.7	9.0	9.3	10.1	10.2	11.1	12.1	12.7
20 to 40	7.3	7.4	7.6	7.9	8.1	8.3	8.4	8.4	8.7	9.1	9.8	9.9	10.8	11.7	12.3
0 to 20	7.2	7.2	7.5	7.7	7.9	8.1	8.2	8.2	8.5	8.9	9.6	9.7	10.5	11.4	12.0
−20 to 0	7.1	7.2	7.4	7.6	7.8	8.0	8.0	8.1	8.4	8.7	9.4	9.5	10.3	11.2	11.7
−40 to −20	7.1	7.1	7.4	7.5	7.7	7.9	8.0	8.0	8.3	8.6	9.3	9.4	10.2	11.0	11.5
−60 to −40 (ref.)	7.2	7.2	7.4	7.6	7.8	8.0	8.0	8.1	8.3	8.7	9.3	9.4	10.1	10.9	11.4
−70 to −60 (ref.)	7.3	7.4	7.6	7.7	7.9	8.1	8.2	8.2	8.5	8.8	9.4	9.5	10.2	10.9	11.4

Absolute Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90	6.8	6.9	7.2	7.4	7.6	7.9	7.9	8.0	8.3	8.7	9.5	9.6	10.6	11.6	12.3
60 to 80	6.5	6.6	6.9	7.1	7.3	7.6	7.6	7.7	8.0	8.4	9.2	9.3	10.2	11.2	11.8
40 to 60	6.2	6.2	6.5	6.7	6.9	7.1	7.2	7.3	7.6	7.9	8.7	8.8	9.7	10.6	11.2
20 to 40	5.8	5.9	6.1	6.3	6.5	6.7	6.8	6.9	7.2	7.5	8.2	8.3	9.2	10.1	10.7
0 to 20	5.4	5.5	5.7	5.9	6.1	6.3	6.4	6.4	6.7	7.1	7.8	7.8	8.7	9.5	10.1
−20 to 0	5.1	5.1	5.3	5.5	5.7	5.9	6.0	6.0	6.3	6.6	7.3	7.4	8.2	9.0	9.5
−40 to −20	4.7	4.7	5.0	5.1	5.3	5.5	5.6	5.6	5.9	6.2	6.8	6.9	7.7	8.4	8.9
−60 to −40	4.3	4.4	4.6	4.7	4.9	5.1	5.2	5.2	5.4	5.7	6.3	6.4	7.1	7.9	8.4
−70 to −60	4.0	4.1	4.3	4.4	4.6	4.8	4.8	4.9	5.1	5.4	6.0	6.1	6.8	7.5	7.9

Coef. disp. form. (frac. eq.)(ref.)	
P1	1.06784810E-01
Q1	7.32229118E+01
P2	2.04998014E-02
Q2	4.06036318E-02
P3	3.97089133E-01
Q3	6.38000144E-03

Fitting error of disp. form. σ [1E-6]		
	Visible	Infrared
Power ser. eq.	0.6	9.5
Frac. eq. (ref.)	0.8	7.7

Prod. Freq. (A to D)	C

Similar glass type			
OHARA	S-LAH52	HOYA	NBFD12
CDGM	H-LaF54	SCHOTT	–

2022-7-1	StP, AP, SP
2019-4-1	Transmittance
2015-4-1	Color Code, Prod. Freq., Similar glass type

HIKARI GLASS CO., LTD.

J-LASF03

n_d = 1.806100 n_e = 1.810772

ν_d = 40.97 ν_e = 40.73

Glass code (d)
806410
Glass code (e)
811407

Spectral l.	Refractive idx
2.058	1.76515
1.970	1.76691
1.530	1.77510
1.129	1.78273
1.064	1.78419
t	1.78542
s	1.79030
A'	1.793753
r	1.796981
C	1.800248
C'	1.801171
He-Ne	1.802035
D	1.805927
d	1.806100
e	1.810772
F	1.819921
F'	1.821077
g	1.831111
h	1.840675
0.389	1.846641
i	1.857625

Coef. disp. form. (pwr ser.)	
A0	3.17262102E+00
A1	-1.44956612E-02
A2	-1.48050666E-04
A3	3.02384298E-02
A4	7.95161351E-04
A5	-3.21543048E-06
A6	3.05533181E-06
A7	0.00000000E+00
A8	0.00000000E+00

Partial dispersion	
F-C	0.019673
F'-C'	0.019906
C-t	0.014828
C-A'	0.006495
d-C	0.005852
e-C	0.010524
g-d	0.025011
g-F	0.011190
h-g	0.009564
i-g	0.026514
C'-t	0.015751
e-C'	0.009601
F'-e	0.010305
i-F'	0.036548

Relative partial dispersion	
C-t／F-C	0.7537
C-A'／F-C	0.3301
d-C／F-C	0.2975
e-C／F-C	0.5349
g-d／F-C	1.2713
g-F／F-C	0.5688
h-g／F-C	0.4861
i-g／F-C	1.3477
C'-t／F'-C'	0.7913
e-C'／F'-C'	0.4823
F'-e／F'-C'	0.5177
i-F'／F'-C'	1.8360

Deviation of relative partial disp.	
ΔPdC	0.0018
ΔPgF	-0.0068

Internal CC (80%/5%)
371/328
Color Code (80%/5%)
410/330
CCI

B	0.00
G	1.30
R	1.35

Thermal properties	
CTE(-30,70) [1E-7/℃]	52
CTE(100,300) [1E-7/℃]	65
Tg [℃]	620
At [℃]	650
StP [℃]	576
AP [℃]	604
SP [℃]	708
Ht cndct. [W/m･K]	0.861
Sp. heat [kJ/kg･K]	0.499
Ht diffus. [1E-6 m2/sec]	0.400

Chemical properties [class]	
Acid res. (surface)	4
Alkaline detergent res.	1
Climate resistance	1
Water res. (powder)	1
Acid res. (powder)	4

Mechanical properties	
Knoop hardness	643 (6)
Abrasion hardness	78
Young's mod. [GPa]	114.0
Shear mod. [GPa]	43.9
Poisson's ratio	0.297
Stress optical coef. [1E-5 nm/cm／Pa]	2.15

Internal trans. (10mm)	
λ [nm]	τ
280	–
290	–
300	–
310	–
320	–
330	0.07
340	0.25
350	0.49
360	0.67
370	0.79
380	0.86
390	0.910
400	0.936
420	0.964
440	0.976
460	0.983
480	0.989
500	0.993
550	0.997
600	0.998
650	0.998
700	0.999
800	0.997
900	0.996
1000	0.996
1200	0.997
1400	0.992
1600	0.989
1800	0.975
2000	0.953
2200	0.88
2400	0.67

Specific gravity
4.31

Relative Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90 (ref.)	5.9	6.0	6.2	6.5	6.7	6.9	7.0	7.1	7.4	7.8	8.6	8.7	9.6	10.6	11.3
60 to 80 (ref.)	5.7	5.8	6.1	6.3	6.5	6.7	6.8	6.9	7.2	7.5	8.3	8.4	9.3	10.3	10.9
40 to 60	5.5	5.6	5.8	6.0	6.2	6.5	6.5	6.6	6.9	7.2	7.9	8.0	8.9	9.9	10.5
20 to 40	5.3	5.4	5.6	5.8	6.0	6.2	6.3	6.3	6.6	7.0	7.6	7.7	8.6	9.5	10.0
0 to 20	5.2	5.2	5.4	5.6	5.8	6.0	6.1	6.1	6.4	6.7	7.4	7.5	8.3	9.1	9.7
-20 to 0	5.1	5.1	5.3	5.5	5.7	5.9	5.9	6.0	6.3	6.6	7.2	7.3	8.0	8.8	9.4
-40 to -20	5.0	5.1	5.3	5.5	5.6	5.8	5.9	5.9	6.2	6.5	7.1	7.1	7.9	8.6	9.1
-60 to -40 (ref.)	5.1	5.2	5.3	5.5	5.7	5.9	5.9	6.0	6.2	6.5	7.0	7.1	7.8	8.5	9.0
-70 to -60 (ref.)	5.3	5.3	5.5	5.6	5.8	6.0	6.0	6.1	6.3	6.6	7.1	7.2	7.8	8.5	9.0

Absolute Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90	4.8	4.9	5.1	5.4	5.6	5.8	5.9	6.0	6.3	6.6	7.4	7.5	8.5	9.4	10.1
60 to 80	4.5	4.6	4.8	5.1	5.3	5.5	5.6	5.6	5.9	6.3	7.0	7.1	8.1	9.0	9.6
40 to 60	4.2	4.2	4.5	4.7	4.9	5.1	5.1	5.2	5.5	5.8	6.5	6.6	7.5	8.4	9.0
20 to 40	3.8	3.8	4.1	4.3	4.5	4.7	4.7	4.8	5.0	5.4	6.1	6.1	7.0	7.8	8.4
0 to 20	3.4	3.5	3.7	3.8	4.0	4.2	4.3	4.3	4.6	4.9	5.6	5.6	6.4	7.3	7.8
-20 to 0	3.0	3.1	3.3	3.4	3.6	3.8	3.9	3.9	4.2	4.5	5.1	5.1	5.9	6.7	7.2
-40 to -20	2.7	2.7	2.9	3.0	3.2	3.4	3.4	3.5	3.7	4.0	4.6	4.6	5.4	6.1	6.6
-60 to -40	2.3	2.3	2.5	2.6	2.8	3.0	3.0	3.1	3.3	3.5	4.1	4.1	4.8	5.5	5.9
-70 to -60	2.0	2.0	2.2	2.3	2.5	2.6	2.7	2.7	2.9	3.2	3.7	3.8	4.4	5.1	5.5

Coef. disp. form. (frac. eq.)(ref.)	
P1	1.16842249E-01
Q1	7.25891074E+01
P2	2.16356451E-02
Q2	4.21702012E-02
P3	3.98366606E-01
Q3	6.31251150E-03

Fitting error of disp. form. σ [1E-6]		
	Visible	Infrared
Power ser. eq.	0.8	2.5
Frac. eq. (ref.)	0.7	3.4

Prod. Freq. (A to D)	A

Similar glass type			
OHARA	S-LAH53V	HOYA	NBFD13
CDGM	H-ZLaF52A	SCHOTT	N-LASF43

2022-7-1	StP, AP, SP
2020-4-1	Similar glass type
2019-4-1	Transmittance

HIKARI GLASS CO., LTD.

J-LASF05

n_d = 1.834810 n_e = 1.839454

ν_d = 42.73 ν_e = 42.48

Glass code (d)
835427
Glass code (e)
839425

Spectral l.	Refractive idx
2.058	1.79536
1.970	1.79697
1.530	1.80451
1.129	1.81173
1.064	1.81314
t	1.81433
s	1.81912
A'	1.822536
r	1.825740
C	1.828989
C'	1.829907
He-Ne	1.830766
D	1.834638
d	1.834810
e	1.839454
F	1.848524
F'	1.849668
g	1.859557
h	1.868920
0.389	1.874725
i	1.885334

Partial dispersion	
F-C	0.019535
F'-C'	0.019761
C-t	0.014655
C-A'	0.006453
d-C	0.005821
e-C	0.010465
g-d	0.024747
g-F	0.011033
h-g	0.009363
i-g	0.025777
C'-t	0.015573
e-C'	0.009547
F'-e	0.010214
i-F'	0.035666

Relative partial dispersion	
C-t／F-C	0.7502
C-A'／F-C	0.3303
d-C／F-C	0.2980
e-C／F-C	0.5357
g-d／F-C	1.2668
g-F／F-C	0.5648
h-g／F-C	0.4793
i-g／F-C	1.3195
C'-t／F'-C'	0.7881
e-C'／F'-C'	0.4831
F'-e／F'-C'	0.5169
i-F'／F'-C'	1.8049

Deviation of relative partial disp.	
ΔPdC	0.0015
ΔPgF	−0.0079

Internal CC (80%/5%)
365/320
Color Code (80%/5%)
405/320
CCI

B	0.00
G	0.88
R	0.92

Thermal properties	
CTE(−30,70) [1E-7/℃]	55
CTE(100,300) [1E-7/℃]	77
Tg [℃]	674
At [℃]	708
StP [℃]	627
AP [℃]	658
SP [℃]	768
Ht cndct. [W/m･K]	0.907
Sp. heat [kJ/kg･K]	0.501
Ht diffus. [1E-6 m2/sec]	0.378

Chemical properties [class]	
Acid res. (surface)	1
Alkaline detergent res.	1
Climate resistance	1
Water res. (powder)	2
Acid res. (powder)	3

Mechanical properties	
Knoop hardness	611 (6)
Abrasion hardness	75
Young's mod. [GPa]	119.8
Shear mod. [GPa]	46.0
Poisson's ratio	0.303
Stress optical coef. [1E-5 nm/cm／Pa]	1.49

Internal trans. (10mm)	
λ [nm]	τ
280	–
290	–
300	–
310	–
320	0.05
330	0.20
340	0.43
350	0.63
360	0.76
370	0.85
380	0.904
390	0.937
400	0.956
420	0.975
440	0.983
460	0.989
480	0.992
500	0.995
550	0.998
600	0.998
650	0.999
700	0.998
800	0.998
900	0.997
1000	0.997
1200	0.998
1400	0.999
1600	0.994
1800	0.988
2000	0.973
2200	0.938
2400	0.78

Specific gravity
4.79

Coef. disp. form. (pwr ser.)	
A0	3.27458352E+00
A1	−1.32752140E-02
A2	−1.35438033E-04
A3	3.11933067E-02
A4	7.11503841E-04
A5	3.51334559E-06
A6	1.88560229E-06
A7	0.00000000E+00
A8	0.00000000E+00

Relative Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90 (ref.)	4.3	4.4	4.6	4.9	5.1	5.3	5.4	5.4	5.7	6.0	6.8	6.9	7.7	8.7	9.3
60 to 80 (ref.)	4.2	4.3	4.6	4.7	4.9	5.2	5.2	5.3	5.6	5.9	6.6	6.7	7.5	8.5	9.1
40 to 60	4.1	4.1	4.4	4.6	4.8	5.0	5.0	5.1	5.4	5.7	6.4	6.5	7.3	8.2	8.8
20 to 40	3.9	4.0	4.3	4.5	4.7	4.8	4.9	5.0	5.2	5.5	6.2	6.3	7.1	7.9	8.5
0 to 20	3.9	4.0	4.2	4.4	4.6	4.8	4.8	4.9	5.1	5.4	6.0	6.1	6.9	7.7	8.3
−20 to 0	3.9	3.9	4.2	4.4	4.5	4.7	4.8	4.8	5.1	5.4	6.0	6.0	6.8	7.6	8.1
−40 to −20	3.9	4.0	4.2	4.4	4.6	4.8	4.8	4.9	5.1	5.4	5.9	6.0	6.7	7.5	8.1
−60 to −40 (ref.)	4.1	4.2	4.4	4.6	4.7	4.9	4.9	5.0	5.2	5.5	6.0	6.1	6.8	7.6	8.1
−70 to −60 (ref.)	4.3	4.4	4.6	4.8	4.9	5.1	5.1	5.2	5.4	5.7	6.2	6.3	7.0	7.7	8.2

Absolute Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90	3.2	3.3	3.5	3.7	3.9	4.2	4.2	4.3	4.6	4.9	5.6	5.7	6.6	7.5	8.1
60 to 80	3.0	3.1	3.3	3.5	3.7	3.9	4.0	4.0	4.3	4.6	5.3	5.4	6.3	7.2	7.8
40 to 60	2.7	2.8	3.0	3.2	3.4	3.6	3.6	3.7	4.0	4.3	4.9	5.0	5.8	6.7	7.3
20 to 40	2.4	2.5	2.7	2.9	3.1	3.3	3.3	3.4	3.6	3.9	4.6	4.6	5.4	6.3	6.8
0 to 20	2.1	2.2	2.4	2.6	2.7	2.9	3.0	3.0	3.3	3.6	4.2	4.3	5.0	5.8	6.4
−20 to 0	1.8	1.9	2.1	2.3	2.4	2.6	2.7	2.7	2.9	3.2	3.8	3.9	4.6	5.4	5.9
−40 to −20	1.5	1.6	1.8	1.9	2.1	2.3	2.3	2.4	2.6	2.9	3.4	3.5	4.2	4.9	5.4
−60 to −40	1.2	1.3	1.5	1.6	1.8	1.9	2.0	2.0	2.2	2.5	3.0	3.1	3.8	4.5	5.0
−70 to −60	1.0	1.0	1.2	1.4	1.5	1.7	1.7	1.8	2.0	2.2	2.8	2.8	3.5	4.2	4.6

Coef. disp. form. (frac. eq.)(ref.)	
P1	1.07685998E-01
Q1	7.57647015E+01
P2	2.51666246E-02
Q2	3.62464825E-02
P3	4.06060216E-01
Q3	6.09115841E-03

Fitting error of disp. form. σ [1E-6]		
	Visible	Infrared
Power ser. eq.	0.7	6.0
Frac. eq. (ref.)	0.6	7.2

Prod. Freq. (A to D)	A

Similar glass type			
OHARA	S-LAH55VS	HOYA	TAFD5F、TAFD5G
CDGM	H-ZLaF55D	SCHOTT	N-LASF41

2022-7-1	StP, AP, SP
2020-4-1	Similar glass type
2019-4-1	Transmittance

HIKARI GLASS CO., LTD.

J-LASF05HS

n_d = 1.834810 n_e = 1.839454

ν_d = 42.73 ν_e = 42.48

Glass code (d)
835427
Glass code (e)
839425

Spectral l.	Refractive idx
2.058	1.79536
1.970	1.79697
1.530	1.80451
1.129	1.81173
1.064	1.81314
t	1.81433
s	1.81912
A'	1.822536
r	1.825740
C	1.828989
C'	1.829907
He-Ne	1.830766
D	1.834638
d	1.834810
e	1.839454
F	1.848524
F'	1.849668
g	1.859557
h	1.868920
0.389	1.874725
i	1.885334

Partial dispersion	
F-C	0.019535
F'-C'	0.019761
C-t	0.014655
C-A'	0.006453
d-C	0.005821
e-C	0.010465
g-d	0.024747
g-F	0.011033
h-g	0.009363
i-g	0.025777
C'-t	0.015573
e-C'	0.009547
F'-e	0.010214
i-F'	0.035666

Relative partial dispersion	
C-t／F-C	0.7502
C-A'／F-C	0.3303
d-C／F-C	0.2980
e-C／F-C	0.5357
g-d／F-C	1.2668
g-F／F-C	0.5648
h-g／F-C	0.4793
i-g／F-C	1.3195
C'-t／F'-C'	0.7881
e-C'／F'-C'	0.4831
F'-e／F'-C'	0.5169
i-F'／F'-C'	1.8049

Deviation of relative partial disp.	
ΔPdC	0.0015
ΔPgF	−0.0079

Internal CC (80%/5%)
353/317
Color Code (80%/5%)
395/320

CCI	
B	0.00
G	0.65
R	0.66

Thermal properties	
CTE(−30,70) [1E-7/℃]	55
CTE(100,300) [1E-7/℃]	77
Tg [℃]	674
At [℃]	708
StP [℃]	627
AP [℃]	658
SP [℃]	768
Ht cndct. [W/m･K]	0.907
Sp. heat [kJ/kg･K]	0.501
Ht diffus. [1E-6 m2/sec]	0.378

Chemical properties [class]	
Acid res. (surface)	1
Alkaline detergent res.	1
Climate resistance	1
Water res. (powder)	2
Acid res. (powder)	3

Mechanical properties	
Knoop hardness	611 (6)
Abrasion hardness	75
Young's mod. [GPa]	119.8
Shear mod. [GPa]	46.0
Poisson's ratio	0.303
Stress optical coef. [1E-5 nm/cm／Pa]	1.49

Internal trans. (10mm)	
λ [nm]	τ
280	–
290	–
300	–
310	–
320	0.10
330	0.36
340	0.62
350	0.77
360	0.85
370	0.905
380	0.938
390	0.957
400	0.969
420	0.982
440	0.987
460	0.991
480	0.994
500	0.996
550	0.998
600	0.999
650	0.998
700	0.998
800	0.999
900	0.999
1000	0.998
1200	0.997
1400	0.994
1600	0.990
1800	0.986
2000	0.963
2200	0.905
2400	0.73

Specific gravity
4.79

Coef. disp. form. (pwr ser.)	
A0	3.27458352E+00
A1	−1.32752140E-02
A2	−1.35438033E-04
A3	3.11933067E-02
A4	7.11503841E-04
A5	3.51334559E-06
A6	1.88560229E-06
A7	0.00000000E+00
A8	0.00000000E+00

Relative Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90 (ref.)	4.3	4.4	4.6	4.9	5.1	5.3	5.4	5.4	5.7	6.0	6.8	6.9	7.7	8.7	9.3
60 to 80 (ref.)	4.2	4.3	4.6	4.7	4.9	5.2	5.2	5.3	5.6	5.9	6.6	6.7	7.5	8.5	9.1
40 to 60	4.1	4.1	4.4	4.6	4.8	5.0	5.0	5.1	5.4	5.7	6.4	6.5	7.3	8.2	8.8
20 to 40	3.9	4.0	4.3	4.5	4.7	4.8	4.9	5.0	5.2	5.5	6.2	6.3	7.1	7.9	8.5
0 to 20	3.9	4.0	4.2	4.4	4.6	4.8	4.8	4.9	5.1	5.4	6.0	6.1	6.9	7.7	8.3
−20 to 0	3.9	3.9	4.2	4.4	4.5	4.7	4.8	4.8	5.1	5.4	6.0	6.0	6.8	7.6	8.1
−40 to −20	3.9	4.0	4.2	4.4	4.6	4.8	4.8	4.9	5.1	5.4	5.9	6.0	6.7	7.5	8.1
−60 to −40 (ref.)	4.1	4.2	4.4	4.6	4.7	4.9	4.9	5.0	5.2	5.5	6.0	6.1	6.8	7.6	8.1
−70 to −60 (ref.)	4.3	4.4	4.6	4.8	4.9	5.1	5.1	5.2	5.4	5.7	6.2	6.3	7.0	7.7	8.2

Absolute Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90	3.2	3.3	3.5	3.7	3.9	4.2	4.2	4.3	4.6	4.9	5.6	5.7	6.6	7.5	8.1
60 to 80	3.0	3.1	3.3	3.5	3.7	3.9	4.0	4.0	4.3	4.6	5.3	5.4	6.3	7.2	7.8
40 to 60	2.7	2.8	3.0	3.2	3.4	3.6	3.6	3.7	4.0	4.3	4.9	5.0	5.8	6.7	7.3
20 to 40	2.4	2.5	2.7	2.9	3.1	3.3	3.3	3.4	3.6	3.9	4.6	4.6	5.4	6.3	6.8
0 to 20	2.1	2.2	2.4	2.6	2.7	2.9	3.0	3.0	3.3	3.6	4.2	4.3	5.0	5.8	6.4
−20 to 0	1.8	1.9	2.1	2.3	2.4	2.6	2.7	2.7	2.9	3.2	3.8	3.9	4.6	5.4	5.9
−40 to −20	1.5	1.6	1.8	1.9	2.1	2.3	2.3	2.4	2.6	2.9	3.4	3.5	4.2	4.9	5.4
−60 to −40	1.2	1.3	1.5	1.6	1.8	1.9	2.0	2.0	2.2	2.5	3.0	3.1	3.8	4.5	5.0
−70 to −60	1.0	1.0	1.2	1.4	1.5	1.7	1.7	1.8	2.0	2.2	2.8	2.8	3.5	4.2	4.6

Coef. disp. form. (frac. eq.)(ref.)	
P1	1.07685998E-01
Q1	7.57647015E+01
P2	2.51666246E-02
Q2	3.62464825E-02
P3	4.06060216E-01
Q3	6.09115841E-03

Fitting error of disp. form. σ [1E-6]		
	Visible	Infrared
Power ser. eq.	0.7	6.0
Frac. eq. (ref.)	0.6	7.2

Prod. Freq. (A to D)	A

Similar glass type			
OHARA	S-LAH55VS	HOYA	TAFD5F、TAFD5G
CDGM	H-ZLaF55D	SCHOTT	N-LASF41

2022-7-1	StP, AP, SP
2020-4-1	Similar glass type
2019-4-1	Transmittance

HIKARI GLASS CO., LTD.

J-LASF08A

n_d = 1.883000 n_e = 1.888158

ν_d = 40.69 ν_e = 40.44

Glass code (d)
883407
Glass code (e)
888404

Spectral l.	Refractive idx
2.058	1.84112
1.970	1.84270
1.530	1.85025
1.129	1.85777
1.064	1.85926
t	1.86054
s	1.86572
A'	1.869450
r	1.872971
C	1.876555
C'	1.877569
He-Ne	1.878520
D	1.882809
d	1.883000
e	1.888158
F	1.898256
F'	1.899531
g	1.910567
h	1.921025
0.389	1.927512
i	1.939369

Coef. disp. form. (pwr ser.)	
A0	3.44086290E+00
A1	-1.38053657E-02
A2	-5.63338044E-05
A3	3.50570730E-02
A4	9.60233781E-04
A5	-7.65969630E-06
A6	2.57013206E-06
A7	0.00000000E+00
A8	0.00000000E+00

Partial dispersion	
F-C	0.021701
F'-C'	0.021962
C-t	0.016015
C-A'	0.007105
d-C	0.006445
e-C	0.011603
g-d	0.027567
g-F	0.012311
h-g	0.010458
i-g	0.028802
C'-t	0.017029
e-C'	0.010589
F'-e	0.011373
i-F'	0.039838

Relative partial dispersion	
C-t／F-C	0.7380
C-A'／F-C	0.3274
d-C／F-C	0.2970
e-C／F-C	0.5347
g-d／F-C	1.2703
g-F／F-C	0.5673
h-g／F-C	0.4819
i-g／F-C	1.3272
C'-t／F'-C'	0.7754
e-C'／F'-C'	0.4822
F'-e／F'-C'	0.5178
i-F'／F'-C'	1.8140

Deviation of relative partial disp.	
ΔPdC	0.0014
ΔPgF	-0.0088

Internal CC (80%/5%)
363/329
Color Code (70%/5%)
370/330
CCI

B	0.00
G	0.90
R	0.92

Thermal properties	
CTE(-30,70) [1E-7/℃]	62
CTE(100,300) [1E-7/℃]	77
Tg [℃]	700
At [℃]	740
StP [℃]	662
AP [℃]	693
SP [℃]	806
Ht cndct. [W/m･K]	0.790
Sp. heat [kJ/kg･K]	0.403
Ht diffus. [1E-6 m2/sec]	0.362

Chemical properties [class]	
Acid res. (surface)	1
Alkaline detergent res.	1
Climate resistance	1
Water res. (powder)	1
Acid res. (powder)	1

Mechanical properties	
Knoop hardness	655 (7)
Abrasion hardness	57
Young's mod. [GPa]	124.9
Shear mod. [GPa]	48.0
Poisson's ratio	0.302
Stress optical coef. [1E-5 nm/cm／Pa]	1.23

Internal trans. (10mm)	
λ [nm]	τ
280	–
290	–
300	–
310	–
320	–
330	0.06
340	0.30
350	0.57
360	0.76
370	0.86
380	0.912
390	0.942
400	0.959
420	0.975
440	0.982
460	0.988
480	0.991
500	0.995
550	0.998
600	0.998
650	0.998
700	0.999
800	0.999
900	0.998
1000	0.999
1200	0.999
1400	0.999
1600	0.998
1800	0.992
2000	0.977
2200	0.948
2400	0.82

Specific gravity
5.41

Relative Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90 (ref.)	3.9	4.0	4.3	4.5	4.8	5.0	5.1	5.1	5.5	5.9	6.7	6.8	7.8	8.7	9.4
60 to 80 (ref.)	3.7	3.8	4.2	4.4	4.6	4.8	4.9	5.0	5.3	5.7	6.5	6.6	7.5	8.5	9.1
40 to 60	3.6	3.7	4.0	4.2	4.4	4.6	4.7	4.8	5.1	5.4	6.2	6.3	7.2	8.1	8.8
20 to 40	3.4	3.5	3.9	4.1	4.3	4.5	4.5	4.6	4.9	5.2	6.0	6.1	7.0	7.8	8.4
0 to 20	3.3	3.5	3.8	4.0	4.2	4.4	4.4	4.5	4.8	5.1	5.8	5.9	6.7	7.6	8.1
-20 to 0	3.3	3.4	3.7	3.9	4.1	4.3	4.4	4.4	4.7	5.0	5.7	5.8	6.6	7.4	7.9
-40 to -20	3.4	3.5	3.8	3.9	4.1	4.3	4.4	4.4	4.7	5.0	5.6	5.7	6.5	7.3	7.8
-60 to -40 (ref.)	3.5	3.6	3.9	4.1	4.3	4.4	4.5	4.5	4.8	5.1	5.7	5.8	6.5	7.3	7.8
-70 to -60 (ref.)	3.7	3.8	4.1	4.3	4.4	4.6	4.7	4.7	5.0	5.2	5.9	5.9	6.6	7.4	7.8

Absolute Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90	2.7	2.8	3.2	3.4	3.6	3.8	3.9	4.0	4.3	4.7	5.5	5.6	6.5	7.5	8.2
60 to 80	2.5	2.6	2.9	3.1	3.3	3.6	3.6	3.7	4.0	4.4	5.2	5.3	6.2	7.1	7.8
40 to 60	2.2	2.3	2.6	2.8	3.0	3.2	3.3	3.3	3.6	4.0	4.7	4.8	5.7	6.6	7.2
20 to 40	1.8	1.9	2.2	2.4	2.6	2.9	2.9	3.0	3.3	3.6	4.3	4.4	5.3	6.1	6.7
0 to 20	1.5	1.6	1.9	2.1	2.3	2.5	2.6	2.6	2.9	3.2	3.9	4.0	4.8	5.6	6.2
-20 to 0	1.2	1.3	1.6	1.8	1.9	2.1	2.2	2.2	2.5	2.8	3.5	3.6	4.3	5.1	5.6
-40 to -20	0.9	1.0	1.2	1.4	1.6	1.8	1.8	1.9	2.1	2.4	3.0	3.1	3.9	4.6	5.1
-60 to -40	0.6	0.7	0.9	1.1	1.2	1.4	1.5	1.5	1.7	2.0	2.6	2.7	3.4	4.1	4.6
-70 to -60	0.3	0.4	0.7	0.8	1.0	1.1	1.2	1.2	1.5	1.7	2.3	2.4	3.1	3.7	4.2

Coef. disp. form. (frac. eq.)(ref.)	
P1	1.34045707E-01
Q1	9.83260621E+01
P2	4.96463488E-02
Q2	2.94341953E-02
P3	3.98912094E-01
Q3	5.38901754E-03

Fitting error of disp. form. σ [1E-6]		
	Visible	Infrared
Power ser. eq.	0.9	8.6
Frac. eq. (ref.)	1.8	6.3

Prod. Freq. (A to D)	A

Similar glass type			
OHARA	S-LAH58	HOYA	TAFD30
CDGM	H-ZLaF68C	SCHOTT	N-LASF31A

2022-7-1	StP, AP, SP
2020-4-1	Similar glass type
2019-4-1	Transmittance

HIKARI GLASS CO., LTD.

J-LASF09A

n_d = 1.816000 n_e = 1.820169

ν_d = 46.59 ν_e = 46.35

Glass code (d)
816466
Glass code (e)
820464

Spectral l.	Refractive idx
2.058	1.77826
1.970	1.77991
1.530	1.78761
1.129	1.79474
1.064	1.79609
t	1.79723
s	1.80171
A'	1.804861
r	1.807791
C	1.810744
C'	1.811575
He-Ne	1.812353
D	1.815845
d	1.816000
e	1.820169
F	1.828257
F'	1.829271
g	1.838004
h	1.846196
0.389	1.851236
i	1.860365

Partial dispersion	
F-C	0.017513
F'-C'	0.017696
C-t	0.013518
C-A'	0.005883
d-C	0.005256
e-C	0.009425
g-d	0.022004
g-F	0.009747
h-g	0.008192
i-g	0.022361
C'-t	0.014349
e-C'	0.008594
F'-e	0.009102
i-F'	0.031094

Relative partial dispersion	
C-t／F-C	0.7719
C-A'／F-C	0.3359
d-C／F-C	0.3001
e-C／F-C	0.5382
g-d／F-C	1.2564
g-F／F-C	0.5566
h-g／F-C	0.4678
i-g／F-C	1.2768
C'-t／F'-C'	0.8109
e-C'／F'-C'	0.4856
F'-e／F'-C'	0.5144
i-F'／F'-C'	1.7571

Deviation of relative partial disp.	
ΔPdC	0.0019
ΔPgF	−0.0096

Internal CC (80%/5%)
348/283
Color Code (80%/5%)
380/285

CCI	
B	0.00
G	0.39
R	0.38

Thermal properties	
CTE(−30,70) [1E-7/℃]	56
CTE(100,300) [1E-7/℃]	73
Tg [℃]	702
At [℃]	731
StP [℃]	659
AP [℃]	686
SP [℃]	786
Ht cndct. [W/m·K]	0.772
Sp. heat [kJ/kg·K]	0.434
Ht diffus. [1E-6 m2/sec]	0.357

Chemical properties [class]	
Acid res. (surface)	1
Alkaline detergent res.	1
Climate resistance	1
Water res. (powder)	1
Acid res. (powder)	2

Mechanical properties	
Knoop hardness	653 (7)
Abrasion hardness	57
Young's mod. [GPa]	124.4
Shear mod. [GPa]	47.9
Poisson's ratio	0.299
Stress optical coef. [1E-5 nm/cm／Pa]	1.33

Internal trans. (10mm)	
λ [nm]	τ
280	–
290	0.08
300	0.18
310	0.27
320	0.45
330	0.62
340	0.73
350	0.82
360	0.89
370	0.928
380	0.955
390	0.970
400	0.980
420	0.989
440	0.993
460	0.995
480	0.997
500	0.998
550	0.999
600	0.999
650	0.998
700	0.999
800	0.996
900	0.72
1000	0.71
1200	0.999
1400	0.997
1600	0.995
1800	0.987
2000	0.965
2200	0.911
2400	0.72

Specific gravity
4.99

Coef. disp. form. (pwr ser.)	
A0	3.21676146E+00
A1	−1.39424450E-02
A2	−1.18797124E-04
A3	2.79205286E-02
A4	6.01395043E-04
A5	−4.64990540E-06
A6	1.72221463E-06
A7	−3.69002554E-08
A8	0.00000000E+00

Relative Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90 (ref.)	4.2	4.3	4.5	4.8	4.9	5.1	5.2	5.3	5.5	5.8	6.4	6.5	7.2	7.9	8.3
60 to 80 (ref.)	4.1	4.2	4.5	4.6	4.8	5.0	5.1	5.1	5.4	5.6	6.2	6.3	7.0	7.6	8.1
40 to 60	4.0	4.0	4.3	4.5	4.6	4.8	4.9	4.9	5.2	5.4	6.0	6.1	6.7	7.4	7.8
20 to 40	3.9	3.9	4.2	4.3	4.5	4.7	4.7	4.8	5.0	5.3	5.8	5.9	6.5	7.1	7.5
0 to 20	3.8	3.9	4.1	4.3	4.4	4.6	4.6	4.7	4.9	5.2	5.7	5.7	6.3	6.9	7.3
−20 to 0	3.8	3.9	4.1	4.2	4.4	4.5	4.6	4.6	4.8	5.1	5.6	5.6	6.2	6.8	7.2
−40 to −20	3.9	3.9	4.1	4.3	4.4	4.6	4.6	4.7	4.9	5.1	5.6	5.6	6.2	6.7	7.1
−60 to −40 (ref.)	4.0	4.1	4.3	4.4	4.6	4.7	4.8	4.8	5.0	5.2	5.6	5.7	6.2	6.8	7.1
−70 to −60 (ref.)	4.2	4.3	4.5	4.6	4.8	4.9	4.9	5.0	5.2	5.4	5.8	5.9	6.4	6.9	7.2

Absolute Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90	3.1	3.2	3.4	3.6	3.8	4.0	4.1	4.1	4.4	4.7	5.3	5.3	6.0	6.7	7.1
60 to 80	2.9	3.0	3.2	3.4	3.6	3.8	3.8	3.9	4.1	4.4	5.0	5.0	5.7	6.4	6.8
40 to 60	2.6	2.7	2.9	3.1	3.3	3.4	3.5	3.5	3.8	4.0	4.6	4.7	5.3	5.9	6.3
20 to 40	2.3	2.4	2.6	2.8	2.9	3.1	3.2	3.2	3.4	3.7	4.2	4.3	4.9	5.5	5.9
0 to 20	2.0	2.1	2.3	2.5	2.6	2.8	2.8	2.9	3.1	3.3	3.8	3.9	4.5	5.0	5.4
−20 to 0	1.7	1.8	2.0	2.2	2.3	2.5	2.5	2.5	2.7	3.0	3.4	3.5	4.0	4.6	5.0
−40 to −20	1.4	1.5	1.7	1.8	2.0	2.1	2.2	2.2	2.4	2.6	3.1	3.1	3.6	4.2	4.5
−60 to −40	1.2	1.2	1.4	1.5	1.7	1.8	1.8	1.9	2.0	2.3	2.7	2.7	3.2	3.7	4.1
−70 to −60	0.9	1.0	1.2	1.3	1.4	1.6	1.6	1.6	1.8	2.0	2.4	2.4	2.9	3.4	3.7

Coef. disp. form. (frac. eq.)(ref.)	
P1	1.26284136E-01
Q1	8.29136708E+01
P2	5.50433653E-02
Q2	2.36945638E-02
P3	3.69870773E-01
Q3	4.86867246E-03

Fitting error of disp. form. σ [1E-6]		
	Visible	Infrared
Power ser. eq.	0.8	4.8
Frac. eq. (ref.)	0.9	5.5

Prod. Freq. (A to D)	A

Similar glass type			
OHARA	S-LAH59	HOYA	TAF5
CDGM	H-ZLaF69	SCHOTT	–

2022-7-1	StP, AP, SP
2019-4-1	Transmittance
2017-4-1	1st edition

HIKARI GLASS CO., LTD.

J-LASF010

n_d = 1.834000 n_e = 1.839319

ν_d = 37.18 ν_e = 36.94

Glass code (d)
834372
Glass code (e)
839369

Spectral l.	Refractive idx
2.058	1.78975
1.970	1.79154
1.530	1.79993
1.129	1.80799
1.064	1.80956
t	1.81089
s	1.81625
A'	1.820090
r	1.823703
C	1.827379
C'	1.828420
He-Ne	1.829395
D	1.833803
d	1.834000
e	1.839319
F	1.849808
F'	1.851140
g	1.862767
h	1.873960
0.389	1.881006
i	1.894125

Coef. disp. form. (pwr ser.)	
A0	3.25964047E+00
A1	-1.45636865E-02
A2	-1.71298494E-04
A3	3.51194196E-02
A4	6.30621917E-04
A5	9.80352299E-05
A6	-8.04182070E-06
A7	6.28587289E-07
A8	0.00000000E+00

Partial dispersion	
F-C	0.022429
F'-C'	0.022720
C-t	0.016489
C-A'	0.007289
d-C	0.006621
e-C	0.011940
g-d	0.028767
g-F	0.012959
h-g	0.011193
i-g	0.031358
C'-t	0.017530
e-C'	0.010899
F'-e	0.011821
i-F'	0.042985

Relative partial dispersion	
C-t／F-C	0.7352
C-A'／F-C	0.3250
d-C／F-C	0.2952
e-C／F-C	0.5323
g-d／F-C	1.2826
g-F／F-C	0.5778
h-g／F-C	0.4990
i-g／F-C	1.3981
C'-t／F'-C'	0.7716
e-C'／F'-C'	0.4797
F'-e／F'-C'	0.5203
i-F'／F'-C'	1.8919

Deviation of relative partial disp.	
ΔPdC	0.0012
ΔPgF	-0.0042

Internal CC (80%/5%)
378/343
Color Code (80%/5%)
425/345

CCI	
B	0.00
G	1.64
R	1.77

Thermal properties	
CTE(-30,70) [1E-7/℃]	54
CTE(100,300) [1E-7/℃]	68
Tg [℃]	628
At [℃]	664
StP [℃]	583
AP [℃]	612
SP [℃]	718
Ht cndct. [W/m･K]	0.947
Sp. heat [kJ/kg･K]	0.541
Ht diffus. [1E-6 m2/sec]	0.409

Chemical properties [class]	
Acid res. (surface)	1
Alkaline detergent res.	1
Climate resistance	1
Water res. (powder)	1
Acid res. (powder)	3

Mechanical properties	
Knoop hardness	639 (6)
Abrasion hardness	71
Young's mod. [GPa]	116.7
Shear mod. [GPa]	45.0
Poisson's ratio	0.297
Stress optical coef. [1E-5 nm/cm／Pa]	2.21

Internal trans. (10mm)	
λ [nm]	τ
280	–
290	–
300	–
310	–
320	–
330	–
340	0.03
350	0.18
360	0.46
370	0.70
380	0.82
390	0.88
400	0.919
420	0.955
440	0.970
460	0.979
480	0.985
500	0.990
550	0.996
600	0.998
650	0.998
700	0.999
800	0.998
900	0.997
1000	0.997
1200	0.998
1400	0.997
1600	0.992
1800	0.982
2000	0.965
2200	0.910
2400	0.72

Specific gravity
4.28

Relative Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90 (ref.)	6.3	6.4	6.7	7.0	7.3	7.6	7.7	7.7	8.1	8.5	9.4	9.6	10.7	12.0	12.9
60 to 80 (ref.)	6.1	6.2	6.6	6.8	7.0	7.3	7.4	7.4	7.8	8.2	9.1	9.2	10.4	11.6	12.4
40 to 60	5.8	5.9	6.2	6.5	6.7	6.9	7.0	7.1	7.4	7.8	8.7	8.8	9.9	11.0	11.9
20 to 40	5.5	5.6	5.9	6.2	6.4	6.6	6.7	6.8	7.1	7.5	8.3	8.4	9.4	10.6	11.3
0 to 20	5.3	5.4	5.7	5.9	6.1	6.4	6.4	6.5	6.8	7.2	7.9	8.0	9.0	10.1	10.9
-20 to 0	5.1	5.2	5.5	5.7	5.9	6.1	6.2	6.3	6.6	6.9	7.7	7.8	8.7	9.7	10.4
-40 to -20	5.0	5.1	5.4	5.6	5.8	6.0	6.1	6.1	6.4	6.7	7.4	7.5	8.4	9.4	10.1
-60 to -40 (ref.)	5.0	5.1	5.4	5.6	5.8	6.0	6.0	6.1	6.3	6.7	7.3	7.4	8.3	9.2	9.9
-70 to -60 (ref.)	5.1	5.2	5.5	5.6	5.8	6.0	6.1	6.1	6.4	6.7	7.3	7.4	8.3	9.2	9.8

Absolute Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90	5.2	5.3	5.7	5.9	6.2	6.4	6.5	6.6	6.9	7.4	8.3	8.4	9.6	10.8	11.7
60 to 80	4.9	5.0	5.3	5.6	5.8	6.1	6.1	6.2	6.5	7.0	7.8	8.0	9.1	10.3	11.1
40 to 60	4.4	4.5	4.8	5.1	5.3	5.6	5.6	5.7	6.0	6.4	7.3	7.4	8.4	9.6	10.4
20 to 40	4.0	4.1	4.4	4.6	4.8	5.0	5.1	5.2	5.5	5.9	6.7	6.8	7.8	8.9	9.7
0 to 20	3.5	3.6	3.9	4.1	4.3	4.5	4.6	4.7	5.0	5.3	6.1	6.2	7.1	8.2	8.9
-20 to 0	3.1	3.1	3.4	3.6	3.8	4.0	4.1	4.2	4.4	4.8	5.5	5.6	6.5	7.5	8.2
-40 to -20	2.6	2.7	2.9	3.1	3.3	3.5	3.6	3.6	3.9	4.2	4.9	5.0	5.9	6.8	7.5
-60 to -40	2.2	2.2	2.5	2.7	2.8	3.0	3.1	3.1	3.4	3.7	4.3	4.4	5.2	6.1	6.8
-70 to -60	1.8	1.9	2.1	2.3	2.5	2.6	2.7	2.7	3.0	3.3	3.9	4.0	4.7	5.6	6.2

Coef. disp. form. (frac. eq.)(ref.)	
P1	1.04623045E-01
Q1	6.64846075E+01
P2	2.01481579E-02
Q2	4.84277053E-02
P3	4.09502477E-01
Q3	6.84010411E-03

Fitting error of disp. form. σ [1E-6]	Visible	Infrared
Power ser. eq.	0.7	6.8
Frac. eq. (ref.)	1.5	13.0

Prod. Freq. (A to D)	A

Similar glass type			
OHARA	S-LAH60	HOYA	NBFD10
CDGM	H-ZLaF53B	SCHOTT	N-LASF40

2022-7-1	StP, AP, SP
2019-4-1	Transmittance
2015-4-1	Color Code, Prod. Freq., Similar glass type

HIKARI GLASS CO., LTD.

J-LASF013

n_d = 1.804400 n_e = 1.809220

ν_d = 39.61 ν_e = 39.36

Glass code (d)
804396
Glass code (e)
809394

Spectral l.	Refractive idx
2.058	1.76221
1.970	1.76404
1.530	1.77251
1.129	1.78037
1.064	1.78186
t	1.78312
s	1.78814
A'	1.791690
r	1.795010
C	1.798372
C'	1.799322
He-Ne	1.800212
D	1.804221
d	1.804400
e	1.809220
F	1.818682
F'	1.819880
g	1.830298
h	1.840270
0.389	1.846513
i	1.858063

Coef. disp. form. (pwr ser.)	
A0	3.16350950E+00
A1	-1.45894059E-02
A2	-2.12587159E-04
A3	3.15033746E-02
A4	5.85519102E-04
A5	5.85508847E-05
A6	-3.44096993E-06
A7	3.17840715E-07
A8	0.00000000E+00

Partial dispersion	
F-C	0.020310
F'-C'	0.020558
C-t	0.015248
C-A'	0.006682
d-C	0.006028
e-C	0.010848
g-d	0.025898
g-F	0.011616
h-g	0.009972
i-g	0.027765
C'-t	0.016198
e-C'	0.009898
F'-e	0.010660
i-F'	0.038183

Relative partial dispersion	
C-t／F-C	0.7508
C-A'／F-C	0.3290
d-C／F-C	0.2968
e-C／F-C	0.5341
g-d／F-C	1.2751
g-F／F-C	0.5719
h-g／F-C	0.4910
i-g／F-C	1.3671
C'-t／F'-C'	0.7879
e-C'／F'-C'	0.4815
F'-e／F'-C'	0.5185
i-F'／F'-C'	1.8573

Deviation of relative partial disp.	
ΔPdC	0.0017
ΔPgF	-0.0060

Internal CC (80%/5%)
372/332
Color Code (80%/5%)
410/335

CCI	
B	0.00
G	1.22
R	1.28

Thermal properties	
CTE(-30,70) [1E-7/℃]	51
CTE(100,300) [1E-7/℃]	67
Tg [℃]	618
At [℃]	649
StP [℃]	573
AP [℃]	601
SP [℃]	705
Ht cndct. [W/m･K]	0.884
Sp. heat [kJ/kg･K]	0.530
Ht diffus. [1E-6 m2/sec]	0.395

Chemical properties [class]	
Acid res. (surface)	4
Alkaline detergent res.	2
Climate resistance	1
Water res. (powder)	1
Acid res. (powder)	4

Mechanical properties	
Knoop hardness	626 (6)
Abrasion hardness	76
Young's mod. [GPa]	112.6
Shear mod. [GPa]	43.4
Poisson's ratio	0.297
Stress optical coef. [1E-5 nm/cm／Pa]	2.31

Internal trans. (10mm)	
λ [nm]	τ
280	-
290	-
300	-
310	-
320	-
330	0.03
340	0.17
350	0.42
360	0.64
370	0.78
380	0.86
390	0.910
400	0.939
420	0.966
440	0.978
460	0.985
480	0.990
500	0.993
550	0.997
600	0.998
650	0.998
700	0.999
800	0.999
900	0.999
1000	0.999
1200	0.999
1400	0.995
1600	0.990
1800	0.979
2000	0.951
2200	0.86
2400	0.63

Specific gravity
4.2

Relative Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90 (ref.)	6.2	6.3	6.5	6.8	7.0	7.2	7.3	7.4	7.7	8.0	8.9	9.0	9.9	11.0	11.7
60 to 80 (ref.)	6.0	6.1	6.4	6.6	6.8	7.0	7.1	7.1	7.4	7.8	8.6	8.7	9.7	10.7	11.3
40 to 60	5.8	5.9	6.1	6.3	6.5	6.8	6.8	6.9	7.2	7.5	8.3	8.4	9.3	10.3	10.9
20 to 40	5.6	5.7	5.9	6.1	6.3	6.5	6.6	6.6	6.9	7.3	8.0	8.1	9.0	9.9	10.5
0 to 20	5.5	5.5	5.8	5.9	6.1	6.3	6.4	6.5	6.7	7.1	7.7	7.8	8.7	9.6	10.2
-20 to 0	5.4	5.5	5.7	5.8	6.0	6.2	6.3	6.3	6.6	6.9	7.6	7.6	8.4	9.3	9.9
-40 to -20	5.4	5.4	5.6	5.8	6.0	6.2	6.2	6.3	6.5	6.8	7.4	7.5	8.3	9.1	9.6
-60 to -40 (ref.)	5.5	5.5	5.7	5.9	6.0	6.2	6.3	6.3	6.6	6.8	7.4	7.5	8.2	9.0	9.5
-70 to -60 (ref.)	5.6	5.7	5.8	6.0	6.2	6.3	6.4	6.4	6.7	6.9	7.5	7.6	8.3	9.0	9.5

Absolute Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90	5.1	5.2	5.4	5.6	5.9	6.1	6.2	6.2	6.5	6.9	7.7	7.8	8.8	9.8	10.5
60 to 80	4.8	4.9	5.1	5.3	5.6	5.8	5.9	5.9	6.2	6.6	7.3	7.4	8.4	9.4	10.1
40 to 60	4.5	4.5	4.8	5.0	5.2	5.4	5.4	5.5	5.8	6.1	6.9	7.0	7.9	8.8	9.5
20 to 40	4.1	4.2	4.4	4.6	4.8	5.0	5.0	5.1	5.4	5.7	6.4	6.5	7.3	8.2	8.9
0 to 20	3.7	3.8	4.0	4.2	4.4	4.6	4.6	4.7	4.9	5.2	5.9	6.0	6.8	7.7	8.3
-20 to 0	3.4	3.4	3.6	3.8	4.0	4.1	4.2	4.2	4.5	4.8	5.4	5.5	6.3	7.1	7.7
-40 to -20	3.0	3.0	3.2	3.4	3.6	3.7	3.8	3.8	4.1	4.4	5.0	5.0	5.8	6.5	7.1
-60 to -40	2.6	2.7	2.8	3.0	3.1	3.3	3.4	3.4	3.6	3.9	4.5	4.5	5.2	6.0	6.5
-70 to -60	2.3	2.4	2.5	2.7	2.8	3.0	3.1	3.1	3.3	3.6	4.1	4.2	4.9	5.6	6.0

Coef. disp. form. (frac. eq.)(ref.)	
P1	1.07014916E-01
Q1	6.46906731E+01
P2	2.05151386E-02
Q2	4.51374212E-02
P3	3.98531952E-01
Q3	6.50186587E-03

Fitting error of disp. form. σ [1E-6]		
	Visible	Infrared
Power ser. eq.	0.7	9.7
Frac. eq. (ref.)	0.8	9.5

Prod. Freq. (A to D)	A

Similar glass type			
OHARA	S-LAH63	HOYA	NBFD3
CDGM	H-ZLAF51	SCHOTT	-

2022-7-1	StP, AP, SP
2019-4-1	Transmittance
2015-4-1	Color Code, Prod. Freq.

HIKARI GLASS CO., LTD.

J-LASF014

n_d = 1.788000 n_e = 1.791961

ν_d = 47.35 ν_e = 47.11

Glass code (d)
788474
Glass code (e)
792471

Spectral l.	Refractive idx
2.058	1.75096
1.970	1.75266
1.530	1.76050
1.129	1.76759
1.064	1.76891
t	1.77001
s	1.77435
A'	1.777378
r	1.780181
C	1.782997
C'	1.783790
He-Ne	1.784530
D	1.787853
d	1.788000
e	1.791961
F	1.799638
F'	1.800601
g	1.808889
h	1.816670
0.389	1.821462
i	1.830154

Coef. disp. form. (pwr ser.)	
A0	3.12119480E+00
A1	-1.37527216E-02
A2	-1.86592469E-04
A3	2.63764849E-02
A4	4.53698660E-04
A5	1.09722341E-05
A6	6.11243363E-07
A7	0.00000000E+00
A8	0.00000000E+00

Partial dispersion	
F-C	0.016641
F'-C'	0.016811
C-t	0.012982
C-A'	0.005619
d-C	0.005003
e-C	0.008964
g-d	0.020889
g-F	0.009251
h-g	0.007781
i-g	0.021265
C'-t	0.013775
e-C'	0.008171
F'-e	0.008640
i-F'	0.029553

Relative partial dispersion	
C-t／F-C	0.7801
C-A'／F-C	0.3377
d-C／F-C	0.3006
e-C／F-C	0.5387
g-d／F-C	1.2553
g-F／F-C	0.5559
h-g／F-C	0.4676
i-g／F-C	1.2779
C'-t／F'-C'	0.8194
e-C'／F'-C'	0.4861
F'-e／F'-C'	0.5139
i-F'／F'-C'	1.7580

Deviation of relative partial disp.	
ΔPdC	0.0021
ΔPgF	-0.0090

Internal CC (80%/5%)
352/311
Color Code (80%/5%)
380/310

CCI	
B	0.00
G	0.50
R	0.52

Thermal properties	
CTE(-30,70) [1E-7/℃]	57
CTE(100,300) [1E-7/℃]	74
Tg [℃]	683
At [℃]	707
StP [℃]	643
AP [℃]	670
SP [℃]	767
Ht cndct. [W/m･K]	0.844
Sp. heat [kJ/kg･K]	0.501
Ht diffus. [1E-6 m2/sec]	0.386

Chemical properties [class]	
Acid res. (surface)	1
Alkaline detergent res.	1
Climate resistance	1
Water res. (powder)	1
Acid res. (powder)	3

Mechanical properties	
Knoop hardness	632 (6)
Abrasion hardness	59
Young's mod. [GPa]	119.6
Shear mod. [GPa]	46.1
Poisson's ratio	0.297
Stress optical coef. [1E-5 nm/cm／Pa]	1.66

Internal trans. (10mm)	
λ [nm]	τ
280	-
290	-
300	-
310	0.04
320	0.19
330	0.43
340	0.64
350	0.78
360	0.86
370	0.914
380	0.946
390	0.965
400	0.976
420	0.987
440	0.991
460	0.993
480	0.996
500	0.997
550	0.999
600	0.999
650	0.999
700	0.999
800	0.998
900	0.998
1000	0.998
1200	0.999
1400	0.997
1600	0.992
1800	0.978
2000	0.957
2200	0.89
2400	0.68

Specific gravity
4.36

Relative Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90 (ref.)	3.9	4.0	4.1	4.3	4.5	4.6	4.7	4.7	5.0	5.3	5.8	5.9	6.4	6.9	7.3
60 to 80 (ref.)	3.8	3.8	4.1	4.2	4.3	4.5	4.6	4.6	4.8	5.1	5.7	5.7	6.3	6.8	7.1
40 to 60	3.6	3.7	3.9	4.0	4.2	4.3	4.4	4.4	4.7	4.9	5.5	5.5	6.1	6.6	6.9
20 to 40	3.5	3.6	3.8	3.9	4.1	4.2	4.3	4.3	4.5	4.8	5.3	5.4	5.9	6.4	6.7
0 to 20	3.4	3.5	3.7	3.8	4.0	4.1	4.2	4.2	4.4	4.7	5.2	5.3	5.8	6.3	6.6
-20 to 0	3.4	3.5	3.7	3.8	3.9	4.1	4.1	4.2	4.4	4.7	5.2	5.2	5.7	6.2	6.5
-40 to -20	3.5	3.5	3.7	3.9	4.0	4.1	4.2	4.2	4.4	4.7	5.2	5.2	5.7	6.2	6.5
-60 to -40 (ref.)	3.6	3.7	3.9	4.0	4.1	4.3	4.3	4.4	4.6	4.8	5.3	5.4	5.8	6.3	6.6
-70 to -60 (ref.)	3.8	3.9	4.1	4.2	4.3	4.5	4.5	4.5	4.8	5.0	5.5	5.5	6.0	6.4	6.7

Absolute Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90	2.8	2.9	3.1	3.2	3.4	3.5	3.6	3.6	3.9	4.1	4.7	4.7	5.3	5.8	6.1
60 to 80	2.6	2.7	2.9	3.0	3.1	3.3	3.3	3.4	3.6	3.9	4.4	4.5	5.0	5.5	5.9
40 to 60	2.3	2.4	2.6	2.7	2.8	3.0	3.0	3.1	3.3	3.6	4.1	4.1	4.7	5.1	5.5
20 to 40	2.0	2.1	2.2	2.4	2.5	2.7	2.7	2.8	3.0	3.2	3.7	3.8	4.3	4.8	5.1
0 to 20	1.7	1.8	1.9	2.1	2.2	2.3	2.4	2.4	2.7	2.9	3.4	3.5	3.9	4.4	4.7
-20 to 0	1.4	1.5	1.6	1.8	1.9	2.0	2.1	2.1	2.3	2.6	3.1	3.1	3.6	4.0	4.3
-40 to -20	1.1	1.2	1.3	1.5	1.6	1.7	1.8	1.8	2.0	2.2	2.7	2.8	3.2	3.7	4.0
-60 to -40	0.8	0.9	1.0	1.1	1.3	1.4	1.4	1.5	1.7	1.9	2.4	2.4	2.9	3.3	3.6
-70 to -60	0.6	0.6	0.8	0.9	1.0	1.2	1.2	1.2	1.4	1.7	2.1	2.2	2.6	3.0	3.3

Coef. disp. form. (frac. eq.)(ref.)	
P1	1.09786177E-01
Q1	6.93481767E+01
P2	2.36064082E-02
Q2	3.22011336E-02
P3	3.90622283E-01
Q3	5.76163595E-03

Fitting error of disp. form. σ [1E-6]		
	Visible	Infrared
Power ser. eq.	0.8	9.7
Frac. eq. (ref.)	0.8	10.0

Prod. Freq. (A to D)	B

Similar glass type			
OHARA	S-LAH64	HOYA	TAF4
CDGM	H-LaF10LA	SCHOTT	N-LAF21

2022-7-1	StP, AP, SP
2019-4-1	Transmittance
2015-4-1	Color Code, Similar glass type

HIKARI GLASS CO., LTD.

J-LASF015

n_d = 1.804000 n_e = 1.808106

ν_d = 46.60 ν_e = 46.35

Glass code (d)
804466
Glass code (e)
808464

Spectral l.	Refractive idx
2.058	1.76695
1.970	1.76858
1.530	1.77612
1.129	1.78310
1.064	1.78442
t	1.78553
s	1.78994
A'	1.793033
r	1.795917
C	1.798824
C'	1.799643
He-Ne	1.800408
D	1.803847
d	1.804000
e	1.808106
F	1.816078
F'	1.817079
g	1.825697
h	1.833795
0.389	1.838784
i	1.847835

Coef. disp. form. (pwr ser.)	
A0	3.17452404E+00
A1	-1.32156517E-02
A2	-1.65919934E-04
A3	2.76472367E-02
A4	4.83338934E-04
A5	1.20380702E-05
A6	6.02649728E-07
A7	0.00000000E+00
A8	0.00000000E+00

Partial dispersion	
F-C	0.017254
F'-C'	0.017436
C-t	0.013293
C-A'	0.005791
d-C	0.005176
e-C	0.009282
g-d	0.021697
g-F	0.009619
h-g	0.008098
i-g	0.022138
C'-t	0.014112
e-C'	0.008463
F'-e	0.008973
i-F'	0.030756

Relative partial dispersion	
C-t／F-C	0.7704
C-A'／F-C	0.3356
d-C／F-C	0.3000
e-C／F-C	0.5380
g-d／F-C	1.2575
g-F／F-C	0.5575
h-g／F-C	0.4693
i-g／F-C	1.2831
C'-t／F'-C'	0.8094
e-C'／F'-C'	0.4854
F'-e／F'-C'	0.5146
i-F'／F'-C'	1.7639

Deviation of relative partial disp.	
ΔPdC	0.0018
ΔPgF	-0.0087

Internal CC (80%/5%)
355/312
Color Code (80%/5%)
385/315

CCI	
B	0.00
G	0.53
R	0.54

Thermal properties	
CTE(-30,70) [1E-7/℃]	60
CTE(100,300) [1E-7/℃]	75
Tg [℃]	697
At [℃]	728
StP [℃]	653
AP [℃]	683
SP [℃]	785
Ht cndct. [W/m･K]	0.834
Sp. heat [kJ/kg･K]	0.470
Ht diffus. [1E-6 m2/sec]	0.387

Chemical properties [class]	
Acid res. (surface)	1
Alkaline detergent res.	1
Climate resistance	1
Water res. (powder)	1
Acid res. (powder)	3

Mechanical properties	
Knoop hardness	670 (7)
Abrasion hardness	64
Young's mod. [GPa]	119.6
Shear mod. [GPa]	46.1
Poisson's ratio	0.298
Stress optical coef. [1E-5 nm/cm／Pa]	1.43

Internal trans. (10mm)	
λ [nm]	τ
280	-
290	-
300	-
310	0.03
320	0.16
330	0.39
340	0.60
350	0.75
360	0.85
370	0.907
380	0.942
390	0.962
400	0.975
420	0.985
440	0.989
460	0.992
480	0.995
500	0.996
550	0.998
600	0.998
650	0.998
700	0.999
800	0.997
900	0.995
1000	0.996
1200	0.998
1400	0.997
1600	0.993
1800	0.986
2000	0.969
2200	0.923
2400	0.74

Specific gravity
4.57

Relative Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90 (ref.)	3.5	3.6	3.8	4.0	4.1	4.3	4.4	4.4	4.7	5.0	5.6	5.6	6.3	6.9	7.4
60 to 80 (ref.)	3.4	3.5	3.7	3.9	4.0	4.2	4.2	4.3	4.5	4.8	5.4	5.5	6.1	6.8	7.3
40 to 60	3.3	3.4	3.6	3.7	3.9	4.1	4.1	4.2	4.4	4.7	5.3	5.3	5.9	6.6	7.0
20 to 40	3.2	3.3	3.5	3.7	3.8	4.0	4.0	4.1	4.3	4.6	5.1	5.2	5.8	6.4	6.8
0 to 20	3.2	3.3	3.5	3.6	3.7	3.9	3.9	4.0	4.2	4.5	5.0	5.1	5.7	6.2	6.7
-20 to 0	3.2	3.3	3.5	3.6	3.7	3.9	3.9	4.0	4.2	4.5	5.0	5.1	5.6	6.2	6.6
-40 to -20	3.3	3.4	3.6	3.7	3.8	4.0	4.0	4.1	4.3	4.5	5.0	5.1	5.6	6.2	6.6
-60 to -40 (ref.)	3.5	3.6	3.8	3.9	4.0	4.1	4.2	4.2	4.4	4.7	5.2	5.2	5.7	6.3	6.7
-70 to -60 (ref.)	3.7	3.8	4.0	4.1	4.2	4.4	4.4	4.4	4.6	4.9	5.4	5.4	5.9	6.4	6.8

Absolute Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90	2.4	2.5	2.7	2.9	3.0	3.2	3.2	3.3	3.5	3.8	4.4	4.5	5.1	5.8	6.3
60 to 80	2.2	2.3	2.5	2.7	2.8	3.0	3.0	3.1	3.3	3.6	4.2	4.2	4.9	5.5	6.0
40 to 60	1.9	2.0	2.2	2.4	2.5	2.7	2.7	2.8	3.0	3.3	3.9	3.9	4.5	5.1	5.6
20 to 40	1.7	1.8	2.0	2.1	2.2	2.4	2.4	2.5	2.7	3.0	3.5	3.6	4.2	4.7	5.2
0 to 20	1.4	1.5	1.7	1.8	2.0	2.1	2.2	2.2	2.4	2.7	3.2	3.3	3.8	4.4	4.8
-20 to 0	1.2	1.2	1.4	1.6	1.7	1.8	1.9	1.9	2.1	2.4	2.9	2.9	3.5	4.0	4.4
-40 to -20	0.9	1.0	1.2	1.3	1.4	1.5	1.6	1.6	1.8	2.1	2.5	2.6	3.1	3.6	4.0
-60 to -40	0.6	0.7	0.9	1.0	1.1	1.2	1.3	1.3	1.5	1.8	2.2	2.3	2.7	3.2	3.6
-70 to -60	0.4	0.5	0.7	0.8	0.9	1.0	1.1	1.1	1.3	1.5	2.0	2.0	2.5	3.0	3.3

Coef. disp. form. (frac. eq.)(ref.)	
P1	1.10686191E-01
Q1	7.43053260E+01
P2	2.71367682E-02
Q2	3.09494207E-02
P3	3.93128419E-01
Q3	5.72630320E-03

Fitting error of disp. form. σ [1E-6]		
	Visible	Infrared
Power ser. eq.	0.8	3.9
Frac. eq. (ref.)	0.9	4.0

Prod. Freq. (A to D)	A

Similar glass type			
OHARA	S-LAH65VS	HOYA	TAF3
CDGM	H-ZLaF50E	SCHOTT	N-LASF44

2022-7-1	StP, AP, SP
2020-4-1	Similar glass type
2019-4-1	Transmittance

HIKARI GLASS CO., LTD.

J-LASF015HS

n_d = 1.804000 n_e = 1.808106

ν_d = 46.60 ν_e = 46.35

Glass code (d)
804466
Glass code (e)
808464

Spectral l.	Refractive idx
2.058	1.76695
1.970	1.76858
1.530	1.77612
1.129	1.78310
1.064	1.78442
t	1.78553
s	1.78994
A'	1.793033
r	1.795917
C	1.798824
C'	1.799643
He-Ne	1.800408
D	1.803847
d	1.804000
e	1.808106
F	1.816078
F'	1.817079
g	1.825697
h	1.833795
0.389	1.838784
i	1.847835

Coef. disp. form. (pwr ser.)	
A0	3.17452404E+00
A1	-1.32156517E-02
A2	-1.65919934E-04
A3	2.76472367E-02
A4	4.83338934E-04
A5	1.20380702E-05
A6	6.02649728E-07
A7	0.00000000E+00
A8	0.00000000E+00

Partial dispersion	
F-C	0.017254
F'-C'	0.017436
C-t	0.013293
C-A'	0.005791
d-C	0.005176
e-C	0.009282
g-d	0.021697
g-F	0.009619
h-g	0.008098
i-g	0.022138
C'-t	0.014112
e-C'	0.008463
F'-e	0.008973
i-F'	0.030756

Relative partial dispersion	
C-t／F-C	0.7704
C-A'／F-C	0.3356
d-C／F-C	0.3000
e-C／F-C	0.5380
g-d／F-C	1.2575
g-F／F-C	0.5575
h-g／F-C	0.4693
i-g／F-C	1.2831
C'-t／F'-C'	0.8094
e-C'／F'-C'	0.4854
F'-e／F'-C'	0.5146
i-F'／F'-C'	1.7639

Deviation of relative partial disp.	
ΔPdC	0.0018
ΔPgF	-0.0087

Internal CC (80%/5%)
347/311
Color Code (80%/5%)
380/310

CCI	
B	0.00
G	0.45
R	0.46

Thermal properties	
CTE(-30,70) [1E-7/℃]	60
CTE(100,300) [1E-7/℃]	75
Tg [℃]	697
At [℃]	728
StP [℃]	653
AP [℃]	683
SP [℃]	785
Ht cndct. [W/m･K]	0.834
Sp. heat [kJ/kg･K]	0.470
Ht diffus. [1E-6 m2/sec]	0.387

Chemical properties [class]	
Acid res. (surface)	1
Alkaline detergent res.	1
Climate resistance	1
Water res. (powder)	1
Acid res. (powder)	3

Mechanical properties	
Knoop hardness	670 (7)
Abrasion hardness	64
Young's mod. [GPa]	119.6
Shear mod. [GPa]	46.1
Poisson's ratio	0.298
Stress optical coef. [1E-5 nm/cm／Pa]	1.43

Internal trans. (10mm)	
λ [nm]	τ
280	–
290	–
300	–
310	0.04
320	0.26
330	0.52
340	0.71
350	0.83
360	0.89
370	0.933
380	0.957
390	0.971
400	0.979
420	0.987
440	0.991
460	0.994
480	0.996
500	0.998
550	0.999
600	0.999
650	0.999
700	0.999
800	0.999
900	0.998
1000	0.999
1200	0.999
1400	0.996
1600	0.994
1800	0.980
2000	0.956
2200	0.88
2400	0.70

Specific gravity
4.57

Relative Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90 (ref.)	3.5	3.6	3.8	4.0	4.1	4.3	4.4	4.4	4.7	5.0	5.6	5.6	6.3	6.9	7.4
60 to 80 (ref.)	3.4	3.5	3.7	3.9	4.0	4.2	4.2	4.3	4.5	4.8	5.4	5.5	6.1	6.8	7.3
40 to 60	3.3	3.4	3.6	3.7	3.9	4.1	4.1	4.2	4.4	4.7	5.3	5.3	5.9	6.6	7.0
20 to 40	3.2	3.3	3.5	3.7	3.8	4.0	4.0	4.1	4.3	4.6	5.1	5.2	5.8	6.4	6.8
0 to 20	3.2	3.3	3.5	3.6	3.7	3.9	3.9	4.0	4.2	4.5	5.0	5.1	5.7	6.2	6.7
-20 to 0	3.2	3.3	3.5	3.6	3.7	3.9	3.9	4.0	4.2	4.5	5.0	5.1	5.6	6.2	6.6
-40 to -20	3.3	3.4	3.6	3.7	3.8	4.0	4.0	4.1	4.3	4.5	5.0	5.1	5.6	6.2	6.6
-60 to -40 (ref.)	3.5	3.6	3.8	3.9	4.0	4.1	4.2	4.2	4.4	4.7	5.2	5.2	5.7	6.3	6.7
-70 to -60 (ref.)	3.7	3.8	4.0	4.1	4.2	4.4	4.4	4.4	4.6	4.9	5.4	5.4	5.9	6.4	6.8

Absolute Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90	2.4	2.5	2.7	2.9	3.0	3.2	3.2	3.3	3.5	3.8	4.4	4.5	5.1	5.8	6.3
60 to 80	2.2	2.3	2.5	2.7	2.8	3.0	3.0	3.1	3.3	3.6	4.2	4.2	4.9	5.5	6.0
40 to 60	1.9	2.0	2.2	2.4	2.5	2.7	2.7	2.8	3.0	3.3	3.9	3.9	4.5	5.1	5.6
20 to 40	1.7	1.8	2.0	2.1	2.2	2.4	2.4	2.5	2.7	3.0	3.5	3.6	4.2	4.7	5.2
0 to 20	1.4	1.5	1.7	1.8	2.0	2.1	2.2	2.2	2.4	2.7	3.2	3.3	3.8	4.4	4.8
-20 to 0	1.2	1.2	1.4	1.6	1.7	1.8	1.9	1.9	2.1	2.4	2.9	2.9	3.5	4.0	4.4
-40 to -20	0.9	1.0	1.2	1.3	1.4	1.5	1.6	1.6	1.8	2.1	2.5	2.6	3.1	3.6	4.0
-60 to -40	0.6	0.7	0.9	1.0	1.1	1.2	1.3	1.3	1.5	1.8	2.2	2.3	2.7	3.2	3.6
-70 to -60	0.4	0.5	0.7	0.8	0.9	1.0	1.1	1.1	1.3	1.5	2.0	2.0	2.5	3.0	3.3

Coef. disp. form. (frac. eq.)(ref.)	
P1	1.10686191E-01
Q1	7.43053260E+01
P2	2.71367682E-02
Q2	3.09494207E-02
P3	3.93128419E-01
Q3	5.72630320E-03

Fitting error of disp. form. σ [1E-6]		
	Visible	Infrared
Power ser. eq.	0.8	3.9
Frac. eq. (ref.)	0.9	4.0

Prod. Freq. (A to D)	A

Similar glass type			
OHARA	S-LAH65VS	HOYA	TAF3
CDGM	H-ZLaF50E	SCHOTT	N-LASF44

2022-7-1	StP, AP, SP
2020-4-1	Similar glass type
2019-4-1	1st edition

HIKARI GLASS CO., LTD.

J-LASF016

n_d = 1.772500 n_e = 1.776208

ν_d = 49.62 ν_e = 49.38

Glass code (d)
773496
Glass code (e)
776494

Spectral l.	Refractive idx
2.058	1.73631
1.970	1.73805
1.530	1.74600
1.129	1.75307
1.064	1.75436
t	1.75544
s	1.75961
A'	1.762492
r	1.765146
C	1.767801
C'	1.768547
He-Ne	1.769243
D	1.772362
d	1.772500
e	1.776208
F	1.783370
F'	1.784266
g	1.791961
h	1.799154
0.389	1.803567
i	1.811540

Partial dispersion	
F-C	0.015569
F'-C'	0.015719
C-t	0.012365
C-A'	0.005309
d-C	0.004699
e-C	0.008407
g-d	0.019461
g-F	0.008591
h-g	0.007193
i-g	0.019579
C'-t	0.013111
e-C'	0.007661
F'-e	0.008058
i-F'	0.027274

Relative partial dispersion	
C-t／F-C	0.7942
C-A'／F-C	0.3410
d-C／F-C	0.3018
e-C／F-C	0.5400
g-d／F-C	1.2500
g-F／F-C	0.5518
h-g／F-C	0.4620
i-g／F-C	1.2576
C'-t／F'-C'	0.8341
e-C'／F'-C'	0.4874
F'-e／F'-C'	0.5126
i-F'／F'-C'	1.7351

Deviation of relative partial disp.	
ΔPdC	0.0022
ΔPgF	−0.0093

Internal CC (80%/5%)
348/302
Color Code (80%/5%)
375/305

CCI	
B	0.00
G	0.33
R	0.34

Thermal properties	
CTE(−30,70) [1E-7/℃]	55
CTE(100,300) [1E-7/℃]	71
Tg [℃]	669
At [℃]	697
StP [℃]	623
AP [℃]	651
SP [℃]	747
Ht cndct. [W/m·K]	0.826
Sp. heat [kJ/kg·K]	0.494
Ht diffus. [1E-6 m2/sec]	0.393

Chemical properties [class]	
Acid res. (surface)	1
Alkaline detergent res.	2
Climate resistance	1
Water res. (powder)	1
Acid res. (powder)	4

Mechanical properties	
Knoop hardness	715 (7)
Abrasion hardness	57
Young's mod. [GPa]	120.0
Shear mod. [GPa]	46.3
Poisson's ratio	0.295
Stress optical coef. [1E-5 nm/cm／Pa]	1.71

Internal trans. (10mm)	
λ [nm]	τ
280	–
290	–
300	0.03
310	0.15
320	0.37
330	0.57
340	0.72
350	0.82
360	0.89
370	0.934
380	0.960
390	0.973
400	0.982
420	0.990
440	0.993
460	0.995
480	0.996
500	0.998
550	0.998
600	0.998
650	0.998
700	0.999
800	0.999
900	0.999
1000	0.999
1200	0.999
1400	0.998
1600	0.990
1800	0.976
2000	0.951
2200	0.87
2400	0.63

Specific gravity
4.26

Coef. disp. form. (pwr ser.)	
A0	3.07219058E+00
A1	−1.42144846E-02
A2	−1.67817254E-04
A3	2.44174902E-02
A4	4.25680243E-04
A5	6.77243763E-06
A6	4.02219194E-07
A7	0.00000000E+00
A8	0.00000000E+00

Relative Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90 (ref.)	4.2	4.3	4.4	4.6	4.7	4.9	4.9	5.0	5.2	5.5	6.0	6.0	6.6	7.1	7.5
60 to 80 (ref.)	4.1	4.1	4.3	4.5	4.6	4.8	4.8	4.9	5.1	5.3	5.8	5.9	6.4	7.0	7.4
40 to 60	4.0	4.0	4.2	4.3	4.5	4.6	4.7	4.7	4.9	5.2	5.7	5.7	6.2	6.8	7.2
20 to 40	3.9	3.9	4.1	4.2	4.4	4.5	4.6	4.6	4.8	5.1	5.5	5.6	6.1	6.6	7.0
0 to 20	3.8	3.9	4.0	4.2	4.3	4.5	4.5	4.5	4.7	5.0	5.5	5.5	6.0	6.5	6.9
−20 to 0	3.8	3.9	4.0	4.2	4.3	4.4	4.5	4.5	4.7	5.0	5.4	5.5	6.0	6.5	6.9
−40 to −20	3.9	4.0	4.1	4.2	4.4	4.5	4.6	4.6	4.8	5.0	5.5	5.5	6.0	6.5	6.9
−60 to −40 (ref.)	4.1	4.1	4.3	4.4	4.5	4.7	4.7	4.8	4.9	5.2	5.6	5.7	6.1	6.6	7.0
−70 to −60 (ref.)	4.3	4.3	4.5	4.6	4.7	4.9	4.9	5.0	5.2	5.4	5.8	5.9	6.3	6.8	7.2

Absolute Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90	3.1	3.2	3.3	3.5	3.6	3.8	3.8	3.9	4.1	4.3	4.8	4.9	5.4	6.0	6.4
60 to 80	2.9	3.0	3.1	3.3	3.4	3.6	3.6	3.7	3.9	4.1	4.6	4.7	5.2	5.7	6.1
40 to 60	2.6	2.7	2.9	3.0	3.1	3.3	3.3	3.4	3.6	3.8	4.3	4.4	4.9	5.4	5.8
20 to 40	2.4	2.4	2.6	2.7	2.8	3.0	3.0	3.1	3.3	3.5	4.0	4.0	4.5	5.0	5.4
0 to 20	2.1	2.1	2.3	2.4	2.5	2.7	2.7	2.8	3.0	3.2	3.7	3.7	4.2	4.7	5.1
−20 to 0	1.8	1.9	2.0	2.1	2.3	2.4	2.4	2.5	2.7	2.9	3.4	3.4	3.9	4.3	4.7
−40 to −20	1.5	1.6	1.7	1.9	2.0	2.1	2.2	2.2	2.4	2.6	3.0	3.1	3.5	4.0	4.4
−60 to −40	1.3	1.3	1.5	1.6	1.7	1.8	1.9	1.9	2.1	2.3	2.7	2.8	3.2	3.7	4.0
−70 to −60	1.1	1.1	1.3	1.4	1.5	1.6	1.6	1.7	1.9	2.1	2.5	2.5	3.0	3.4	3.8

Coef. disp. form. (frac. eq.)(ref.)	
P1	1.20365489E-01
Q1	7.25421180E+01
P2	5.80216137E-02
Q2	2.18135490E-02
P3	3.50533101E-01
Q3	4.51892348E-03

Fitting error of disp. form. σ [1E-6]		
	Visible	Infrared
Power ser. eq.	0.6	2.4
Frac. eq. (ref.)	0.6	2.1

Prod. Freq. (A to D)	A

Similar glass type			
OHARA	S-LAH66	HOYA	TAF1
CDGM	H-LaF50B	SCHOTT	N-LAF34

2022-7-1	StP, AP, SP
2019-4-1	Transmittance
2015-4-1	Color Code, Similar glass type

HIKARI GLASS CO., LTD.

J-LASF017

n_d = 1.795000 n_e = 1.799174

ν_d = 45.31 ν_e = 45.06

Glass code (d)
795453
Glass code (e)
799451

Spectral l.	Refractive idx
2.058	1.75641
1.970	1.75817
1.530	1.76627
1.129	1.77364
1.064	1.77501
t	1.77616
s	1.78069
A'	1.783853
r	1.786787
C	1.789742
C'	1.790573
He-Ne	1.791351
D	1.794845
d	1.795000
e	1.799174
F	1.807287
F'	1.808308
g	1.817109
h	1.825410
0.389	1.830542
i	1.839897

Partial dispersion	
F-C	0.017545
F'-C'	0.017735
C-t	0.013577
C-A'	0.005889
d-C	0.005258
e-C	0.009432
g-d	0.022109
g-F	0.009822
h-g	0.008301
i-g	0.022788
C'-t	0.014408
e-C'	0.008601
F'-e	0.009134
i-F'	0.031589

Relative partial dispersion	
C-t／F-C	0.7738
C-A'／F-C	0.3357
d-C／F-C	0.2997
e-C／F-C	0.5376
g-d／F-C	1.2601
g-F／F-C	0.5598
h-g／F-C	0.4731
i-g／F-C	1.2988
C'-t／F'-C'	0.8124
e-C'／F'-C'	0.4850
F'-e／F'-C'	0.5150
i-F'／F'-C'	1.7812

Deviation of relative partial disp.	
ΔPdC	0.0020
ΔPgF	−0.0085

Internal CC (80%/5%)
364/321
Color Code (80%/5%)
395/320
CCI

B	0.00
G	0.83
R	0.86

Thermal properties	
CTE(−30,70) [1E-7/℃]	64
CTE(100,300) [1E-7/℃]	71
Tg [℃]	660
At [℃]	686
StP [℃]	615
AP [℃]	643
SP [℃]	740
Ht cndct. [W/m·K]	0.881
Sp. heat [kJ/kg·K]	0.502
Ht diffus. [1E-6 m2/sec]	0.405

Chemical properties [class]	
Acid res. (surface)	1
Alkaline detergent res.	2
Climate resistance	1
Water res. (powder)	1
Acid res. (powder)	4

Mechanical properties	
Knoop hardness	707 (7)
Abrasion hardness	61
Young's mod. [GPa]	118.6
Shear mod. [GPa]	45.7
Poisson's ratio	0.297
Stress optical coef. [1E-5 nm/cm／Pa]	1.74

Internal trans. (10mm)	
λ [nm]	τ
280	–
290	–
300	–
310	–
320	0.04
330	0.18
340	0.40
350	0.61
360	0.76
370	0.85
380	0.909
390	0.941
400	0.959
420	0.978
440	0.985
460	0.989
480	0.993
500	0.996
550	0.998
600	0.999
650	0.999
700	0.999
800	0.998
900	0.997
1000	0.997
1200	0.997
1400	0.995
1600	0.990
1800	0.979
2000	0.960
2200	0.89
2400	0.67

Specific gravity
4.34

Coef. disp. form. (pwr ser.)	
A0	3.14264424E+00
A1	−1.44687256E-02
A2	−1.59589924E-04
A3	2.73342436E-02
A4	6.08068420E-04
A5	1.80054470E-07
A6	1.58176253E-06
A7	0.00000000E+00
A8	0.00000000E+00

Relative Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90 (ref.)	4.7	4.7	4.8	5.1	5.3	5.5	5.5	5.6	5.8	6.1	6.7	6.8	7.6	8.4	8.8
60 to 80 (ref.)	4.5	4.5	4.7	4.9	5.1	5.3	5.3	5.4	5.6	5.9	6.5	6.6	7.3	8.1	8.5
40 to 60	4.3	4.3	4.5	4.7	4.9	5.0	5.1	5.2	5.4	5.7	6.2	6.3	7.0	7.7	8.2
20 to 40	4.1	4.1	4.3	4.5	4.7	4.8	4.9	4.9	5.2	5.4	6.0	6.1	6.7	7.4	7.9
0 to 20	4.0	4.0	4.2	4.3	4.5	4.7	4.7	4.8	5.0	5.2	5.8	5.8	6.5	7.2	7.6
−20 to 0	3.9	3.9	4.1	4.2	4.4	4.6	4.6	4.7	4.9	5.1	5.6	5.7	6.3	7.0	7.4
−40 to −20	3.9	3.9	4.1	4.2	4.4	4.5	4.6	4.6	4.8	5.1	5.5	5.6	6.2	6.8	7.2
−60 to −40 (ref.)	4.0	4.0	4.2	4.3	4.5	4.6	4.7	4.7	4.9	5.1	5.6	5.6	6.2	6.8	7.2
−70 to −60 (ref.)	4.1	4.2	4.3	4.4	4.6	4.7	4.8	4.8	5.0	5.2	5.7	5.7	6.3	6.9	7.2

Absolute Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90	3.6	3.6	3.8	4.0	4.2	4.4	4.4	4.5	4.7	5.0	5.6	5.7	6.4	7.2	7.6
60 to 80	3.3	3.3	3.5	3.7	3.9	4.1	4.1	4.2	4.4	4.7	5.3	5.3	6.1	6.8	7.3
40 to 60	2.9	3.0	3.1	3.3	3.5	3.7	3.7	3.8	4.0	4.3	4.8	4.9	5.6	6.3	6.7
20 to 40	2.6	2.6	2.8	2.9	3.1	3.3	3.3	3.4	3.6	3.9	4.4	4.5	5.1	5.8	6.2
0 to 20	2.2	2.2	2.4	2.6	2.7	2.9	2.9	3.0	3.2	3.4	3.9	4.0	4.7	5.3	5.7
−20 to 0	1.9	1.9	2.0	2.2	2.4	2.5	2.6	2.6	2.8	3.0	3.5	3.6	4.2	4.8	5.2
−40 to −20	1.5	1.5	1.7	1.8	2.0	2.1	2.2	2.2	2.4	2.6	3.1	3.1	3.7	4.3	4.7
−60 to −40	1.2	1.2	1.3	1.4	1.6	1.7	1.8	1.8	2.0	2.2	2.6	2.7	3.3	3.8	4.1
−70 to −60	0.9	0.9	1.0	1.2	1.3	1.4	1.5	1.5	1.7	1.9	2.3	2.4	2.9	3.4	3.8

Coef. disp. form. (frac. eq.)(ref.)	
P1	1.13511476E-01
Q1	6.97040915E+01
P2	2.39810663E-02
Q2	3.50738448E-02
P3	3.92647816E-01
Q3	5.82130127E-03

Fitting error of disp. form. σ [1E-6]		
	Visible	Infrared
Power ser. eq.	0.7	5.9
Frac. eq. (ref.)	0.7	8.3

Prod. Freq. (A to D)	B

Similar glass type			
OHARA	–	HOYA	TAF2
CDGM	–	SCHOTT	–

2022-7-1	StP, AP, SP
2019-4-1	Transmittance
2015-4-1	Color Code, Prod. Freq.

J-LASF021

n_d = 1.850260 n_e = 1.856474

ν_d = 32.35 ν_e = 32.11

Glass code (d)
850324
Glass code (e)
856321

Spectral l.	Refractive idx
2.058	1.80323
1.970	1.80489
1.530	1.81290
1.129	1.82107
1.064	1.82273
t	1.82415
s	1.83001
A'	1.834300
r	1.838396
C	1.842602
C'	1.843800
He-Ne	1.844925
D	1.850031
d	1.850260
e	1.856474
F	1.868883
F'	1.870475
g	1.884512
h	1.898302
0.389	1.907144
i	–

Partial dispersion	
F-C	0.026281
F'-C'	0.026675
C-t	0.018451
C-A'	0.008302
d-C	0.007658
e-C	0.013872
g-d	0.034252
g-F	0.015629
h-g	0.013790
i-g	–
C'-t	0.019649
e-C'	0.012674
F'-e	0.014001
i-F'	–

Relative partial dispersion	
C-t／F-C	0.7021
C-A'／F-C	0.3159
d-C／F-C	0.2914
e-C／F-C	0.5278
g-d／F-C	1.3033
g-F／F-C	0.5947
h-g／F-C	0.5247
i-g／F-C	–
C'-t／F'-C'	0.7366
e-C'／F'-C'	0.4751
F'-e／F'-C'	0.5249
i-F'／F'-C'	–

Deviation of relative partial disp.	
ΔPdC	−0.0004
ΔPgF	0.0046

Internal CC (80%/5%)
398/360
Color Code (70%/5%)
410/360

CCI	
B	–
G	–
R	–

Thermal properties	
CTE(−30,70) [1E-7/℃]	70
CTE(100,300) [1E-7/℃]	85
Tg [℃]	618
At [℃]	660
StP [℃]	577
AP [℃]	610
SP [℃]	722
Ht cndct. [W/m·K]	0.735
Sp. heat [kJ/kg·K]	0.500
Ht diffus. [1E-6 m2/sec]	0.336

Chemical properties [class]	
Acid res. (surface)	1
Alkaline detergent res.	1
Climate resistance	1
Water res. (powder)	1
Acid res. (powder)	3

Mechanical properties	
Knoop hardness	531 (5)
Abrasion hardness	104
Young's mod. [GPa]	104.6
Shear mod. [GPa]	40.3
Poisson's ratio	0.298
Stress optical coef. [1E-5 nm/cm／Pa]	1.76

Internal trans. (10mm)	
λ [nm]	τ
280	–
290	–
300	–
310	–
320	–
330	–
340	–
350	–
360	0.04
370	0.31
380	0.58
390	0.73
400	0.82
420	0.900
440	0.936
460	0.956
480	0.969
500	0.978
550	0.990
600	0.991
650	0.991
700	0.993
800	0.995
900	0.996
1000	0.996
1200	0.996
1400	0.998
1600	0.989
1800	0.980
2000	0.965
2200	0.918
2400	0.78

Specific gravity
4.37

Coef. disp. form. (pwr ser.)	
A0	3.30477446E+00
A1	−1.45925795E-02
A2	0.00000000E+00
A3	3.59916632E-02
A4	3.49591839E-03
A5	−7.43189237E-04
A6	1.55265866E-04
A7	−1.52961037E-05
A8	6.59677491E-07

Relative Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90 (ref.)	2.7	2.8	3.1	3.4	3.7	4.0	4.1	4.2	4.6	5.2	6.4	6.6	8.2	10.0	11.4
60 to 80 (ref.)	2.6	2.7	3.0	3.3	3.5	3.8	3.9	4.0	4.4	5.0	6.2	6.3	7.9	9.6	10.9
40 to 60	2.5	2.5	2.8	3.1	3.3	3.6	3.7	3.8	4.2	4.7	5.8	6.0	7.5	9.1	10.3
20 to 40	2.3	2.4	2.7	2.9	3.2	3.4	3.5	3.6	4.0	4.5	5.6	5.7	7.1	8.6	9.8
0 to 20	2.2	2.3	2.6	2.8	3.0	3.3	3.4	3.5	3.8	4.3	5.3	5.4	6.7	8.2	9.3
−20 to 0	2.2	2.3	2.5	2.7	3.0	3.2	3.3	3.4	3.7	4.2	5.1	5.3	6.5	7.8	8.8
−40 to −20	2.3	2.3	2.6	2.8	3.0	3.2	3.3	3.3	3.7	4.1	5.0	5.1	6.3	7.6	8.5
−60 to −40 (ref.)	2.4	2.5	2.7	2.9	3.1	3.3	3.4	3.4	3.8	4.2	5.0	5.1	6.2	7.4	8.2
−70 to −60 (ref.)	2.6	2.7	2.9	3.1	3.3	3.5	3.5	3.6	3.9	4.3	5.1	5.2	6.2	7.3	8.1

Absolute Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90	1.6	1.7	2.0	2.3	2.6	2.9	3.0	3.0	3.5	4.0	5.3	5.4	7.0	8.8	10.2
60 to 80	1.4	1.5	1.8	2.0	2.3	2.6	2.7	2.8	3.2	3.7	4.9	5.0	6.6	8.3	9.6
40 to 60	1.1	1.2	1.4	1.7	1.9	2.2	2.3	2.4	2.8	3.3	4.4	4.6	6.0	7.6	8.8
20 to 40	0.8	0.8	1.1	1.3	1.6	1.8	1.9	2.0	2.4	2.9	3.9	4.1	5.4	7.0	8.1
0 to 20	0.4	0.5	0.8	1.0	1.2	1.5	1.5	1.6	2.0	2.4	3.4	3.6	4.8	6.3	7.3
−20 to 0	0.1	0.2	0.4	0.6	0.9	1.1	1.2	1.2	1.6	2.0	2.9	3.1	4.3	5.6	6.6
−40 to −20	−0.2	−0.1	0.1	0.3	0.5	0.7	0.8	0.9	1.2	1.6	2.5	2.6	3.7	4.9	5.8
−60 to −40	−0.5	−0.4	−0.2	−0.1	0.1	0.3	0.4	0.5	0.8	1.2	2.0	2.1	3.1	4.3	5.1
−70 to −60	−0.7	−0.7	−0.5	−0.3	−0.1	0.1	0.1	0.2	0.5	0.8	1.6	1.7	2.7	3.8	4.5

Coef. disp. form. (frac. eq.)(ref.)	
P1	1.02088736E-01
Q1	7.18066986E+01
P2	2.16492298E-02
Q2	5.59339860E-02
P3	4.12483323E-01
Q3	7.38988329E-03

Fitting error of disp. form. σ [1E-6]		
	Visible	Infrared
Power ser. eq.	1.0	6.6
Frac. eq. (ref.)	1.3	10.8

Prod. Freq. (A to D)	A

Similar glass type			
OHARA	S-LAH71	HOYA	–
CDGM	H-ZLaF71	SCHOTT	N-LASF9

2022-7-1	StP, AP, SP
2019-4-1	Transmittance
2015-4-1	Color Code, Similar glass type, Please see the revision history about others.

HIKARI GLASS CO., LTD.

J-LASF021HS

n_d = 1.850260 n_e = 1.856474

ν_d = 32.35 ν_e = 32.11

Glass code (d)
850324
Glass code (e)
856321

Spectral l.	Refractive idx
2.058	1.80323
1.970	1.80489
1.530	1.81290
1.129	1.82107
1.064	1.82273
t	1.82415
s	1.83001
A'	1.834300
r	1.838396
C	1.842602
C'	1.843800
He-Ne	1.844925
D	1.850031
d	1.850260
e	1.856474
F	1.868883
F'	1.870475
g	1.884512
h	1.898302
0.389	1.907144
i	–

Coef. disp. form. (pwr ser.)	
A0	3.30477446E+00
A1	-1.45925795E-02
A2	0.00000000E+00
A3	3.59916632E-02
A4	3.49591839E-03
A5	-7.43189237E-04
A6	1.55265866E-04
A7	-1.52961037E-05
A8	6.59677491E-07

Partial dispersion	
F-C	0.026281
F'-C'	0.026675
C-t	0.018451
C-A'	0.008302
d-C	0.007658
e-C	0.013872
g-d	0.034252
g-F	0.015629
h-g	0.013790
i-g	–
C'-t	0.019649
e-C'	0.012674
F'-e	0.014001
i-F'	–

Relative partial dispersion	
C-t／F-C	0.7021
C-A'／F-C	0.3159
d-C／F-C	0.2914
e-C／F-C	0.5278
g-d／F-C	1.3033
g-F／F-C	0.5947
h-g／F-C	0.5247
i-g／F-C	–
C'-t／F'-C'	0.7366
e-C'／F'-C'	0.4751
F'-e／F'-C'	0.5249
i-F'／F'-C'	–

Deviation of relative partial disp.	
ΔPdC	-0.0004
ΔPgF	0.0046

Internal CC (80%/5%)
389/357
Color Code (70%/5%)
395/355

CCI	
B	0.00
G	2.28
R	2.40

Thermal properties	
CTE(-30,70) [1E-7/℃]	70
CTE(100,300) [1E-7/℃]	85
Tg [℃]	618
At [℃]	660
StP [℃]	577
AP [℃]	610
SP [℃]	722
Ht cndct. [W/m･K]	0.735
Sp. heat [kJ/kg･K]	0.500
Ht diffus. [1E-6 m2/sec]	0.336

Chemical properties [class]	
Acid res. (surface)	1
Alkaline detergent res.	1
Climate resistance	1
Water res. (powder)	1
Acid res. (powder)	3

Mechanical properties	
Knoop hardness	531 (5)
Abrasion hardness	104
Young's mod. [GPa]	104.6
Shear mod. [GPa]	40.3
Poisson's ratio	0.298
Stress optical coef. [1E-5 nm/cm／Pa]	1.76

Internal trans. (10mm)	
λ [nm]	τ
280	–
290	–
300	–
310	–
320	–
330	–
340	–
350	–
360	0.12
370	0.44
380	0.70
390	0.82
400	0.88
420	0.937
440	0.959
460	0.971
480	0.978
500	0.983
550	0.991
600	0.992
650	0.993
700	0.993
800	0.997
900	0.998
1000	0.999
1200	0.999
1400	0.998
1600	0.996
1800	0.984
2000	0.967
2200	0.916
2400	0.78

Specific gravity
4.37

Relative Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90 (ref.)	2.7	2.8	3.1	3.4	3.7	4.0	4.1	4.2	4.6	5.2	6.4	6.6	8.2	10.0	11.4
60 to 80 (ref.)	2.6	2.7	3.0	3.3	3.5	3.8	3.9	4.0	4.4	5.0	6.2	6.3	7.9	9.6	10.9
40 to 60	2.5	2.5	2.8	3.1	3.3	3.6	3.7	3.8	4.2	4.7	5.8	6.0	7.5	9.1	10.3
20 to 40	2.3	2.4	2.7	2.9	3.2	3.4	3.5	3.6	4.0	4.5	5.6	5.7	7.1	8.6	9.8
0 to 20	2.2	2.3	2.6	2.8	3.0	3.3	3.4	3.5	3.8	4.3	5.3	5.4	6.7	8.2	9.3
-20 to 0	2.2	2.3	2.5	2.7	3.0	3.2	3.3	3.4	3.7	4.2	5.1	5.3	6.5	7.8	8.8
-40 to -20	2.3	2.3	2.6	2.8	3.0	3.2	3.3	3.3	3.7	4.1	5.0	5.1	6.3	7.6	8.5
-60 to -40 (ref.)	2.4	2.5	2.7	2.9	3.1	3.3	3.4	3.4	3.8	4.2	5.0	5.1	6.2	7.4	8.2
-70 to -60 (ref.)	2.6	2.7	2.9	3.1	3.3	3.5	3.5	3.6	3.9	4.3	5.1	5.2	6.2	7.3	8.1

Absolute Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90	1.6	1.7	2.0	2.3	2.6	2.9	3.0	3.0	3.5	4.0	5.3	5.4	7.0	8.8	10.2
60 to 80	1.4	1.5	1.8	2.0	2.3	2.6	2.7	2.8	3.2	3.7	4.9	5.0	6.6	8.3	9.6
40 to 60	1.1	1.2	1.4	1.7	1.9	2.2	2.3	2.4	2.8	3.3	4.4	4.6	6.0	7.6	8.8
20 to 40	0.8	0.8	1.1	1.3	1.6	1.8	1.9	2.0	2.4	2.9	3.9	4.1	5.4	7.0	8.1
0 to 20	0.4	0.5	0.8	1.0	1.2	1.5	1.5	1.6	2.0	2.4	3.4	3.6	4.8	6.3	7.3
-20 to 0	0.1	0.2	0.4	0.6	0.9	1.1	1.2	1.2	1.6	2.0	2.9	3.1	4.3	5.6	6.6
-40 to -20	-0.2	-0.1	0.1	0.3	0.5	0.7	0.8	0.9	1.2	1.6	2.5	2.6	3.7	4.9	5.8
-60 to -40	-0.5	-0.4	-0.2	-0.1	0.1	0.3	0.4	0.5	0.8	1.2	2.0	2.1	3.1	4.3	5.1
-70 to -60	-0.7	-0.7	-0.5	-0.3	-0.1	0.1	0.1	0.2	0.5	0.8	1.6	1.7	2.7	3.8	4.5

Coef. disp. form. (frac. eq.)(ref.)	
P1	1.02088736E-01
Q1	7.18066986E+01
P2	2.16492298E-02
Q2	5.59339860E-02
P3	4.12483323E-01
Q3	7.38988329E-03

Fitting error of disp. form. σ [1E-6]		
	Visible	Infrared
Power ser. eq.	1.0	6.6
Frac. eq. (ref.)	1.3	10.8

Prod. Freq. (A to D)	A

Similar glass type			
OHARA	S-LAH71	HOYA	-
CDGM	H-ZLaF71	SCHOTT	N-LASF9HT

2022-7-1	StP, AP, SP
2019-4-1	Transmittance
2016-4-1	1st edition

HIKARI GLASS CO., LTD.

J-LASFH2

n_d = 1.766840 n_e = 1.770740

ν_d = 46.78 ν_e = 46.53

Glass code (d)
767468
Glass code (e)
771465

Spectral l.	Refractive idx
2.058	1.72933
1.970	1.73112
1.530	1.73930
1.129	1.74659
1.064	1.74792
t	1.74904
s	1.75337
A'	1.756369
r	1.759137
C	1.761914
C'	1.762694
He-Ne	1.763423
D	1.766695
d	1.766840
e	1.770740
F	1.778307
F'	1.779257
g	1.787448
h	1.795163
0.389	1.799930
i	–

Partial dispersion	
F-C	0.016393
F'-C'	0.016563
C-t	0.012877
C-A'	0.005545
d-C	0.004926
e-C	0.008826
g-d	0.020608
g-F	0.009141
h-g	0.007715
i-g	–
C'-t	0.013657
e-C'	0.008046
F'-e	0.008517
i-F'	–

Internal CC (80%/5%)
367/331
Color Code (80%/5%)
390/330

CCI	
B	0.00
G	0.66
R	0.68

Thermal properties	
CTE(-30,70) [1E-7/℃]	55
CTE(100,300) [1E-7/℃]	64
Tg [℃]	644
At [℃]	674
StP [℃]	602
AP [℃]	630
SP [℃]	730
Ht cndct. [W/m·K]	0.890
Sp. heat [kJ/kg·K]	0.529
Ht diffus. [1E-6 m2/sec]	0.410

Internal trans. (10mm)	
λ [nm]	τ
280	–
290	–
300	–
310	–
320	–
330	0.04
340	0.21
350	0.47
360	0.70
370	0.83
380	0.906
390	0.944
400	0.964
420	0.983
440	0.989
460	0.993
480	0.996
500	0.997
550	0.998
600	0.999
650	0.999
700	0.999
800	0.999
900	0.998
1000	0.998
1200	0.998
1400	0.996
1600	0.991
1800	0.979
2000	0.957
2200	0.88
2400	0.64

Coef. disp. form. (pwr ser.)	
A0	3.04927657E+00
A1	-1.45487808E-02
A2	-1.68864692E-04
A3	2.51825857E-02
A4	5.22534606E-04
A5	2.91654231E-06
A6	1.27935733E-06
A7	0.00000000E+00
A8	0.00000000E+00

Relative partial dispersion	
C-t／F-C	0.7855
C-A'／F-C	0.3383
d-C／F-C	0.3005
e-C／F-C	0.5384
g-d／F-C	1.2571
g-F／F-C	0.5576
h-g／F-C	0.4706
i-g／F-C	–
C'-t／F'-C'	0.8245
e-C'／F'-C'	0.4858
F'-e／F'-C'	0.5142
i-F'／F'-C'	–

Deviation of relative partial disp.	
ΔPdC	0.0022
ΔPgF	−0.0083

Chemical properties [class]	
Acid res. (surface)	1
Alkaline detergent res.	1
Climate resistance	1
Water res. (powder)	2
Acid res. (powder)	4

Mechanical properties	
Knoop hardness	666 (7)
Abrasion hardness	64
Young's mod. [GPa]	117.1
Shear mod. [GPa]	45.3
Poisson's ratio	0.293
Stress optical coef. [1E-5 nm/cm／Pa]	1.99

Specific gravity
4.11

Relative Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90 (ref.)	4.7	4.8	5.0	5.3	5.4	5.6	5.7	5.7	5.9	6.2	6.8	6.9	7.5	8.1	8.6
60 to 80 (ref.)	4.6	4.7	5.0	5.1	5.3	5.4	5.5	5.5	5.8	6.0	6.6	6.7	7.3	7.9	8.4
40 to 60	4.4	4.5	4.8	4.9	5.1	5.2	5.3	5.3	5.6	5.8	6.4	6.4	7.0	7.6	8.1
20 to 40	4.3	4.4	4.6	4.8	4.9	5.1	5.1	5.2	5.4	5.6	6.2	6.2	6.8	7.4	7.8
0 to 20	4.2	4.3	4.5	4.7	4.8	5.0	5.0	5.0	5.3	5.5	6.0	6.1	6.6	7.2	7.6
-20 to 0	4.2	4.2	4.5	4.6	4.7	4.9	4.9	5.0	5.2	5.4	5.9	5.9	6.5	7.0	7.4
-40 to -20	4.2	4.3	4.5	4.6	4.8	4.9	4.9	5.0	5.2	5.4	5.9	5.9	6.4	6.9	7.3
-60 to -40 (ref.)	4.3	4.4	4.6	4.7	4.9	5.0	5.0	5.1	5.3	5.5	5.9	6.0	6.5	7.0	7.3
-70 to -60 (ref.)	4.5	4.6	4.8	4.9	5.0	5.2	5.2	5.2	5.4	5.6	6.1	6.1	6.6	7.1	7.4

Absolute Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90	3.7	3.8	4.0	4.2	4.3	4.5	4.6	4.6	4.8	5.1	5.7	5.7	6.4	7.0	7.4
60 to 80	3.4	3.5	3.8	3.9	4.1	4.2	4.3	4.3	4.6	4.8	5.4	5.4	6.0	6.7	7.1
40 to 60	3.1	3.2	3.4	3.6	3.7	3.9	3.9	4.0	4.2	4.5	5.0	5.0	5.6	6.2	6.6
20 to 40	2.8	2.9	3.1	3.3	3.4	3.6	3.6	3.6	3.8	4.1	4.6	4.7	5.2	5.8	6.2
0 to 20	2.5	2.6	2.8	2.9	3.1	3.2	3.2	3.3	3.5	3.7	4.2	4.3	4.8	5.3	5.7
-20 to 0	2.2	2.2	2.4	2.6	2.7	2.9	2.9	2.9	3.1	3.4	3.8	3.9	4.4	4.9	5.3
-40 to -20	1.8	1.9	2.1	2.2	2.4	2.5	2.5	2.6	2.8	3.0	3.4	3.5	4.0	4.5	4.8
-60 to -40	1.5	1.6	1.8	1.9	2.0	2.2	2.2	2.2	2.4	2.6	3.0	3.1	3.5	4.0	4.4
-70 to -60	1.3	1.4	1.5	1.7	1.8	1.9	1.9	2.0	2.1	2.3	2.7	2.8	3.2	3.7	4.0

Coef. disp. form. (frac. eq.)(ref.)	
P1	1.19707434E-01
Q1	7.01444787E+01
P2	2.24070281E-02
Q2	3.52523493E-02
P3	3.83448965E-01
Q3	5.70886929E-03

Fitting error of disp. form. σ [1E-6]		
	Visible	Infrared
Power ser. eq.	0.6	3.6
Frac. eq. (ref.)	0.6	4.4

Prod. Freq. (A to D)	B

Similar glass type			
OHARA	–	HOYA	–
CDGM	–	SCHOTT	–

2022-7-1	StP, AP, SP
2019-4-1	Transmittance
2015-4-1	Internal trans, Color Code

HIKARI GLASS CO., LTD.

J-LASFH6

n_d = 1.806100 n_e = 1.811821

ν_d = 33.34 ν_e = 33.10

Glass code (d)
806333
Glass code (e)
811331

Spectral l.	Refractive idx
2.058	1.76229
1.970	1.76385
1.530	1.77139
1.129	1.77905
1.064	1.78059
t	1.78192
s	1.78737
A'	1.791353
r	1.795145
C	1.799034
C'	1.800140
He-Ne	1.801179
D	1.805889
d	1.806100
e	1.811821
F	1.823209
F'	1.824665
g	1.837482
h	1.850008
0.389	1.857993
i	1.873117

Coef. disp. form. (pwr ser.)	
A0	3.15462091E+00
A1	-1.34426083E-02
A2	0.00000000E+00
A3	3.31718297E-02
A4	2.71221217E-03
A5	-5.03803783E-04
A6	1.00437086E-04
A7	-9.19121981E-06
A8	3.75808895E-07

Partial dispersion	
F-C	0.024175
F'-C'	0.024525
C-t	0.017112
C-A'	0.007681
d-C	0.007066
e-C	0.012787
g-d	0.031382
g-F	0.014273
h-g	0.012526
i-g	0.035635
C'-t	0.018218
e-C'	0.011681
F'-e	0.012844
i-F'	0.048452

Relative partial dispersion	
C-t／F-C	0.7078
C-A'／F-C	0.3177
d-C／F-C	0.2923
e-C／F-C	0.5289
g-d／F-C	1.2981
g-F／F-C	0.5904
h-g／F-C	0.5181
i-g／F-C	1.4740
C'-t／F'-C'	0.7428
e-C'／F'-C'	0.4763
F'-e／F'-C'	0.5237
i-F'／F'-C'	1.9756

Deviation of relative partial disp.	
ΔPdC	0.0000
ΔPgF	0.0020

Internal CC (80%/5%)
387/354
Color Code (80%/5%)
420/355

CCI	
B	0.00
G	2.11
R	2.30

Thermal properties	
CTE(-30,70) [1E-7/℃]	71
CTE(100,300) [1E-7/℃]	87
Tg [℃]	648
At [℃]	693
StP [℃]	605
AP [℃]	641
SP [℃]	765
Ht cndct. [W/m･K]	0.899
Sp. heat [kJ/kg･K]	0.562
Ht diffus. [1E-6 m2/sec]	0.425

Chemical properties [class]	
Acid res. (surface)	1
Alkaline detergent res.	1
Climate resistance	1
Water res. (powder)	1
Acid res. (powder)	2

Mechanical properties	
Knoop hardness	545 (5)
Abrasion hardness	102
Young's mod. [GPa]	108.1
Shear mod. [GPa]	42.0
Poisson's ratio	0.288
Stress optical coef. [1E-5 nm/cm／Pa]	1.84

Internal trans. (10mm)	
λ [nm]	τ
280	–
290	–
300	–
310	–
320	–
330	–
340	–
350	0.01
360	0.13
370	0.42
380	0.68
390	0.83
400	0.900
420	0.947
440	0.965
460	0.974
480	0.981
500	0.986
550	0.993
600	0.996
650	0.998
700	0.998
800	0.998
900	0.998
1000	0.998
1200	0.997
1400	0.994
1600	0.990
1800	0.983
2000	0.970
2200	0.928
2400	0.83

Specific gravity
3.77

Relative Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90 (ref.)	2.6	2.8	3.1	3.3	3.6	3.9	3.9	4.0	4.4	4.9	6.0	6.1	7.5	9.2	10.5
60 to 80 (ref.)	2.6	2.7	3.0	3.3	3.5	3.8	3.8	3.9	4.3	4.8	5.8	6.0	7.3	8.9	10.1
40 to 60	2.5	2.6	2.9	3.2	3.4	3.6	3.7	3.8	4.1	4.6	5.6	5.7	7.0	8.5	9.6
20 to 40	2.5	2.6	2.9	3.1	3.3	3.5	3.6	3.7	4.0	4.5	5.4	5.5	6.7	8.1	9.2
0 to 20	2.4	2.6	2.9	3.1	3.3	3.5	3.6	3.6	4.0	4.4	5.3	5.4	6.5	7.8	8.8
-20 to 0	2.5	2.6	2.9	3.1	3.3	3.5	3.6	3.6	3.9	4.3	5.2	5.3	6.4	7.6	8.5
-40 to -20	2.6	2.7	3.0	3.2	3.4	3.6	3.6	3.7	4.0	4.4	5.2	5.3	6.3	7.4	8.3
-60 to -40 (ref.)	2.8	2.9	3.2	3.4	3.6	3.8	3.8	3.9	4.2	4.5	5.3	5.4	6.3	7.3	8.1
-70 to -60 (ref.)	3.1	3.2	3.4	3.6	3.8	4.0	4.0	4.1	4.4	4.7	5.4	5.5	6.4	7.4	8.1

Absolute Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90	1.5	1.7	2.0	2.2	2.5	2.7	2.8	2.9	3.3	3.8	4.8	5.0	6.4	8.0	9.3
60 to 80	1.4	1.5	1.8	2.0	2.3	2.5	2.6	2.7	3.1	3.5	4.6	4.7	6.0	7.6	8.8
40 to 60	1.1	1.3	1.6	1.8	2.0	2.3	2.3	2.4	2.8	3.2	4.2	4.3	5.6	7.1	8.2
20 to 40	0.9	1.0	1.3	1.5	1.7	2.0	2.0	2.1	2.5	2.9	3.8	3.9	5.1	6.5	7.6
0 to 20	0.7	0.8	1.1	1.3	1.5	1.7	1.8	1.8	2.2	2.6	3.4	3.6	4.7	6.0	6.9
-20 to 0	0.5	0.6	0.8	1.0	1.2	1.4	1.5	1.5	1.9	2.2	3.1	3.2	4.2	5.4	6.3
-40 to -20	0.2	0.3	0.6	0.8	0.9	1.1	1.2	1.3	1.5	1.9	2.7	2.8	3.8	4.9	5.7
-60 to -40	0.0	0.1	0.3	0.5	0.7	0.9	0.9	1.0	1.2	1.6	2.3	2.4	3.3	4.3	5.1
-70 to -60	-0.2	-0.1	0.2	0.3	0.5	0.7	0.7	0.8	1.0	1.3	2.0	2.1	3.0	3.9	4.6

Coef. disp. form. (frac. eq.)(ref.)	
P1	9.87706769E-02
Q1	7.10909665E+01
P2	1.90691474E-02
Q2	5.57644489E-02
P3	3.98623922E-01
Q3	7.61374087E-03

Fitting error of disp. form. σ [1E-6]		
	Visible	Infrared
Power ser. eq.	1.2	6.9
Frac. eq. (ref.)	2.2	12.1

Prod. Freq. (A to D)	C

Similar glass type			
OHARA	–	HOYA	NBFD15
CDGM	H-ZLAF56B	SCHOTT	–

2022-7-1	StP, AP, SP
2019-4-1	Transmittance
2015-4-1	Color Code, Prod. Freq., Similar glass type

HIKARI GLASS CO., LTD.

J-LASFH9A

n_d = 1.902650 n_e = 1.908632

ν_d = 35.77 ν_e = 35.52

Glass code (d)
903358
Glass code (e)
909355

Spectral l.	Refractive idx
2.058	1.85645
1.970	1.85810
1.530	1.86602
1.129	1.87410
1.064	1.87574
t	1.87715
s	1.88293
A'	1.887140
r	1.891140
C	1.895235
C'	1.896397
He-Ne	1.897488
D	1.902429
d	1.902650
e	1.908632
F	1.920469
F'	1.921975
g	1.935143
h	1.947853
0.389	1.955869
i	1.970835

Coef. disp. form. (pwr ser.)	
A0	3.49725259E+00
A1	-1.37767486E-02
A2	-1.24635517E-04
A3	4.10568814E-02
A4	7.21039098E-04
A5	1.36134140E-04
A6	-1.24733129E-05
A7	9.24974680E-07
A8	0.00000000E+00

Partial dispersion	
F-C	0.025234
F'-C'	0.025578
C-t	0.018087
C-A'	0.008095
d-C	0.007415
e-C	0.013397
g-d	0.032493
g-F	0.014674
h-g	0.012710
i-g	0.035692
C'-t	0.019249
e-C'	0.012235
F'-e	0.013343
i-F'	0.048860

Relative partial dispersion	
C-t／F-C	0.7168
C-A'／F-C	0.3208
d-C／F-C	0.2938
e-C／F-C	0.5309
g-d／F-C	1.2877
g-F／F-C	0.5815
h-g／F-C	0.5037
i-g／F-C	1.4144
C'-t／F'-C'	0.7526
e-C'／F'-C'	0.4783
F'-e／F'-C'	0.5217
i-F'／F'-C'	1.9102

Deviation of relative partial disp.	
ΔPdC	0.0005
ΔPgF	-0.0028

Internal CC (80%/5%)
381/350
Color Code (70%/5%)
390/350

CCI	
B	0.00
G	1.87
R	1.95

Thermal properties	
CTE(-30,70) [1E-7/℃]	62
CTE(100,300) [1E-7/℃]	80
Tg [℃]	701
At [℃]	738
StP [℃]	658
AP [℃]	689
SP [℃]	798
Ht cndct. [W/m･K]	0.846
Sp. heat [kJ/kg･K]	0.457
Ht diffus. [1E-6 m2/sec]	0.377

Chemical properties [class]	
Acid res. (surface)	1
Alkaline detergent res.	1
Climate resistance	1
Water res. (powder)	1
Acid res. (powder)	1

Mechanical properties	
Knoop hardness	603 (6)
Abrasion hardness	67
Young's mod. [GPa]	123.3
Shear mod. [GPa]	47.3
Poisson's ratio	0.303
Stress optical coef. [1E-5 nm/cm／Pa]	0.97

Internal trans. (10mm)	
λ [nm]	τ
280	-
290	-
300	-
310	-
320	-
330	-
340	-
350	0.06
360	0.33
370	0.62
380	0.79
390	0.87
400	0.912
420	0.950
440	0.967
460	0.977
480	0.984
500	0.989
550	0.996
600	0.997
650	0.997
700	0.997
800	0.998
900	0.999
1000	0.998
1200	0.997
1400	0.994
1600	0.990
1800	0.983
2000	0.963
2200	0.914
2400	0.77

Specific gravity
4.91

Relative Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90 (ref.)	3.3	3.4	3.7	4.1	4.3	4.7	4.7	4.8	5.2	5.7	6.8	6.9	8.2	9.6	10.7
60 to 80 (ref.)	3.1	3.2	3.6	3.9	4.2	4.5	4.5	4.6	5.0	5.5	6.5	6.6	7.9	9.3	10.3
40 to 60	2.9	3.1	3.4	3.7	3.9	4.2	4.3	4.4	4.7	5.2	6.1	6.3	7.5	8.8	9.7
20 to 40	2.8	2.9	3.2	3.5	3.7	4.0	4.1	4.1	4.5	4.9	5.8	6.0	7.1	8.4	9.3
0 to 20	2.7	2.8	3.1	3.3	3.6	3.8	3.9	4.0	4.3	4.7	5.6	5.7	6.8	8.0	8.8
-20 to 0	2.6	2.7	3.0	3.2	3.5	3.7	3.8	3.9	4.2	4.6	5.4	5.5	6.5	7.7	8.5
-40 to -20	2.6	2.7	3.0	3.2	3.4	3.7	3.8	3.8	4.1	4.5	5.3	5.4	6.4	7.4	8.2
-60 to -40 (ref.)	2.7	2.8	3.1	3.3	3.5	3.8	3.8	3.9	4.2	4.5	5.3	5.4	6.3	7.3	8.0
-70 to -60 (ref.)	2.9	3.0	3.3	3.5	3.7	3.9	4.0	4.0	4.3	4.6	5.4	5.5	6.3	7.3	8.0

Absolute Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90	2.1	2.3	2.6	2.9	3.2	3.5	3.6	3.6	4.0	4.5	5.5	5.7	7.0	8.4	9.4
60 to 80	1.9	2.0	2.3	2.6	2.9	3.2	3.3	3.3	3.7	4.2	5.2	5.3	6.6	7.9	8.9
40 to 60	1.5	1.6	2.0	2.2	2.5	2.8	2.8	2.9	3.3	3.7	4.7	4.8	6.0	7.3	8.2
20 to 40	1.2	1.3	1.6	1.8	2.1	2.3	2.4	2.5	2.8	3.3	4.2	4.3	5.4	6.7	7.5
0 to 20	0.8	0.9	1.2	1.5	1.7	1.9	2.0	2.1	2.4	2.8	3.7	3.8	4.8	6.0	6.8
-20 to 0	0.5	0.6	0.8	1.1	1.3	1.5	1.6	1.7	2.0	2.4	3.2	3.3	4.3	5.4	6.1
-40 to -20	0.1	0.2	0.5	0.7	0.9	1.1	1.2	1.2	1.5	1.9	2.7	2.8	3.7	4.7	5.5
-60 to -40	-0.2	-0.2	0.1	0.3	0.5	0.7	0.8	0.8	1.1	1.4	2.1	2.2	3.1	4.1	4.8
-70 to -60	-0.5	-0.4	-0.2	0.0	0.2	0.4	0.5	0.5	0.8	1.1	1.8	1.9	2.7	3.6	4.3

Coef. disp. form. (frac. eq.)(ref.)	
P1	1.11954525E-01
Q1	8.21989294E+01
P2	2.00210947E-02
Q2	4.96736613E-02
P3	4.34276646E-01
Q3	7.01617935E-03

Fitting error of disp. form. σ [1E-6]		
	Visible	Infrared
Power ser. eq.	1.0	4.3
Frac. eq. (ref.)	2.6	8.2

Prod. Freq. (A to D)	A

Similar glass type			
OHARA	S-LAH93	HOYA	TAFD35
CDGM	H-ZLaF4LA	SCHOTT	-

2022-7-1	StP, AP, SP, Similar glass type
2019-4-1	Transmittance
2017-4-1	1st edition

HIKARI GLASS CO., LTD.

J-LASFH13

n_d = 1.903660 n_e = 1.910493

ν_d = 31.27 ν_e = 31.04

Glass code (d)
904313
Glass code (e)
910310

Spectral l.	Refractive idx
2.058	1.85394
1.970	1.85556
1.530	1.86348
1.129	1.87190
1.064	1.87366
t	1.87518
s	1.88150
A'	1.886175
r	1.890648
C	1.895254
C'	1.896567
He-Ne	1.897801
D	1.903409
d	1.903660
e	1.910493
F	1.924149
F'	1.925900
g	1.941336
h	1.956483
0.389	1.966172
i	–

Partial dispersion	
F-C	0.028895
F'-C'	0.029333
C-t	0.020070
C-A'	0.009079
d-C	0.008406
e-C	0.015239
g-d	0.037676
g-F	0.017187
h-g	0.015147
i-g	–
C'-t	0.021383
e-C'	0.013926
F'-e	0.015407
i-F'	–

Internal CC (80%/5%)
397/356
Color Code (70%/5%)
410/355

CCI	
B	0.00
G	3.67
R	3.76

Thermal properties	
CTE(-30,70) [1E-7/℃]	67
CTE(100,300) [1E-7/℃]	83
Tg [℃]	654
At [℃]	699
StP [℃]	613
AP [℃]	646
SP [℃]	763
Ht cndct. [W/m·K]	0.910
Sp. heat [kJ/kg·K]	0.508
Ht diffus. [1E-6 m2/sec]	0.384

Internal trans. (10mm)	
λ [nm]	τ
280	–
290	–
300	–
310	–
320	–
330	–
340	–
350	–
360	0.11
370	0.35
380	0.59
390	0.73
400	0.82
420	0.903
440	0.939
460	0.958
480	0.970
500	0.981
550	0.993
600	0.993
650	0.993
700	0.995
800	0.994
900	0.992
1000	0.994
1200	0.997
1400	0.999
1600	0.990
1800	0.983
2000	0.971
2200	0.943
2400	0.85

Coef. disp. form. (pwr ser.)	
A0	3.48496859E+00
A1	-1.34692969E-02
A2	-8.98801936E-05
A3	4.53620373E-02
A4	1.10287376E-03
A5	1.48043312E-04
A6	-1.27401645E-05
A7	1.28412516E-06
A8	0.00000000E+00

Relative partial dispersion	
C-t／F-C	0.6946
C-A'／F-C	0.3142
d-C／F-C	0.2909
e-C／F-C	0.5274
g-d／F-C	1.3039
g-F／F-C	0.5948
h-g／F-C	0.5242
i-g／F-C	–
C'-t／F'-C'	0.7290
e-C'／F'-C'	0.4748
F'-e／F'-C'	0.5252
i-F'／F'-C'	–

Deviation of relative partial disp.	
ΔPdC	-0.0004
ΔPgF	0.0029

Chemical properties [class]	
Acid res. (surface)	1
Alkaline detergent res.	1
Climate resistance	1
Water res. (powder)	1
Acid res. (powder)	1

Mechanical properties	
Knoop hardness	649 (6)
Abrasion hardness	105
Young's mod. [GPa]	111.5
Shear mod. [GPa]	42.8
Poisson's ratio	0.301
Stress optical coef. [1E-5 nm/cm／Pa]	1.68

Specific gravity
4.66

Relative Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90 (ref.)	3.4	3.5	3.7	4.1	4.5	4.9	5.0	5.1	5.7	6.4	7.8	8.0	9.6	11.6	13.2
60 to 80 (ref.)	3.2	3.3	3.6	3.9	4.2	4.6	4.8	4.9	5.4	6.1	7.4	7.6	9.2	11.1	12.6
40 to 60	3.0	3.0	3.3	3.6	3.9	4.3	4.4	4.5	5.1	5.7	7.0	7.1	8.6	10.4	11.8
20 to 40	2.8	2.8	3.0	3.3	3.7	4.0	4.1	4.2	4.7	5.3	6.5	6.7	8.1	9.8	11.1
0 to 20	2.6	2.6	2.8	3.1	3.4	3.8	3.9	4.0	4.5	5.0	6.1	6.3	7.6	9.2	10.4
-20 to 0	2.5	2.5	2.7	3.0	3.2	3.6	3.7	3.8	4.2	4.8	5.8	6.0	7.2	8.6	9.8
-40 to -20	2.4	2.4	2.6	2.9	3.2	3.5	3.6	3.7	4.1	4.6	5.6	5.7	6.8	8.2	9.3
-60 to -40 (ref.)	2.5	2.5	2.7	2.9	3.2	3.5	3.6	3.6	4.1	4.5	5.5	5.6	6.6	7.8	8.9
-70 to -60 (ref.)	2.6	2.6	2.8	3.0	3.3	3.6	3.6	3.7	4.1	4.6	5.4	5.6	6.5	7.7	8.7

Absolute Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90	2.3	2.3	2.6	2.9	3.3	3.7	3.8	4.0	4.5	5.2	6.6	6.7	8.4	10.4	11.9
60 to 80	2.0	2.0	2.3	2.6	3.0	3.4	3.5	3.6	4.1	4.8	6.1	6.3	7.8	9.7	11.2
40 to 60	1.6	1.6	1.9	2.1	2.5	2.9	3.0	3.1	3.6	4.2	5.5	5.6	7.1	8.9	10.3
20 to 40	1.1	1.2	1.4	1.7	2.0	2.4	2.5	2.6	3.1	3.7	4.8	5.0	6.4	8.0	9.4
0 to 20	0.7	0.8	1.0	1.2	1.5	1.9	2.0	2.1	2.6	3.1	4.2	4.3	5.6	7.2	8.4
-20 to 0	0.3	0.3	0.5	0.8	1.1	1.4	1.5	1.6	2.0	2.6	3.6	3.7	4.9	6.3	7.5
-40 to -20	-0.1	-0.1	0.1	0.3	0.6	0.9	1.0	1.1	1.5	2.0	3.0	3.1	4.2	5.5	6.6
-60 to -40	-0.5	-0.5	-0.3	-0.1	0.1	0.4	0.5	0.6	1.0	1.4	2.3	2.4	3.4	4.6	5.6
-70 to -60	-0.8	-0.8	-0.7	-0.5	-0.2	0.0	0.1	0.2	0.6	1.0	1.9	2.0	2.9	4.0	4.9

Coef. disp. form. (frac. eq.)(ref.)	
P1	1.33101966E-01
Q1	9.96219670E+01
P2	2.60138903E-02
Q2	5.27668833E-02
P3	4.27058488E-01
Q3	7.32785665E-03

Fitting error of disp. form. σ [1E-6]	Visible	Infrared
Power ser. eq.	0.7	5.3
Frac. eq. (ref.)	1.6	7.9

Prod. Freq. (A to D)	A

Similar glass type			
OHARA	S-LAH95	HOYA	TAFD25
CDGM	H-ZLaF75B	SCHOTT	N-LASF46B

2022-7-1	StP, AP, SP
2020-4-1	Similar glass type
2019-4-1	Transmittance

J-LASFH13HS

n_d = 1.903660 n_e = 1.910493

ν_d = 31.27 ν_e = 31.04

Glass code (d)
904313
Glass code (e)
910310

Spectral l.	Refractive idx
2.058	1.85394
1.970	1.85556
1.530	1.86348
1.129	1.87190
1.064	1.87366
t	1.87518
s	1.88150
A'	1.886175
r	1.890648
C	1.895254
C'	1.896567
He-Ne	1.897801
D	1.903409
d	1.903660
e	1.910493
F	1.924149
F'	1.925900
g	1.941336
h	1.956483
0.389	1.966172
i	–

Coef. disp. form. (pwr ser.)	
A0	3.48496859E+00
A1	-1.34692969E-02
A2	-8.98801936E-05
A3	4.53620373E-02
A4	1.10287376E-03
A5	1.48043312E-04
A6	-1.27401645E-05
A7	1.28412516E-06
A8	0.00000000E+00

Partial dispersion	
F-C	0.028895
F'-C'	0.029333
C-t	0.020070
C-A'	0.009079
d-C	0.008406
e-C	0.015239
g-d	0.037676
g-F	0.017187
h-g	0.015147
i-g	–
C'-t	0.021383
e-C'	0.013926
F'-e	0.015407
i-F'	–

Relative partial dispersion	
C-t／F-C	0.6946
C-A'／F-C	0.3142
d-C／F-C	0.2909
e-C／F-C	0.5274
g-d／F-C	1.3039
g-F／F-C	0.5948
h-g／F-C	0.5242
i-g／F-C	–
C'-t／F'-C'	0.7290
e-C'／F'-C'	0.4748
F'-e／F'-C'	0.5252
i-F'／F'-C'	–

Deviation of relative partial disp.	
ΔPdC	-0.0004
ΔPgF	0.0029

Internal CC (80%/5%)
389/354
Color Code (70%/5%)
400/355
CCI

B	0.00
G	2.54
R	2.65

Thermal properties	
CTE(-30,70) [1E-7/℃]	67
CTE(100,300) [1E-7/℃]	83
Tg [℃]	654
At [℃]	699
StP [℃]	613
AP [℃]	646
SP [℃]	763
Ht cndct. [W/m･K]	0.910
Sp. heat [kJ/kg･K]	0.508
Ht diffus. [1E-6 m2/sec]	0.384

Chemical properties [class]	
Acid res. (surface)	1
Alkaline detergent res.	1
Climate resistance	1
Water res. (powder)	1
Acid res. (powder)	1

Mechanical properties	
Knoop hardness	649 (6)
Abrasion hardness	105
Young's mod. [GPa]	111.5
Shear mod. [GPa]	42.8
Poisson's ratio	0.301
Stress optical coef. [1E-5 nm/cm／Pa]	1.68

Internal trans. (10mm)	
λ [nm]	τ
280	–
290	–
300	–
310	–
320	–
330	–
340	–
350	0.02
360	0.15
370	0.44
380	0.67
390	0.81
400	0.87
420	0.934
440	0.960
460	0.972
480	0.981
500	0.987
550	0.995
600	0.997
650	0.997
700	0.997
800	0.998
900	0.998
1000	0.998
1200	0.999
1400	0.997
1600	0.995
1800	0.984
2000	0.967
2200	0.924
2400	0.80

Specific gravity
4.66

Relative Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90 (ref.)	3.4	3.5	3.7	4.1	4.5	4.9	5.0	5.1	5.7	6.4	7.8	8.0	9.6	11.6	13.2
60 to 80 (ref.)	3.2	3.3	3.6	3.9	4.2	4.6	4.8	4.9	5.4	6.1	7.4	7.6	9.2	11.1	12.6
40 to 60	3.0	3.0	3.3	3.6	3.9	4.3	4.4	4.5	5.1	5.7	7.0	7.1	8.6	10.4	11.8
20 to 40	2.8	2.8	3.0	3.3	3.7	4.0	4.1	4.2	4.7	5.3	6.5	6.7	8.1	9.8	11.1
0 to 20	2.6	2.6	2.8	3.1	3.4	3.8	3.9	4.0	4.5	5.0	6.1	6.3	7.6	9.2	10.4
-20 to 0	2.5	2.5	2.7	3.0	3.2	3.6	3.7	3.8	4.2	4.8	5.8	6.0	7.2	8.6	9.8
-40 to -20	2.4	2.4	2.6	2.9	3.2	3.5	3.6	3.7	4.1	4.6	5.6	5.7	6.8	8.2	9.3
-60 to -40 (ref.)	2.5	2.5	2.7	2.9	3.2	3.5	3.6	3.6	4.1	4.5	5.5	5.6	6.6	7.8	8.9
-70 to -60 (ref.)	2.6	2.6	2.8	3.0	3.3	3.6	3.6	3.7	4.1	4.6	5.4	5.6	6.5	7.7	8.7

Absolute Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90	2.3	2.3	2.6	2.9	3.3	3.7	3.8	4.0	4.5	5.2	6.6	6.7	8.4	10.4	11.9
60 to 80	2.0	2.0	2.3	2.6	3.0	3.4	3.5	3.6	4.1	4.8	6.1	6.3	7.8	9.7	11.2
40 to 60	1.6	1.6	1.9	2.1	2.5	2.9	3.0	3.1	3.6	4.2	5.5	5.6	7.1	8.9	10.3
20 to 40	1.1	1.2	1.4	1.7	2.0	2.4	2.5	2.6	3.1	3.7	4.8	5.0	6.4	8.0	9.4
0 to 20	0.7	0.8	1.0	1.2	1.5	1.9	2.0	2.1	2.6	3.1	4.2	4.3	5.6	7.2	8.4
-20 to 0	0.3	0.3	0.5	0.8	1.1	1.4	1.5	1.6	2.0	2.6	3.6	3.7	4.9	6.3	7.5
-40 to -20	-0.1	-0.1	0.1	0.3	0.6	0.9	1.0	1.1	1.5	2.0	3.0	3.1	4.2	5.5	6.6
-60 to -40	-0.5	-0.5	-0.3	-0.1	0.1	0.4	0.5	0.6	1.0	1.4	2.3	2.4	3.4	4.6	5.6
-70 to -60	-0.8	-0.8	-0.7	-0.5	-0.2	0.0	0.1	0.2	0.6	1.0	1.9	2.0	2.9	4.0	4.9

Coef. disp. form. (frac. eq.)(ref.)	
P1	1.33101966E-01
Q1	9.96219670E+01
P2	2.60138903E-02
Q2	5.27668833E-02
P3	4.27058488E-01
Q3	7.32785665E-03

Fitting error of disp. form. σ [1E-6]		
	Visible	Infrared
Power ser. eq.	0.7	5.3
Frac. eq. (ref.)	1.6	7.9

Prod. Freq. (A to D)	A

Similar glass type			
OHARA	S-LAH95	HOYA	TAFD25
CDGM	H-ZLaF75B	SCHOTT	N-LASF46B

2022-7-1	StP, AP, SP
2020-4-1	Similar glass type
2019-4-1	Transmittance

J-LASFH15

n_d = 1.950000 n_e = 1.957643

ν_d = 29.37 ν_e = 29.14

Glass code (d)
950294
Glass code (e)
958291

Spectral l.	Refractive idx
2.058	1.89577
1.970	1.89747
1.530	1.90583
1.129	1.91488
1.064	1.91680
t	1.91845
s	1.92538
A'	1.930544
r	1.935504
C	1.940626
C'	1.942088
He-Ne	1.943462
D	1.949719
d	1.950000
e	1.957643
F	1.972976
F'	1.974947
g	1.992390
h	2.009607
0.389	2.020683
i	–

Partial dispersion	
F-C	0.032350
F'-C'	0.032859
C-t	0.022174
C-A'	0.010082
d-C	0.009374
e-C	0.017017
g-d	0.042390
g-F	0.019414
h-g	0.017217
i-g	–
C'-t	0.023636
e-C'	0.015555
F'-e	0.017304
i-F'	–

Internal CC (80%/5%)
409/362
Color Code (70%/5%)
420/365

CCI	
B	0.00
G	5.10
R	5.32

Thermal properties	
CTE(-30,70) [1E-7/℃]	74
CTE(100,300) [1E-7/℃]	84
Tg [℃]	690
At [℃]	732
StP [℃]	644
AP [℃]	677
SP [℃]	793
Ht cndct. [W/m·K]	0.858
Sp. heat [kJ/kg·K]	0.473
Ht diffus. [1E-6 m2/sec]	0.380

Internal trans. (10mm)	
λ [nm]	τ
280	–
290	–
300	–
310	–
320	–
330	–
340	–
350	–
360	0.04
370	0.18
380	0.41
390	0.61
400	0.73
420	0.87
440	0.927
460	0.954
480	0.971
500	0.981
550	0.994
600	0.997
650	0.998
700	0.998
800	0.998
900	0.998
1000	0.998
1200	0.999
1400	0.999
1600	0.998
1800	0.990
2000	0.978
2200	0.943
2400	0.85

Relative partial dispersion	
C-t／F-C	0.6854
C-A'／F-C	0.3117
d-C／F-C	0.2898
e-C／F-C	0.5260
g-d／F-C	1.3104
g-F／F-C	0.6001
h-g／F-C	0.5322
i-g／F-C	–
C'-t／F'-C'	0.7193
e-C'／F'-C'	0.4734
F'-e／F'-C'	0.5266
i-F'／F'-C'	–

Chemical properties [class]	
Acid res. (surface)	1
Alkaline detergent res.	1
Climate resistance	1
Water res. (powder)	1
Acid res. (powder)	1

Mechanical properties	
Knoop hardness	545 (5)
Abrasion hardness	112
Young's mod. [GPa]	118.1
Shear mod. [GPa]	45.4
Poisson's ratio	0.301
Stress optical coef. [1E-5 nm/cm／Pa]	1.49

Specific gravity
4.79

Coef. disp. form. (pwr ser.)	
A0	3.64640666E+00
A1	-1.51039558E-02
A2	0.00000000E+00
A3	4.80157444E-02
A4	3.49072452E-03
A5	-5.73639028E-04
A6	1.30249514E-04
A7	-1.29576789E-05
A8	5.92144355E-07

Deviation of relative partial disp.	
ΔPdC	-0.0007
ΔPgF	0.0050

Relative Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90 (ref.)	2.6	2.7	3.0	3.4	3.8	4.2	4.3	4.4	5.0	5.6	7.1	7.3	9.4	11.7	13.3
60 to 80 (ref.)	2.5	2.5	2.9	3.2	3.6	4.0	4.1	4.2	4.7	5.3	6.8	7.0	9.0	11.2	12.7
40 to 60	2.3	2.3	2.7	3.0	3.4	3.7	3.8	3.9	4.4	5.0	6.4	6.6	8.5	10.6	12.0
20 to 40	2.1	2.1	2.5	2.8	3.1	3.5	3.6	3.7	4.1	4.7	6.0	6.2	8.0	10.0	11.3
0 to 20	2.0	2.0	2.3	2.6	2.9	3.3	3.4	3.5	3.9	4.5	5.7	5.9	7.6	9.5	10.7
-20 to 0	1.9	1.9	2.2	2.5	2.8	3.1	3.2	3.3	3.7	4.3	5.4	5.6	7.2	9.0	10.2
-40 to -20	1.9	1.9	2.2	2.5	2.8	3.1	3.2	3.3	3.7	4.1	5.2	5.4	6.9	8.6	9.7
-60 to -40 (ref.)	2.0	2.0	2.3	2.6	2.9	3.1	3.2	3.3	3.7	4.1	5.2	5.3	6.8	8.3	9.3
-70 to -60 (ref.)	2.2	2.2	2.5	2.7	3.0	3.3	3.4	3.4	3.8	4.2	5.2	5.4	6.7	8.2	9.2

Absolute Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90	1.5	1.5	1.9	2.2	2.6	3.0	3.1	3.2	3.7	4.4	5.9	6.1	8.1	10.4	12.0
60 to 80	1.2	1.2	1.6	1.9	2.3	2.7	2.8	2.9	3.4	4.0	5.4	5.6	7.6	9.8	11.3
40 to 60	0.8	0.9	1.2	1.5	1.9	2.2	2.3	2.4	2.9	3.5	4.9	5.0	6.9	9.0	10.4
20 to 40	0.4	0.5	0.8	1.1	1.4	1.8	1.9	2.0	2.4	3.0	4.3	4.5	6.2	8.2	9.5
0 to 20	0.1	0.1	0.4	0.7	1.0	1.4	1.4	1.5	2.0	2.5	3.7	3.9	5.6	7.4	8.7
-20 to 0	-0.3	-0.3	0.0	0.3	0.6	0.9	1.0	1.1	1.5	2.0	3.1	3.3	4.9	6.6	7.8
-40 to -20	-0.7	-0.7	-0.4	-0.1	0.2	0.5	0.5	0.6	1.0	1.5	2.5	2.7	4.2	5.8	6.9
-60 to -40	-1.0	-1.0	-0.8	-0.5	-0.3	0.0	0.1	0.2	0.5	1.0	2.0	2.1	3.5	5.0	6.0
-70 to -60	-1.3	-1.3	-1.1	-0.8	-0.6	-0.3	-0.2	-0.2	0.2	0.6	1.5	1.7	3.0	4.4	5.4

Coef. disp. form. (frac. eq.)(ref.)	
P1	1.12808140E-01
Q1	8.53378336E+01
P2	2.63046433E-02
Q2	5.51236515E-02
P3	4.42143641E-01
Q3	7.63030279E-03

Fitting error of disp. form. σ [1E-6]	Visible	Infrared
Power ser. eq.	1.2	4.0
Frac. eq. (ref.)	1.8	8.5

Prod. Freq. (A to D)	A

Similar glass type			
OHARA	–	HOYA	–
CDGM	–	SCHOTT	–

2023-9-1	Prod. Freq.
2022-7-1	StP, AP, SP
2019-4-1	Transmittance

HIKARI GLASS CO., LTD.

J-LASFH15HS

n_d = 1.950000 n_e = 1.957643

ν_d = 29.37 ν_e = 29.14

Glass code (d)
950294
Glass code (e)
958291

Spectral l.	Refractive idx
2.058	1.89577
1.970	1.89747
1.530	1.90583
1.129	1.91488
1.064	1.91680
t	1.91845
s	1.92538
A'	1.930544
r	1.935504
C	1.940626
C'	1.942088
He-Ne	1.943462
D	1.949719
d	1.950000
e	1.957643
F	1.972976
F'	1.974947
g	1.992390
h	2.009607
0.389	2.020683
i	–

Coef. disp. form. (pwr ser.)	
A0	3.64640666E+00
A1	-1.51039558E-02
A2	0.00000000E+00
A3	4.80157444E-02
A4	3.49072452E-03
A5	-5.73639028E-04
A6	1.30249514E-04
A7	-1.29576789E-05
A8	5.92144355E-07

Partial dispersion	
F-C	0.032350
F'-C'	0.032859
C-t	0.022174
C-A'	0.010082
d-C	0.009374
e-C	0.017017
g-d	0.042390
g-F	0.019414
h-g	0.017217
i-g	–
C'-t	0.023636
e-C'	0.015555
F'-e	0.017304
i-F'	–

Relative partial dispersion	
C-t／F-C	0.6854
C-A'／F-C	0.3117
d-C／F-C	0.2898
e-C／F-C	0.5260
g-d／F-C	1.3104
g-F／F-C	0.6001
h-g／F-C	0.5322
i-g／F-C	–
C'-t／F'-C'	0.7193
e-C'／F'-C'	0.4734
F'-e／F'-C'	0.5266
i-F'／F'-C'	–

Deviation of relative partial disp.	
ΔPdC	-0.0007
ΔPgF	0.0050

Internal CC (80%/5%)
400/361
Color Code (70%/5%)
415/360

CCI	
B	0.00
G	4.13
R	4.39

Thermal properties	
CTE(-30,70) [1E-7/℃]	74
CTE(100,300) [1E-7/℃]	84
Tg [℃]	690
At [℃]	732
StP [℃]	644
AP [℃]	677
SP [℃]	793
Ht cndct. [W/m·K]	0.858
Sp. heat [kJ/kg·K]	0.473
Ht diffus. [1E-6 m2/sec]	0.380

Chemical properties [class]	
Acid res. (surface)	1
Alkaline detergent res.	1
Climate resistance	1
Water res. (powder)	1
Acid res. (powder)	1

Mechanical properties	
Knoop hardness	545 (5)
Abrasion hardness	112
Young's mod. [GPa]	118.1
Shear mod. [GPa]	45.4
Poisson's ratio	0.301
Stress optical coef. [1E-5 nm/cm／Pa]	1.49

Internal trans. (10mm)	
λ [nm]	τ
280	–
290	–
300	–
310	–
320	–
330	–
340	–
350	–
360	0.04
370	0.25
380	0.52
390	0.70
400	0.80
420	0.89
440	0.936
460	0.957
480	0.970
500	0.980
550	0.994
600	0.997
650	0.998
700	0.999
800	0.998
900	0.998
1000	0.998
1200	0.999
1400	0.999
1600	0.996
1800	0.986
2000	0.970
2200	0.930
2400	0.82

Specific gravity
4.79

Relative Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90 (ref.)	2.6	2.7	3.0	3.4	3.8	4.2	4.3	4.4	5.0	5.6	7.1	7.3	9.4	11.7	13.3
60 to 80 (ref.)	2.5	2.5	2.9	3.2	3.6	4.0	4.1	4.2	4.7	5.3	6.8	7.0	9.0	11.2	12.7
40 to 60	2.3	2.3	2.7	3.0	3.4	3.7	3.8	3.9	4.4	5.0	6.4	6.6	8.5	10.6	12.0
20 to 40	2.1	2.1	2.5	2.8	3.1	3.5	3.6	3.7	4.1	4.7	6.0	6.2	8.0	10.0	11.3
0 to 20	2.0	2.0	2.3	2.6	2.9	3.3	3.4	3.5	3.9	4.5	5.7	5.9	7.6	9.5	10.7
-20 to 0	1.9	1.9	2.2	2.5	2.8	3.1	3.2	3.3	3.7	4.3	5.4	5.6	7.2	9.0	10.2
-40 to -20	1.9	1.9	2.2	2.5	2.8	3.1	3.2	3.3	3.7	4.1	5.2	5.4	6.9	8.6	9.7
-60 to -40 (ref.)	2.0	2.0	2.3	2.6	2.9	3.1	3.2	3.3	3.7	4.1	5.2	5.3	6.8	8.3	9.3
-70 to -60 (ref.)	2.2	2.2	2.5	2.7	3.0	3.3	3.4	3.4	3.8	4.2	5.2	5.4	6.7	8.2	9.2

Absolute Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90	1.5	1.5	1.9	2.2	2.6	3.0	3.1	3.2	3.7	4.4	5.9	6.1	8.1	10.4	12.0
60 to 80	1.2	1.2	1.6	1.9	2.3	2.7	2.8	2.9	3.4	4.0	5.4	5.6	7.6	9.8	11.3
40 to 60	0.8	0.9	1.2	1.5	1.9	2.2	2.3	2.4	2.9	3.5	4.9	5.0	6.9	9.0	10.4
20 to 40	0.4	0.5	0.8	1.1	1.4	1.8	1.9	2.0	2.4	3.0	4.3	4.5	6.2	8.2	9.5
0 to 20	0.1	0.1	0.4	0.7	1.0	1.4	1.4	1.5	2.0	2.5	3.7	3.9	5.6	7.4	8.7
-20 to 0	-0.3	-0.3	0.0	0.3	0.6	0.9	1.0	1.1	1.5	2.0	3.1	3.3	4.9	6.6	7.8
-40 to -20	-0.7	-0.7	-0.4	-0.1	0.2	0.5	0.5	0.6	1.0	1.5	2.5	2.7	4.2	5.8	6.9
-60 to -40	-1.0	-1.0	-0.8	-0.5	-0.3	0.0	0.1	0.2	0.5	1.0	2.0	2.1	3.5	5.0	6.0
-70 to -60	-1.3	-1.3	-1.1	-0.8	-0.6	-0.3	-0.2	-0.2	0.2	0.6	1.5	1.7	3.0	4.4	5.4

Coef. disp. form. (frac. eq.)(ref.)	
P1	1.12808140E-01
Q1	8.53378336E+01
P2	2.63046433E-02
Q2	5.51236515E-02
P3	4.42143641E-01
Q3	7.63030279E-03

Fitting error of disp. form. σ [1E-6]		
	Visible	Infrared
Power ser. eq.	1.2	4.0
Frac. eq. (ref.)	1.8	8.5

Prod. Freq. (A to D)	A

Similar glass type			
OHARA	–	HOYA	–
CDGM	–	SCHOTT	–

2023-9-1	Prod. Freq.
2022-7-1	StP, AP, SP
2019-4-1	1st edition

HIKARI GLASS CO., LTD.

J-LASFH16

n_d = 2.001000 n_e = 2.009122

ν_d = 29.12 ν_e = 28.90

Glass code (d)
001291
Glass code (e)
009289

Spectral l.	Refractive idx
2.058	1.94401
1.970	1.94574
1.530	1.95434
1.129	1.96378
1.064	1.96579
t	1.96754
s	1.97486
A'	1.980334
r	1.985599
C	1.991039
C'	1.992592
He-Ne	1.994053
D	2.000702
d	2.001000
e	2.009122
F	2.025410
F'	2.027504
g	2.046018
h	2.064272
0.389	2.075999
i	–

Coef. disp. form. (pwr ser.)	
A0	3.83294326E+00
A1	-1.56840611E-02
A2	0.00000000E+00
A3	5.28843692E-02
A4	3.50978963E-03
A5	-5.06491928E-04
A6	1.15081798E-04
A7	-1.10388704E-05
A8	5.01900181E-07

Partial dispersion	
F-C	0.034371
F'-C'	0.034912
C-t	0.023502
C-A'	0.010705
d-C	0.009961
e-C	0.018083
g-d	0.045018
g-F	0.020608
h-g	0.018254
i-g	–
C'-t	0.025055
e-C'	0.016530
F'-e	0.018382
i-F'	–

Relative partial dispersion	
C-t／F-C	0.6838
C-A'／F-C	0.3115
d-C／F-C	0.2898
e-C／F-C	0.5261
g-d／F-C	1.3098
g-F／F-C	0.5996
h-g／F-C	0.5311
i-g／F-C	–
C'-t／F'-C'	0.7177
e-C'／F'-C'	0.4735
F'-e／F'-C'	0.5265
i-F'／F'-C'	–

Deviation of relative partial disp.	
ΔPdC	-0.0005
ΔPgF	0.0041

Internal CC (80%/5%)
406/361
Color Code (70%/5%)
425/360

CCI	
B	0.00
G	4.96
R	5.18

Thermal properties	
CTE(-30,70) [1E-7/℃]	71
CTE(100,300) [1E-7/℃]	86
Tg [℃]	721
At [℃]	756
StP [℃]	681
AP [℃]	713
SP [℃]	824
Ht cndct. [W/m·K]	0.979
Sp. heat [kJ/kg·K]	0.437
Ht diffus. [1E-6 m2/sec]	0.439

Chemical properties [class]	
Acid res. (surface)	2
Alkaline detergent res.	1
Climate resistance	1
Water res. (powder)	1
Acid res. (powder)	1

Mechanical properties	
Knoop hardness	647 (6)
Abrasion hardness	53
Young's mod. [GPa]	130.3
Shear mod. [GPa]	49.8
Poisson's ratio	0.307
Stress optical coef. [1E-5 nm/cm／Pa]	0.91

Internal trans. (10mm)	
λ [nm]	τ
280	–
290	–
300	–
310	–
320	–
330	–
340	–
350	–
360	0.04
370	0.22
380	0.46
390	0.64
400	0.76
420	0.87
440	0.924
460	0.951
480	0.967
500	0.979
550	0.994
600	0.998
650	0.998
700	0.998
800	0.998
900	0.998
1000	0.998
1200	0.998
1400	0.998
1600	0.991
1800	0.984
2000	0.972
2200	0.946
2400	0.84

Specific gravity
5.1

Relative Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90 (ref.)	2.7	2.9	3.3	3.7	4.1	4.5	4.6	4.7	5.3	6.0	7.6	7.8	10.0	12.4	14.3
60 to 80 (ref.)	2.6	2.7	3.1	3.5	3.9	4.3	4.4	4.5	5.0	5.7	7.3	7.5	9.5	11.9	13.7
40 to 60	2.4	2.5	2.9	3.2	3.6	4.0	4.1	4.2	4.7	5.4	6.9	7.1	9.0	11.3	12.9
20 to 40	2.2	2.3	2.7	3.0	3.4	3.7	3.8	4.0	4.5	5.1	6.5	6.7	8.5	10.6	12.2
0 to 20	2.1	2.2	2.6	2.9	3.2	3.5	3.7	3.7	4.2	4.8	6.1	6.3	8.1	10.1	11.5
-20 to 0	2.0	2.1	2.5	2.8	3.1	3.4	3.5	3.6	4.1	4.6	5.9	6.0	7.7	9.5	10.9
-40 to -20	2.0	2.1	2.5	2.8	3.1	3.4	3.5	3.5	4.0	4.5	5.7	5.8	7.4	9.1	10.3
-60 to -40 (ref.)	2.2	2.3	2.6	2.9	3.1	3.4	3.5	3.6	4.0	4.5	5.6	5.8	7.2	8.8	9.9
-70 to -60 (ref.)	2.3	2.4	2.8	3.0	3.3	3.6	3.7	3.7	4.1	4.6	5.7	5.8	7.2	8.7	9.7

Absolute Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90	1.5	1.6	2.1	2.5	2.8	3.2	3.4	3.5	4.0	4.8	6.3	6.5	8.7	11.1	12.9
60 to 80	1.2	1.4	1.8	2.1	2.5	2.9	3.0	3.1	3.7	4.4	5.9	6.1	8.1	10.5	12.2
40 to 60	0.9	1.0	1.4	1.7	2.1	2.5	2.6	2.7	3.2	3.8	5.3	5.5	7.4	9.7	11.3
20 to 40	0.5	0.6	1.0	1.3	1.7	2.0	2.1	2.2	2.7	3.3	4.7	4.9	6.7	8.8	10.3
0 to 20	0.1	0.2	0.6	0.9	1.2	1.6	1.7	1.8	2.2	2.8	4.1	4.3	6.0	8.0	9.4
-20 to 0	-0.2	-0.1	0.2	0.5	0.8	1.1	1.2	1.3	1.7	2.3	3.5	3.7	5.3	7.1	8.4
-40 to -20	-0.6	-0.5	-0.2	0.1	0.4	0.7	0.8	0.8	1.3	1.8	2.9	3.1	4.6	6.3	7.5
-60 to -40	-1.0	-0.9	-0.6	-0.3	-0.1	0.2	0.3	0.4	0.8	1.3	2.3	2.5	3.9	5.4	6.5
-70 to -60	-1.3	-1.2	-0.9	-0.6	-0.4	-0.1	0.0	0.0	0.4	0.9	1.9	2.0	3.3	4.8	5.8

Coef. disp. form. (frac. eq.)(ref.)	
P1	1.08840381E-01
Q1	8.45835040E+01
P2	2.54513844E-02
Q2	5.52459928E-02
P3	4.60003603E-01
Q3	7.68666453E-03

Fitting error of disp. form. σ [1E-6]		
	Visible	Infrared
Power ser. eq.	1.2	5.6
Frac. eq. (ref.)	2.0	9.1

Prod. Freq. (A to D)	A

Similar glass type			
OHARA	S-LAH99	HOYA	TAFD55
CDGM	–	SCHOTT	–

2022-7-1	StP, AP, SP
2020-4-1	Similar glass type
2019-4-1	Transmittance

HIKARI GLASS CO., LTD.

J-LASFH17

n_d = 2.000690 n_e = 2.009954

ν_d = 25.46 ν_e = 25.25

Glass code (d)
001255
Glass code (e)
010253

Spectral l.	Refractive idx
2.058	1.93788
1.970	1.93971
1.530	1.94886
1.129	1.95908
1.064	1.96128
t	1.96320
s	1.97130
A'	1.977399
r	1.983293
C	1.989413
C'	1.991165
He-Ne	1.992815
D	2.000351
d	2.000690
e	2.009954
F	2.028724
F'	2.031156
g	2.052860
h	2.074654
0.389	2.088894
i	–

Coef. disp. form. (pwr ser.)	
A0	3.81071676E+00
A1	-1.63737936E-02
A2	0.00000000E+00
A3	5.83672875E-02
A4	4.12726108E-03
A5	-5.52229126E-04
A6	1.41302816E-04
A7	-1.45517862E-05
A8	7.44426800E-07

Partial dispersion	
F-C	0.039311
F'-C'	0.039991
C-t	0.026211
C-A'	0.012014
d-C	0.011277
e-C	0.020541
g-d	0.052170
g-F	0.024136
h-g	0.021794
i-g	–
C'-t	0.027963
e-C'	0.018789
F'-e	0.021202
i-F'	–

Relative partial dispersion	
C-t／F-C	0.6668
C-A'／F-C	0.3056
d-C／F-C	0.2869
e-C／F-C	0.5225
g-d／F-C	1.3271
g-F／F-C	0.6140
h-g／F-C	0.5544
i-g／F-C	–
C'-t／F'-C'	0.6992
e-C'／F'-C'	0.4698
F'-e／F'-C'	0.5302
i-F'／F'-C'	–

Deviation of relative partial disp.	
ΔPdC	-0.0018
ΔPgF	0.0123

Internal CC (80%/5%)
425/374
Color Code (70%/5%)
445/375

CCI	
B	0.00
G	9.14
R	9.52

Thermal properties	
CTE(-30,70) [1E-7/℃]	68
CTE(100,300) [1E-7/℃]	83
Tg [℃]	681
At [℃]	727
StP [℃]	638
AP [℃]	672
SP [℃]	788
Ht cndct. [W/m･K]	1.020
Sp. heat [kJ/kg･K]	0.504
Ht diffus. [1E-6 m2/sec]	0.432

Chemical properties [class]	
Acid res. (surface)	1
Alkaline detergent res.	1
Climate resistance	1
Water res. (powder)	1
Acid res. (powder)	1

Mechanical properties	
Knoop hardness	605 (6)
Abrasion hardness	86
Young's mod. [GPa]	123.8
Shear mod. [GPa]	47.7
Poisson's ratio	0.298
Stress optical coef. [1E-5 nm/cm／Pa]	1.59

Internal trans. (10mm)	
λ [nm]	τ
280	–
290	–
300	–
310	–
320	–
330	–
340	–
350	–
360	–
370	0.02
380	0.13
390	0.33
400	0.52
420	0.76
440	0.88
460	0.928
480	0.955
500	0.971
550	0.991
600	0.996
650	0.998
700	0.998
800	0.996
900	0.997
1000	0.997
1200	0.998
1400	0.998
1600	0.997
1800	0.990
2000	0.980
2200	0.954
2400	0.88

Specific gravity
4.69

Relative Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90 (ref.)	3.4	3.6	4.0	4.5	4.9	5.4	5.6	5.7	6.4	7.2	9.2	9.4	12.2	15.5	17.9
60 to 80 (ref.)	3.3	3.4	3.9	4.3	4.7	5.2	5.3	5.4	6.1	6.9	8.8	9.0	11.7	14.9	17.2
40 to 60	3.0	3.1	3.6	4.0	4.4	4.8	5.0	5.1	5.7	6.5	8.3	8.5	11.1	14.1	16.3
20 to 40	2.8	2.9	3.3	3.7	4.1	4.6	4.7	4.8	5.4	6.1	7.8	8.1	10.5	13.3	15.4
0 to 20	2.7	2.8	3.2	3.5	3.9	4.3	4.5	4.6	5.1	5.8	7.4	7.7	9.9	12.6	14.5
-20 to 0	2.6	2.7	3.0	3.4	3.8	4.2	4.3	4.4	4.9	5.6	7.1	7.3	9.4	11.9	13.7
-40 to -20	2.6	2.6	3.0	3.3	3.7	4.1	4.2	4.3	4.8	5.4	6.8	7.0	9.0	11.4	13.1
-60 to -40 (ref.)	2.7	2.7	3.1	3.4	3.7	4.1	4.2	4.3	4.8	5.3	6.7	6.9	8.7	10.9	12.5
-70 to -60 (ref.)	2.8	2.9	3.2	3.5	3.8	4.2	4.3	4.4	4.8	5.4	6.7	6.9	8.6	10.7	12.2

Absolute Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90	2.2	2.3	2.8	3.3	3.7	4.2	4.3	4.5	5.1	6.0	7.9	8.2	10.9	14.2	16.6
60 to 80	1.9	2.0	2.5	2.9	3.4	3.8	4.0	4.1	4.7	5.5	7.4	7.7	10.3	13.4	15.8
40 to 60	1.5	1.6	2.1	2.5	2.9	3.3	3.5	3.6	4.2	5.0	6.7	7.0	9.5	12.4	14.6
20 to 40	1.1	1.2	1.6	2.0	2.4	2.8	3.0	3.1	3.7	4.4	6.1	6.3	8.6	11.5	13.5
0 to 20	0.7	0.8	1.2	1.6	1.9	2.3	2.5	2.6	3.1	3.8	5.4	5.6	7.8	10.5	12.4
-20 to 0	0.3	0.4	0.8	1.1	1.5	1.9	2.0	2.1	2.6	3.2	4.7	4.9	7.0	9.5	11.3
-40 to -20	-0.1	0.0	0.4	0.7	1.0	1.4	1.5	1.6	2.1	2.7	4.1	4.3	6.2	8.5	10.2
-60 to -40	-0.5	-0.4	-0.1	0.2	0.5	0.9	1.0	1.1	1.5	2.1	3.4	3.6	5.4	7.5	9.0
-70 to -60	-0.8	-0.7	-0.4	-0.1	0.2	0.5	0.6	0.7	1.1	1.7	2.9	3.1	4.8	6.8	8.2

Coef. disp. form. (frac. eq.)(ref.)	
P1	1.00167110E-01
Q1	7.47066024E+01
P2	2.87199284E-02
Q2	6.00528312E-02
P3	4.54734535E-01
Q3	8.29318245E-03

Fitting error of disp. form. σ [1E-6]		
	Visible	Infrared
Power ser. eq.	1.0	4.8
Frac. eq. (ref.)	3.1	13.8

Prod. Freq. (A to D)	A

Similar glass type			
OHARA	–	HOYA	TAFD40
CDGM	H-ZLaF90	SCHOTT	–

2022-7-1	StP, AP, SP
2019-4-1	Transmittance
2016-4-1	Prod. Freq., Similar glass type

HIKARI GLASS CO., LTD.

J-LASFH17HS

n_d = 2.000690 n_e = 2.009954

ν_d = 25.46 ν_e = 25.25

Glass code (d)
001255
Glass code (e)
010253

Spectral l.	Refractive idx
2.058	1.93788
1.970	1.93971
1.530	1.94886
1.129	1.95908
1.064	1.96128
t	1.96320
s	1.97130
A'	1.977399
r	1.983293
C	1.989413
C'	1.991165
He-Ne	1.992815
D	2.000351
d	2.000690
e	2.009954
F	2.028724
F'	2.031156
g	2.052860
h	2.074654
0.389	2.088894
i	–

Partial dispersion	
F-C	0.039311
F'-C'	0.039991
C-t	0.026211
C-A'	0.012014
d-C	0.011277
e-C	0.020541
g-d	0.052170
g-F	0.024136
h-g	0.021794
i-g	–
C'-t	0.027963
e-C'	0.018789
F'-e	0.021202
i-F'	–

Relative partial dispersion	
C-t／F-C	0.6668
C-A'／F-C	0.3056
d-C／F-C	0.2869
e-C／F-C	0.5225
g-d／F-C	1.3271
g-F／F-C	0.6140
h-g／F-C	0.5544
i-g／F-C	–
C'-t／F'-C'	0.6992
e-C'／F'-C'	0.4698
F'-e／F'-C'	0.5302
i-F'／F'-C'	–

Deviation of relative partial disp.	
ΔPdC	−0.0018
ΔPgF	0.0123

Internal CC (80%/5%)
419/371
Color Code (70%/5%)
440/370
CCI

B	0.00
G	7.68
R	8.13

Thermal properties	
CTE(−30,70) [1E-7/℃]	68
CTE(100,300) [1E-7/℃]	83
Tg [℃]	681
At [℃]	727
StP [℃]	638
AP [℃]	672
SP [℃]	788
Ht cndct. [W/m·K]	1.020
Sp. heat [kJ/kg·K]	0.504
Ht diffus. [1E-6 m2/sec]	0.432

Chemical properties [class]	
Acid res. (surface)	1
Alkaline detergent res.	1
Climate resistance	1
Water res. (powder)	1
Acid res. (powder)	1

Mechanical properties	
Knoop hardness	605 (6)
Abrasion hardness	86
Young's mod. [GPa]	123.8
Shear mod. [GPa]	47.7
Poisson's ratio	0.298
Stress optical coef. [1E-5 nm/cm／Pa]	1.59

Internal trans. (10mm)	
λ [nm]	τ
280	–
290	–
300	–
310	–
320	–
330	–
340	–
350	–
360	–
370	0.04
380	0.22
390	0.46
400	0.62
420	0.80
440	0.88
460	0.924
480	0.948
500	0.964
550	0.987
600	0.994
650	0.995
700	0.998
800	0.999
900	0.998
1000	0.998
1200	0.999
1400	0.999
1600	0.997
1800	0.991
2000	0.979
2200	0.949
2400	0.86

Specific gravity
4.69

Coef. disp. form. (pwr ser.)	
A0	3.81071676E+00
A1	−1.63737936E-02
A2	0.00000000E+00
A3	5.83672875E-02
A4	4.12726108E-03
A5	−5.52229126E-04
A6	1.41302816E-04
A7	−1.45517862E-05
A8	7.44426800E-07

Relative Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90 (ref.)	3.4	3.6	4.0	4.5	4.9	5.4	5.6	5.7	6.4	7.2	9.2	9.4	12.2	15.5	17.9
60 to 80 (ref.)	3.3	3.4	3.9	4.3	4.7	5.2	5.3	5.4	6.1	6.9	8.8	9.0	11.7	14.9	17.2
40 to 60	3.0	3.1	3.6	4.0	4.4	4.8	5.0	5.1	5.7	6.5	8.3	8.5	11.1	14.1	16.3
20 to 40	2.8	2.9	3.3	3.7	4.1	4.6	4.7	4.8	5.4	6.1	7.8	8.1	10.5	13.3	15.4
0 to 20	2.7	2.8	3.2	3.5	3.9	4.3	4.5	4.6	5.1	5.8	7.4	7.7	9.9	12.6	14.5
−20 to 0	2.6	2.7	3.0	3.4	3.8	4.2	4.3	4.4	4.9	5.6	7.1	7.3	9.4	11.9	13.7
−40 to −20	2.6	2.6	3.0	3.3	3.7	4.1	4.2	4.3	4.8	5.4	6.8	7.0	9.0	11.4	13.1
−60 to −40 (ref.)	2.7	2.7	3.1	3.4	3.7	4.1	4.2	4.3	4.8	5.3	6.7	6.9	8.7	10.9	12.5
−70 to −60 (ref.)	2.8	2.9	3.2	3.5	3.8	4.2	4.3	4.4	4.8	5.4	6.7	6.9	8.6	10.7	12.2

Absolute Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90	2.2	2.3	2.8	3.3	3.7	4.2	4.3	4.5	5.1	6.0	7.9	8.2	10.9	14.2	16.6
60 to 80	1.9	2.0	2.5	2.9	3.4	3.8	4.0	4.1	4.7	5.5	7.4	7.7	10.3	13.4	15.8
40 to 60	1.5	1.6	2.1	2.5	2.9	3.3	3.5	3.6	4.2	5.0	6.7	7.0	9.5	12.4	14.6
20 to 40	1.1	1.2	1.6	2.0	2.4	2.8	3.0	3.1	3.7	4.4	6.1	6.3	8.6	11.5	13.5
0 to 20	0.7	0.8	1.2	1.6	1.9	2.3	2.5	2.6	3.1	3.8	5.4	5.6	7.8	10.5	12.4
−20 to 0	0.3	0.4	0.8	1.1	1.5	1.9	2.0	2.1	2.6	3.2	4.7	4.9	7.0	9.5	11.3
−40 to −20	−0.1	0.0	0.4	0.7	1.0	1.4	1.5	1.6	2.1	2.7	4.1	4.3	6.2	8.5	10.2
−60 to −40	−0.5	−0.4	−0.1	0.2	0.5	0.9	1.0	1.1	1.5	2.1	3.4	3.6	5.4	7.5	9.0
−70 to −60	−0.8	−0.7	−0.4	−0.1	0.2	0.5	0.6	0.7	1.1	1.7	2.9	3.1	4.8	6.8	8.2

Coef. disp. form. (frac. eq.)(ref.)	
P1	1.00167110E-01
Q1	7.47066024E+01
P2	2.87199284E-02
Q2	6.00528312E-02
P3	4.54734535E-01
Q3	8.29318245E-03

Fitting error of disp. form. σ [1E-6]		
	Visible	Infrared
Power ser. eq.	1.0	4.8
Frac. eq. (ref.)	3.1	13.8

Prod. Freq. (A to D)	A

Similar glass type			
OHARA	–	HOYA	TAFD40
CDGM	H-ZLaF90	SCHOTT	–

2022-7-1	StP, AP, SP
2019-4-1	Transmittance
2016-4-1	1st edition

HIKARI GLASS CO., LTD.

J-LASFH21

n_d = 1.953750 n_e = 1.960731

ν_d = 32.33 ν_e = 32.10

Glass code (d)
954323
Glass code (e)
961321

Spectral l.	Refractive idx
2.058	1.90266
1.970	1.90434
1.530	1.91250
1.129	1.92116
1.064	1.92297
t	1.92453
s	1.93103
A'	1.935830
r	1.940421
C	1.945145
C'	1.946490
He-Ne	1.947754
D	1.953493
d	1.953750
e	1.960731
F	1.974641
F'	1.976420
g	1.992059
h	2.007313
0.389	2.017019
i	–

Partial dispersion	
F-C	0.029496
F'-C'	0.029930
C-t	0.020616
C-A'	0.009315
d-C	0.008605
e-C	0.015586
g-d	0.038309
g-F	0.017418
h-g	0.015254
i-g	–
C'-t	0.021961
e-C'	0.014241
F'-e	0.015689
i-F'	–

Relative partial dispersion	
C-t／F-C	0.6989
C-A'／F-C	0.3158
d-C／F-C	0.2917
e-C／F-C	0.5284
g-d／F-C	1.2988
g-F／F-C	0.5905
h-g／F-C	0.5172
i-g／F-C	–
C'-t／F'-C'	0.7337
e-C'／F'-C'	0.4758
F'-e／F'-C'	0.5242
i-F'／F'-C'	–

Deviation of relative partial disp.	
ΔPdC	−0.0001
ΔPgF	0.0004

Internal CC (80%/5%)
392/354
Color Code (70%/5%)
405/355
CCI

B	0.00
G	3.14
R	3.30

Thermal properties	
CTE(−30,70) [1E-7/℃]	70
CTE(100,300) [1E-7/℃]	82
Tg [℃]	720
At [℃]	758
StP [℃]	681
AP [℃]	714
SP [℃]	826
Ht cndct. [W/m·K]	0.893
Sp. heat [kJ/kg·K]	0.459
Ht diffus. [1E-6 m2/sec]	0.386

Chemical properties [class]	
Acid res. (surface)	1
Alkaline detergent res.	1
Climate resistance	1
Water res. (powder)	1
Acid res. (powder)	1

Mechanical properties	
Knoop hardness	632 (6)
Abrasion hardness	52
Young's mod. [GPa]	128.2
Shear mod. [GPa]	49.1
Poisson's ratio	0.306
Stress optical coef. [1E-5 nm/cm／Pa]	0.87

Internal trans. (10mm)	
λ [nm]	τ
280	–
290	–
300	–
310	–
320	–
330	–
340	–
350	0.01
360	0.16
370	0.45
380	0.67
390	0.79
400	0.85
420	0.917
440	0.946
460	0.963
480	0.974
500	0.983
550	0.995
600	0.997
650	0.997
700	0.997
800	0.998
900	0.998
1000	0.999
1200	0.999
1400	0.999
1600	0.997
1800	0.987
2000	0.970
2200	0.942
2400	0.83

Specific gravity
5.05

Coef. disp. form. (pwr ser.)	
A0	3.67012303E+00
A1	−1.39442893E-02
A2	−1.36361252E-04
A3	4.84434485E-02
A4	9.50687214E-04
A5	1.81807808E-04
A6	−1.62618274E-05
A7	1.33939862E-06
A8	0.00000000E+00

Relative Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90 (ref.)	3.0	3.1	3.5	3.9	4.2	4.5	4.6	4.7	5.2	5.8	7.1	7.3	9.0	11.0	12.4
60 to 80 (ref.)	2.9	3.1	3.5	3.8	4.1	4.4	4.5	4.6	5.1	5.7	6.9	7.1	8.7	10.6	12.0
40 to 60	2.9	3.0	3.4	3.7	4.0	4.3	4.4	4.5	4.9	5.5	6.7	6.9	8.4	10.2	11.5
20 to 40	2.8	2.9	3.3	3.6	3.9	4.2	4.3	4.4	4.8	5.4	6.5	6.7	8.1	9.8	11.0
0 to 20	2.8	2.9	3.3	3.6	3.8	4.2	4.2	4.3	4.8	5.3	6.4	6.5	7.9	9.5	10.6
−20 to 0	2.9	3.0	3.3	3.6	3.9	4.2	4.3	4.3	4.7	5.2	6.3	6.4	7.7	9.2	10.2
−40 to −20	3.0	3.1	3.5	3.7	4.0	4.3	4.3	4.4	4.8	5.3	6.3	6.4	7.6	9.0	9.9
−60 to −40 (ref.)	3.3	3.4	3.7	3.9	4.2	4.5	4.5	4.6	5.0	5.4	6.4	6.5	7.6	8.9	9.8
−70 to −60 (ref.)	3.5	3.6	4.0	4.2	4.4	4.7	4.8	4.9	5.2	5.6	6.5	6.7	7.8	8.9	9.8

Absolute Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90	1.8	2.0	2.4	2.7	3.0	3.3	3.4	3.5	4.0	4.6	5.9	6.1	7.7	9.7	11.1
60 to 80	1.6	1.8	2.2	2.5	2.8	3.1	3.2	3.3	3.8	4.3	5.6	5.8	7.4	9.2	10.6
40 to 60	1.4	1.5	1.9	2.2	2.5	2.8	2.9	3.0	3.4	4.0	5.2	5.3	6.9	8.6	9.9
20 to 40	1.2	1.3	1.6	1.9	2.2	2.5	2.6	2.7	3.1	3.6	4.8	4.9	6.4	8.0	9.2
0 to 20	0.9	1.0	1.4	1.6	1.9	2.2	2.3	2.4	2.8	3.3	4.4	4.5	5.9	7.4	8.5
−20 to 0	0.7	0.8	1.1	1.4	1.6	1.9	2.0	2.1	2.5	3.0	4.0	4.1	5.4	6.8	7.8
−40 to −20	0.4	0.5	0.9	1.1	1.4	1.6	1.7	1.8	2.2	2.6	3.6	3.7	4.9	6.2	7.2
−60 to −40	0.2	0.3	0.6	0.8	1.1	1.3	1.4	1.5	1.8	2.3	3.2	3.3	4.4	5.6	6.5
−70 to −60	0.0	0.1	0.4	0.6	0.9	1.1	1.2	1.3	1.6	2.0	2.9	3.0	4.0	5.1	5.9

Coef. disp. form. (frac. eq.)(ref.)	
P1	1.17335992E-01
Q1	8.95209969E+01
P2	2.48804348E-02
Q2	5.10731076E-02
P3	4.46088429E-01
Q3	7.16023280E-03

Fitting error of disp. form. σ [1E-6]		
	Visible	Infrared
Power ser. eq.	0.8	8.1
Frac. eq. (ref.)	1.9	8.8

Prod. Freq. (A to D)	A

Similar glass type			
OHARA	S-LAH98	HOYA	TAFD45
CDGM	H-ZLaF89L	SCHOTT	–

2022-7-1	StP, AP, SP
2020-4-1	Similar glass type
2019-4-1	Transmittance

HIKARI GLASS CO., LTD.

J-LASFH22

n_d = 1.848500 n_e = 1.853109

ν_d = 43.79 ν_e = 43.54

Glass code (d)
849438
Glass code (e)
853435

Spectral l.	Refractive idx
2.058	1.81010
1.970	1.81160
1.530	1.81871
1.129	1.82567
1.064	1.82704
t	1.82821
s	1.83293
A'	1.836311
r	1.839491
C	1.842718
C'	1.843630
He-Ne	1.844484
D	1.848329
d	1.848500
e	1.853109
F	1.862094
F'	1.863225
g	1.872983
h	1.882178
0.389	1.887856
i	1.898179

Partial dispersion	
F-C	0.019376
F'-C'	0.019595
C-t	0.014507
C-A'	0.006407
d-C	0.005782
e-C	0.010391
g-d	0.024483
g-F	0.010889
h-g	0.009195
i-g	0.025196
C'-t	0.015419
e-C'	0.009479
F'-e	0.010116
i-F'	0.034954

Relative partial dispersion	
C-t／F-C	0.7487
C-A'／F-C	0.3307
d-C／F-C	0.2984
e-C／F-C	0.5363
g-d／F-C	1.2636
g-F／F-C	0.5620
h-g／F-C	0.4746
i-g／F-C	1.3004
C'-t／F'-C'	0.7869
e-C'／F'-C'	0.4837
F'-e／F'-C'	0.5163
i-F'／F'-C'	1.7838

Deviation of relative partial disp.	
ΔPdC	0.0014
ΔPgF	−0.0089

Internal CC (80%/5%)
363/326
Color Code (70%/5%)
370/325

CCI	
B	0.00
G	0.89
R	0.92

Thermal properties	
CTE(−30,70) [1E-7/℃]	63
CTE(100,300) [1E-7/℃]	79
Tg [℃]	690
At [℃]	736
StP [℃]	653
AP [℃]	686
SP [℃]	802
Ht cndct. [W/m·K]	0.832
Sp. heat [kJ/kg·K]	0.450
Ht diffus. [1E-6 m2/sec]	0.363

Chemical properties [class]	
Acid res. (surface)	1
Alkaline detergent res.	1
Climate resistance	1
Water res. (powder)	1
Acid res. (powder)	2

Mechanical properties	
Knoop hardness	637 (6)
Abrasion hardness	58
Young's mod. [GPa]	120.4
Shear mod. [GPa]	46.1
Poisson's ratio	0.306
Stress optical coef. [1E-5 nm/cm／Pa]	1.19

Internal trans. (10mm)	
λ [nm]	τ
280	–
290	–
300	–
310	–
320	–
330	0.11
340	0.37
350	0.62
360	0.77
370	0.86
380	0.913
390	0.942
400	0.958
420	0.975
440	0.982
460	0.988
480	0.991
500	0.994
550	0.998
600	0.998
650	0.998
700	0.998
800	0.999
900	0.999
1000	0.999
1200	0.999
1400	0.999
1600	0.999
1800	0.993
2000	0.978
2200	0.950
2400	0.82

Specific gravity
5.08

Coef. disp. form. (pwr ser.)	
A0	3.32390176E+00
A1	−1.24810607E-02
A2	−1.16698235E-04
A3	3.16622125E-02
A4	6.39837554E-04
A5	8.85550500E-06
A6	1.07749628E-06
A7	0.00000000E+00
A8	0.00000000E+00

Relative Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90 (ref.)	4.0	4.1	4.4	4.7	4.9	5.2	5.2	5.3	5.6	6.0	6.8	6.9	7.8	8.7	9.4
60 to 80 (ref.)	3.9	4.0	4.4	4.6	4.8	5.0	5.1	5.2	5.5	5.8	6.6	6.7	7.5	8.5	9.1
40 to 60	3.8	3.9	4.2	4.4	4.7	4.9	5.0	5.0	5.3	5.7	6.4	6.4	7.3	8.1	8.6
20 to 40	3.8	3.8	4.1	4.4	4.6	4.8	4.8	4.9	5.2	5.5	6.2	6.2	7.0	7.8	8.3
0 to 20	3.7	3.8	4.1	4.3	4.5	4.7	4.8	4.8	5.1	5.4	6.0	6.1	6.8	7.5	7.9
−20 to 0	3.8	3.8	4.1	4.3	4.5	4.7	4.8	4.8	5.1	5.3	5.9	6.0	6.6	7.2	7.6
−40 to −20	3.9	3.9	4.2	4.4	4.6	4.8	4.8	4.9	5.1	5.4	5.9	6.0	6.5	7.1	7.4
−60 to −40 (ref.)	4.1	4.1	4.4	4.6	4.8	4.9	5.0	5.0	5.2	5.5	6.0	6.0	6.6	7.1	7.3
−70 to −60 (ref.)	4.3	4.4	4.6	4.8	5.0	5.1	5.2	5.2	5.4	5.7	6.1	6.2	6.7	7.1	7.4

Absolute Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90	2.9	3.0	3.3	3.5	3.8	4.0	4.1	4.2	4.5	4.8	5.6	5.7	6.6	7.5	8.2
60 to 80	2.7	2.8	3.1	3.3	3.6	3.8	3.9	3.9	4.2	4.6	5.3	5.4	6.3	7.1	7.7
40 to 60	2.4	2.5	2.8	3.1	3.3	3.5	3.6	3.6	3.9	4.2	4.9	5.0	5.8	6.6	7.2
20 to 40	2.2	2.3	2.6	2.8	3.0	3.2	3.2	3.3	3.6	3.9	4.5	4.6	5.3	6.1	6.6
0 to 20	1.9	2.0	2.3	2.5	2.7	2.9	2.9	3.0	3.2	3.5	4.1	4.2	4.9	5.6	6.0
−20 to 0	1.7	1.7	2.0	2.2	2.4	2.6	2.6	2.7	2.9	3.2	3.7	3.8	4.4	5.0	5.4
−40 to −20	1.4	1.5	1.7	1.9	2.1	2.3	2.3	2.4	2.6	2.8	3.3	3.4	4.0	4.5	4.8
−60 to −40	1.2	1.2	1.5	1.6	1.8	2.0	2.0	2.1	2.3	2.5	3.0	3.0	3.5	4.0	4.2
−70 to −60	1.0	1.0	1.3	1.4	1.6	1.7	1.8	1.8	2.0	2.2	2.7	2.7	3.2	3.6	3.8

Coef. disp. form. (frac. eq.)(ref.)	
P1	1.14455188E-01
Q1	8.68161861E+01
P2	3.36439492E-02
Q2	3.01414955E-02
P3	4.02866752E-01
Q3	5.82228484E-03

Fitting error of disp. form. σ [1E-6]		
	Visible	Infrared
Power ser. eq.	0.9	5.2
Frac. eq. (ref.)	0.8	4.9

Prod. Freq. (A to D)	A

Similar glass type			
OHARA	–	HOYA	–
CDGM	–	SCHOTT	–

2022-7-1	StP, AP, SP
2019-4-1	Transmittance
2016-4-1	1st edition

HIKARI GLASS CO., LTD.

J-LASFH23

n_d = 1.850000 n_e = 1.857418

ν_d = 27.03 ν_e = 26.81

Glass code (d)
850270
Glass code (e)
857268

Spectral l.	Refractive idx
2.058	1.79871
1.970	1.80026
1.530	1.80794
1.129	1.81637
1.064	1.81818
t	1.81975
s	1.82634
A'	1.831271
r	1.836025
C	1.840948
C'	1.842357
He-Ne	1.843682
D	1.849728
d	1.850000
e	1.857418
F	1.872398
F'	1.874334
g	1.891561
h	1.908764
0.389	1.919943
i	–

Coef. disp. form. (pwr ser.)	
A0	3.27710657E+00
A1	-1.20480934E-02
A2	-1.05066933E-04
A3	4.70173769E-02
A4	9.57912660E-04
A5	2.82409939E-04
A6	-2.89931135E-05
A7	2.51862401E-06
A8	0.00000000E+00

Partial dispersion	
F-C	0.031450
F'-C'	0.031977
C-t	0.021201
C-A'	0.009677
d-C	0.009052
e-C	0.016470
g-d	0.041561
g-F	0.019163
h-g	0.017203
i-g	–
C'-t	0.022610
e-C'	0.015061
F'-e	0.016916
i-F'	–

Relative partial dispersion	
C-t／F-C	0.6741
C-A'／F-C	0.3077
d-C／F-C	0.2878
e-C／F-C	0.5237
g-d／F-C	1.3215
g-F／F-C	0.6093
h-g／F-C	0.5470
i-g／F-C	–
C'-t／F'-C'	0.7071
e-C'／F'-C'	0.4710
F'-e／F'-C'	0.5290
i-F'／F'-C'	–

Deviation of relative partial disp.	
ΔPdC	-0.0016
ΔPgF	0.0103

Internal CC (80%/5%)
390/357
Color Code (70%/5%)
395/360

CCI	
B	0.00
G	2.35
R	2.53

Thermal properties	
CTE(-30,70) [1E-7/℃]	76
CTE(100,300) [1E-7/℃]	95
Tg [℃]	594
At [℃]	644
StP [℃]	554
AP [℃]	590
SP [℃]	718
Ht cndct. [W/m·K]	0.876
Sp. heat [kJ/kg·K]	0.561
Ht diffus. [1E-6 m2/sec]	0.401

Chemical properties [class]	
Acid res. (surface)	1
Alkaline detergent res.	1
Climate resistance	1
Water res. (powder)	1
Acid res. (powder)	1

Mechanical properties	
Knoop hardness	472 (5)
Abrasion hardness	164
Young's mod. [GPa]	98.1
Shear mod. [GPa]	38.2
Poisson's ratio	0.283
Stress optical coef. [1E-5 nm/cm／Pa]	2.75

Internal trans. (10mm)	
λ [nm]	τ
280	–
290	–
300	–
310	–
320	–
330	–
340	–
350	–
360	0.09
370	0.35
380	0.63
390	0.80
400	0.88
420	0.942
440	0.963
460	0.973
480	0.980
500	0.986
550	0.993
600	0.996
650	0.997
700	0.998
800	0.998
900	0.998
1000	0.998
1200	0.998
1400	0.999
1600	0.992
1800	0.981
2000	0.971
2200	0.945
2400	0.88

Specific gravity
3.9

Relative Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90 (ref.)	-0.4	-0.3	0.2	0.6	1.0	1.4	1.5	1.6	2.1	2.8	4.2	4.4	6.4	8.6	10.2
60 to 80 (ref.)	-0.4	-0.3	0.2	0.5	0.9	1.3	1.4	1.5	2.0	2.6	4.0	4.2	6.1	8.2	9.8
40 to 60	-0.4	-0.3	0.1	0.5	0.8	1.2	1.3	1.4	1.8	2.4	3.8	3.9	5.7	7.8	9.3
20 to 40	-0.4	-0.2	0.1	0.4	0.8	1.1	1.2	1.3	1.7	2.3	3.5	3.7	5.4	7.4	8.9
0 to 20	-0.3	-0.2	0.2	0.5	0.7	1.1	1.1	1.2	1.7	2.2	3.3	3.5	5.1	7.0	8.5
-20 to 0	-0.1	0.0	0.3	0.5	0.8	1.1	1.2	1.2	1.6	2.1	3.2	3.4	4.9	6.7	8.1
-40 to -20	0.1	0.2	0.5	0.7	0.9	1.2	1.3	1.3	1.7	2.1	3.2	3.3	4.8	6.5	7.9
-60 to -40 (ref.)	0.4	0.5	0.7	0.9	1.2	1.4	1.5	1.5	1.9	2.3	3.2	3.4	4.7	6.4	7.7
-70 to -60 (ref.)	0.7	0.8	1.0	1.2	1.4	1.6	1.7	1.8	2.1	2.5	3.4	3.5	4.8	6.4	7.7

Absolute Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90	-1.5	-1.4	-0.9	-0.6	-0.2	0.2	0.3	0.4	1.0	1.6	3.1	3.3	5.2	7.4	9.0
60 to 80	-1.6	-1.5	-1.1	-0.7	-0.4	0.0	0.1	0.2	0.7	1.4	2.7	2.9	4.8	6.9	8.5
40 to 60	-1.8	-1.7	-1.3	-0.9	-0.6	-0.2	-0.1	-0.1	0.4	1.0	2.3	2.5	4.3	6.3	7.8
20 to 40	-1.9	-1.8	-1.4	-1.1	-0.8	-0.5	-0.4	-0.3	0.1	0.7	1.9	2.1	3.7	5.7	7.2
0 to 20	-2.1	-2.0	-1.6	-1.4	-1.1	-0.8	-0.7	-0.6	-0.2	0.3	1.5	1.6	3.2	5.1	6.5
-20 to 0	-2.2	-2.1	-1.8	-1.6	-1.3	-1.0	-1.0	-0.9	-0.5	0.0	1.0	1.2	2.7	4.5	5.9
-40 to -20	-2.4	-2.3	-2.0	-1.8	-1.5	-1.3	-1.2	-1.2	-0.8	-0.4	0.6	0.8	2.2	3.9	5.2
-60 to -40	-2.5	-2.4	-2.2	-2.0	-1.8	-1.6	-1.5	-1.4	-1.1	-0.7	0.2	0.3	1.6	3.3	4.5
-70 to -60	-2.6	-2.6	-2.3	-2.2	-2.0	-1.8	-1.7	-1.6	-1.4	-1.0	-0.1	0.0	1.2	2.8	4.1

Coef. disp. form. (frac. eq.)(ref.)	
P1	1.15215113E-01
Q1	8.86478948E+01
P2	2.76609321E-02
Q2	5.86167377E-02
P3	4.03904542E-01
Q3	8.32250156E-03

Fitting error of disp. form. σ [1E-6]		
	Visible	Infrared
Power ser. eq.	1.0	4.2
Frac. eq. (ref.)	2.9	8.8

Prod. Freq. (A to D)	A

Similar glass type			
OHARA	–	HOYA	–
CDGM	–	SCHOTT	–

2022-7-1	StP, AP, SP
2019-4-1	Transmittance
2015-4-1	1st edition

HIKARI GLASS CO., LTD.

J-LASFH24

n_d = 1.902000 n_e = 1.910410

ν_d = 25.26 ν_e = 25.06

Glass code (d)
902253
Glass code (e)
910251

Spectral l.	Refractive idx
2.058	1.84515
1.970	1.84681
1.530	1.85508
1.129	1.86432
1.064	1.86631
t	1.86804
s	1.87537
A'	1.880892
r	1.886230
C	1.891774
C'	1.893362
He-Ne	1.894858
D	1.901692
d	1.902000
e	1.910410
F	1.927478
F'	1.929693
g	1.949493
h	1.969440
0.389	1.982512
i	–

Coef. disp. form. (pwr ser.)	
A0	3.45215485E+00
A1	-1.40748042E-02
A2	0.00000000E+00
A3	5.02420375E-02
A4	3.57942817E-03
A5	-4.94644665E-04
A6	1.29480898E-04
A7	-1.35467075E-05
A8	6.96875364E-07

Partial dispersion	
F-C	0.035704
F'-C'	0.036331
C-t	0.023731
C-A'	0.010882
d-C	0.010226
e-C	0.018636
g-d	0.047493
g-F	0.022015
h-g	0.019947
i-g	–
C'-t	0.025319
e-C'	0.017048
F'-e	0.019283
i-F'	–

Relative partial dispersion	
C-t／F-C	0.6647
C-A'／F-C	0.3048
d-C／F-C	0.2864
e-C／F-C	0.5220
g-d／F-C	1.3302
g-F／F-C	0.6166
h-g／F-C	0.5587
i-g／F-C	–
C'-t／F'-C'	0.6969
e-C'／F'-C'	0.4692
F'-e／F'-C'	0.5308
i-F'／F'-C'	–

Deviation of relative partial disp.	
ΔPdC	-0.0022
ΔPgF	0.0146

Internal CC (80%/5%)
409/366
Color Code (70%/5%)
420/365

CCI	
B	0.00
G	5.45
R	5.71

Thermal properties	
CTE(-30,70) [1E-7/℃]	77
CTE(100,300) [1E-7/℃]	89
Tg [℃]	659
At [℃]	706
StP [℃]	613
AP [℃]	649
SP [℃]	771
Ht cndct. [W/m·K]	0.983
Sp. heat [kJ/kg·K]	0.551
Ht diffus. [1E-6 m2/sec]	0.436

Chemical properties [class]	
Acid res. (surface)	1
Alkaline detergent res.	1
Climate resistance	1
Water res. (powder)	1
Acid res. (powder)	1

Mechanical properties	
Knoop hardness	513 (5)
Abrasion hardness	144
Young's mod. [GPa]	102.1
Shear mod. [GPa]	39.7
Poisson's ratio	0.285
Stress optical coef. [1E-5 nm/cm／Pa]	2.34

Internal trans. (10mm)	
λ [nm]	τ
280	–
290	–
300	–
310	–
320	–
330	–
340	–
350	–
360	0.01
370	0.11
380	0.34
390	0.57
400	0.72
420	0.86
440	0.923
460	0.953
480	0.968
500	0.979
550	0.992
600	0.997
650	0.997
700	0.998
800	0.997
900	0.996
1000	0.997
1200	0.999
1400	0.999
1600	0.992
1800	0.983
2000	0.978
2200	0.957
2400	0.900

Specific gravity
4.1

Relative Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90 (ref.)	0.3	0.4	0.7	1.1	1.5	1.9	2.0	2.1	2.7	3.5	5.2	5.4	7.8	10.9	–
60 to 80 (ref.)	0.1	0.3	0.7	1.0	1.3	1.7	1.8	1.9	2.5	3.2	4.9	5.1	7.4	10.3	–
40 to 60	0.0	0.1	0.5	0.8	1.1	1.5	1.6	1.7	2.2	2.9	4.5	4.7	6.8	9.6	–
20 to 40	-0.2	0.0	0.3	0.6	0.9	1.3	1.4	1.5	2.0	2.6	4.1	4.3	6.3	8.9	–
0 to 20	-0.2	-0.1	0.2	0.5	0.8	1.1	1.2	1.3	1.8	2.4	3.8	4.0	5.9	8.2	–
-20 to 0	-0.3	-0.2	0.2	0.4	0.7	1.0	1.1	1.2	1.7	2.2	3.5	3.7	5.5	7.6	–
-40 to -20	-0.2	-0.1	0.2	0.4	0.7	1.0	1.1	1.2	1.6	2.1	3.4	3.5	5.1	7.1	–
-60 to -40 (ref.)	-0.1	0.0	0.3	0.5	0.8	1.1	1.2	1.2	1.6	2.2	3.3	3.4	4.9	6.7	–
-70 to -60 (ref.)	0.2	0.2	0.5	0.7	1.0	1.2	1.3	1.4	1.8	2.3	3.3	3.5	4.9	6.5	–

Absolute Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90	-0.9	-0.8	-0.4	0.0	0.3	0.7	0.8	0.9	1.5	2.3	4.0	4.2	6.6	9.6	–
60 to 80	-1.1	-1.0	-0.6	-0.3	0.0	0.4	0.5	0.6	1.2	1.9	3.5	3.8	6.0	8.9	–
40 to 60	-1.4	-1.3	-1.0	-0.7	-0.4	0.0	0.1	0.2	0.8	1.4	3.0	3.2	5.3	8.0	–
20 to 40	-1.8	-1.6	-1.3	-1.0	-0.7	-0.4	-0.3	-0.2	0.3	1.0	2.4	2.6	4.6	7.1	–
0 to 20	-2.1	-2.0	-1.7	-1.4	-1.1	-0.8	-0.7	-0.6	-0.1	0.5	1.8	2.0	3.9	6.2	–
-20 to 0	-2.4	-2.3	-2.0	-1.8	-1.5	-1.2	-1.1	-1.0	-0.5	0.0	1.3	1.5	3.2	5.3	–
-40 to -20	-2.7	-2.6	-2.3	-2.1	-1.9	-1.6	-1.5	-1.4	-1.0	-0.5	0.7	0.9	2.5	4.4	–
-60 to -40	-3.0	-2.9	-2.7	-2.5	-2.2	-2.0	-1.9	-1.8	-1.4	-0.9	0.2	0.3	1.7	3.5	–
-70 to -60	-3.3	-3.2	-2.9	-2.7	-2.5	-2.3	-2.2	-2.1	-1.7	-1.3	-0.3	-0.1	1.2	2.8	–

Coef. disp. form. (frac. eq.)(ref.)	
P1	1.07493029E-01
Q1	8.15532458E+01
P2	2.93223861E-02
Q2	6.08031611E-02
P3	4.20201675E-01
Q3	8.51713693E-03

Fitting error of disp. form. σ [1E-6]		
	Visible	Infrared
Power ser. eq.	1.0	4.8
Frac. eq. (ref.)	2.9	9.4

Prod. Freq. (A to D)	A

Similar glass type			
OHARA	–	HOYA	–
CDGM	–	SCHOTT	–

2022-7-1	StP, AP, SP
2019-4-1	Transmittance
2016-4-1	Similar glass type

HIKARI GLASS CO., LTD.

J-LASFH24HS

n_d = 1.902000 n_e = 1.910410

ν_d = 25.26 ν_e = 25.06

Glass code (d)
902253
Glass code (e)
910251

Spectral l.	Refractive idx
2.058	1.84515
1.970	1.84681
1.530	1.85508
1.129	1.86432
1.064	1.86631
t	1.86804
s	1.87537
A'	1.880892
r	1.886230
C	1.891774
C'	1.893362
He-Ne	1.894858
D	1.901692
d	1.902000
e	1.910410
F	1.927478
F'	1.929693
g	1.949493
h	1.969440
0.389	1.982512
i	–

Coef. disp. form. (pwr ser.)	
A0	3.45215485E+00
A1	-1.40748042E-02
A2	0.00000000E+00
A3	5.02420375E-02
A4	3.57942817E-03
A5	-4.94644665E-04
A6	1.29480898E-04
A7	-1.35467075E-05
A8	6.96875364E-07

Partial dispersion	
F-C	0.035704
F'-C'	0.036331
C-t	0.023731
C-A'	0.010882
d-C	0.010226
e-C	0.018636
g-d	0.047493
g-F	0.022015
h-g	0.019947
i-g	–
C'-t	0.025319
e-C'	0.017048
F'-e	0.019283
i-F'	–

Relative partial dispersion	
C-t／F-C	0.6647
C-A'／F-C	0.3048
d-C／F-C	0.2864
e-C／F-C	0.5220
g-d／F-C	1.3302
g-F／F-C	0.6166
h-g／F-C	0.5587
i-g／F-C	–
C'-t／F'-C'	0.6969
e-C'／F'-C'	0.4692
F'-e／F'-C'	0.5308
i-F'／F'-C'	–

Deviation of relative partial disp.	
ΔPdC	-0.0022
ΔPgF	0.0146

Internal CC (80%/5%)
400/366
Color Code (70%/5%)
410/365

CCI	
B	0.00
G	3.65
R	3.80

Thermal properties	
CTE(-30,70) [1E-7/℃]	77
CTE(100,300) [1E-7/℃]	89
Tg [℃]	659
At [℃]	706
StP [℃]	613
AP [℃]	649
SP [℃]	771
Ht cndct. [W/m·K]	0.983
Sp. heat [kJ/kg·K]	0.551
Ht diffus. [1E-6 m2/sec]	0.436

Chemical properties [class]	
Acid res. (surface)	1
Alkaline detergent res.	1
Climate resistance	1
Water res. (powder)	1
Acid res. (powder)	1

Mechanical properties	
Knoop hardness	513 (5)
Abrasion hardness	144
Young's mod. [GPa]	102.1
Shear mod. [GPa]	39.7
Poisson's ratio	0.285
Stress optical coef. [1E-5 nm/cm／Pa]	2.34

Internal trans. (10mm)	
λ [nm]	τ
280	–
290	–
300	–
310	–
320	–
330	–
340	–
350	–
360	–
370	0.13
380	0.45
390	0.69
400	0.81
420	0.910
440	0.951
460	0.969
480	0.978
500	0.984
550	0.994
600	0.996
650	0.996
700	0.997
800	0.997
900	0.997
1000	0.998
1200	0.999
1400	0.998
1600	0.997
1800	0.989
2000	0.980
2200	0.959
2400	0.905

Specific gravity
4.1

Relative Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90 (ref.)	0.3	0.4	0.7	1.1	1.5	1.9	2.0	2.1	2.7	3.5	5.2	5.4	7.8	10.9	–
60 to 80 (ref.)	0.1	0.3	0.7	1.0	1.3	1.7	1.8	1.9	2.5	3.2	4.9	5.1	7.4	10.3	–
40 to 60	0.0	0.1	0.5	0.8	1.1	1.5	1.6	1.7	2.2	2.9	4.5	4.7	6.8	9.6	–
20 to 40	-0.2	0.0	0.3	0.6	0.9	1.3	1.4	1.5	2.0	2.6	4.1	4.3	6.3	8.9	–
0 to 20	-0.2	-0.1	0.2	0.5	0.8	1.1	1.2	1.3	1.8	2.4	3.8	4.0	5.9	8.2	–
-20 to 0	-0.3	-0.2	0.2	0.4	0.7	1.0	1.1	1.2	1.7	2.2	3.5	3.7	5.5	7.6	–
-40 to -20	-0.2	-0.1	0.2	0.4	0.7	1.0	1.1	1.2	1.6	2.1	3.4	3.5	5.1	7.1	–
-60 to -40 (ref.)	-0.1	0.0	0.3	0.5	0.8	1.1	1.2	1.2	1.6	2.2	3.3	3.4	4.9	6.7	–
-70 to -60 (ref.)	0.2	0.2	0.5	0.7	1.0	1.2	1.3	1.4	1.8	2.3	3.3	3.5	4.9	6.5	–

Absolute Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90	-0.9	-0.8	-0.4	0.0	0.3	0.7	0.8	0.9	1.5	2.3	4.0	4.2	6.6	9.6	–
60 to 80	-1.1	-1.0	-0.6	-0.3	0.0	0.4	0.5	0.6	1.2	1.9	3.5	3.8	6.0	8.9	–
40 to 60	-1.4	-1.3	-1.0	-0.7	-0.4	0.0	0.1	0.2	0.8	1.4	3.0	3.2	5.3	8.0	–
20 to 40	-1.8	-1.6	-1.3	-1.0	-0.7	-0.4	-0.3	-0.2	0.3	1.0	2.4	2.6	4.6	7.1	–
0 to 20	-2.1	-2.0	-1.7	-1.4	-1.1	-0.8	-0.7	-0.6	-0.1	0.5	1.8	2.0	3.9	6.2	–
-20 to 0	-2.4	-2.3	-2.0	-1.8	-1.5	-1.2	-1.1	-1.0	-0.5	0.0	1.3	1.5	3.2	5.3	–
-40 to -20	-2.7	-2.6	-2.3	-2.1	-1.9	-1.6	-1.5	-1.4	-1.0	-0.5	0.7	0.9	2.5	4.4	–
-60 to -40	-3.0	-2.9	-2.7	-2.5	-2.2	-2.0	-1.9	-1.8	-1.4	-0.9	0.2	0.3	1.7	3.5	–
-70 to -60	-3.3	-3.2	-2.9	-2.7	-2.5	-2.3	-2.2	-2.1	-1.7	-1.3	-0.3	-0.1	1.2	2.8	–

Coef. disp. form. (frac. eq.)(ref.)	
P1	1.07493029E-01
Q1	8.15532458E+01
P2	2.93223861E-02
Q2	6.08031611E-02
P3	4.20201675E-01
Q3	8.51713693E-03

Fitting error of disp. form. σ [1E-6]		
	Visible	Infrared
Power ser. eq.	1.0	4.8
Frac. eq. (ref.)	2.9	9.4

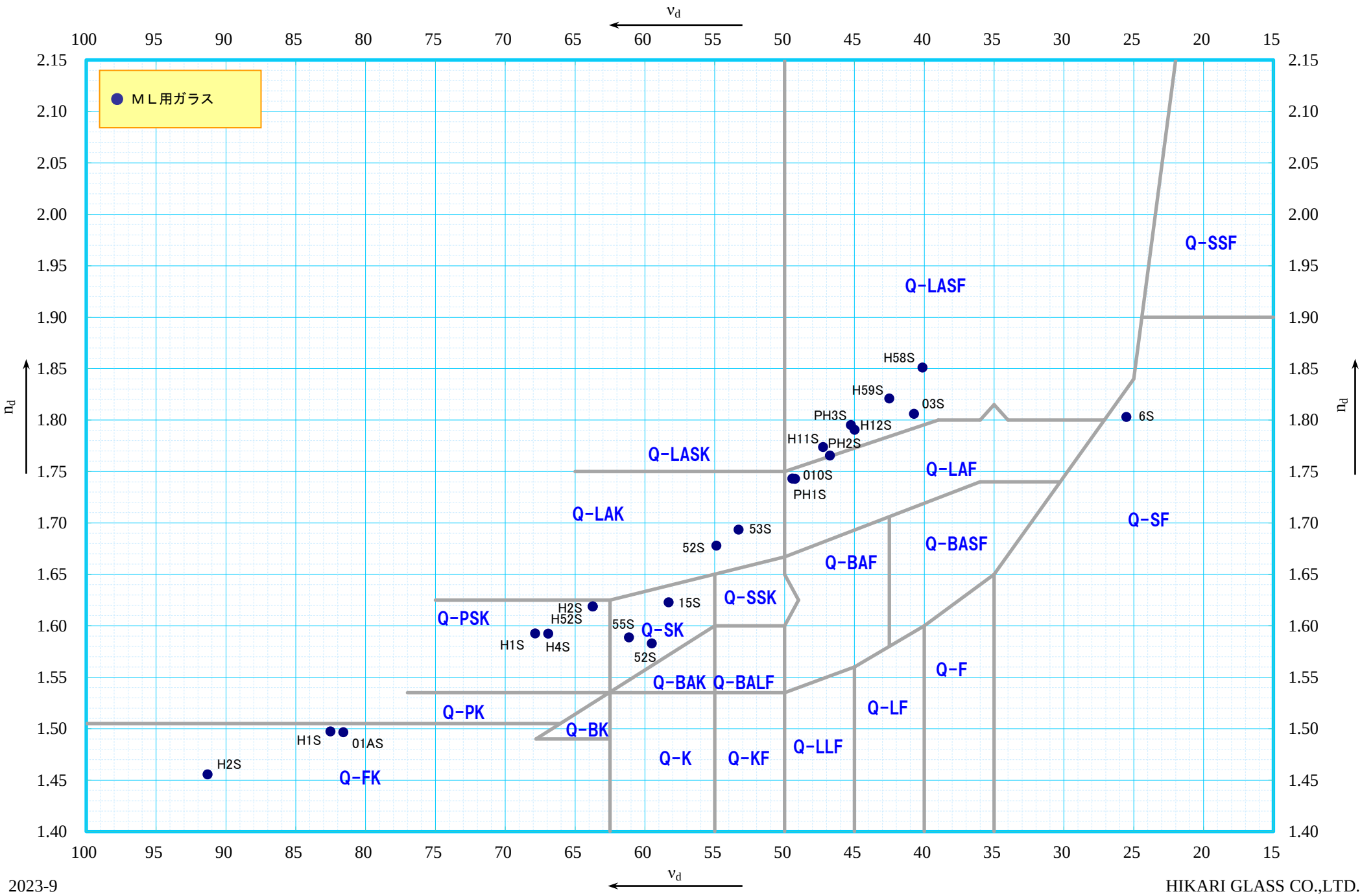
Prod. Freq. (A to D)	A

Similar glass type			
OHARA	–	HOYA	–
CDGM	–	SCHOTT	–

2022-7-1	StP, AP, SP
2019-4-1	Transmittance
2017-4-1	1st edition

HIKARI GLASS CO., LTD.

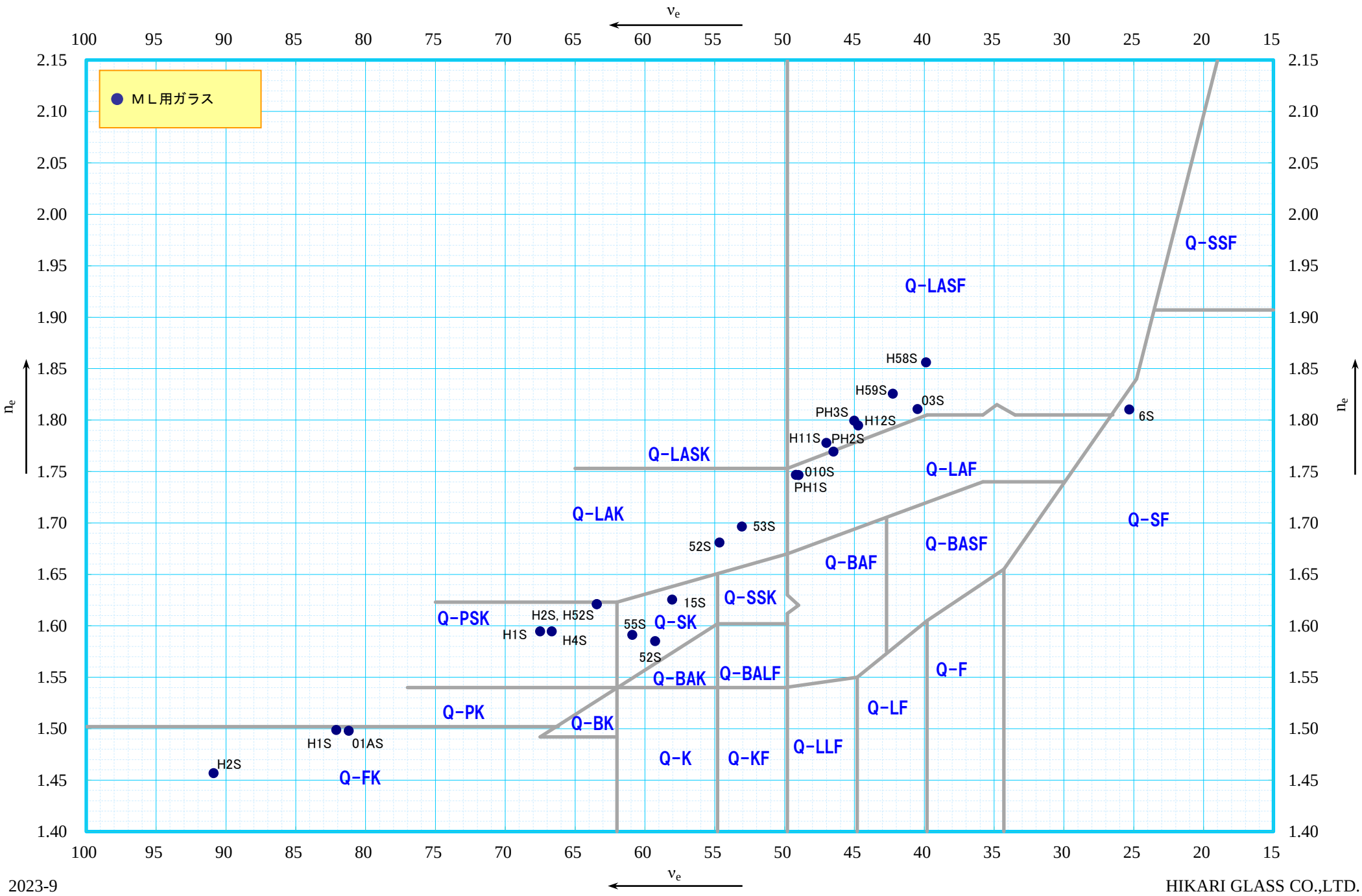
Optical glass for mold lens n_d-ν_d diagram



2023-9

HIKARI GLASS CO.,LTD.

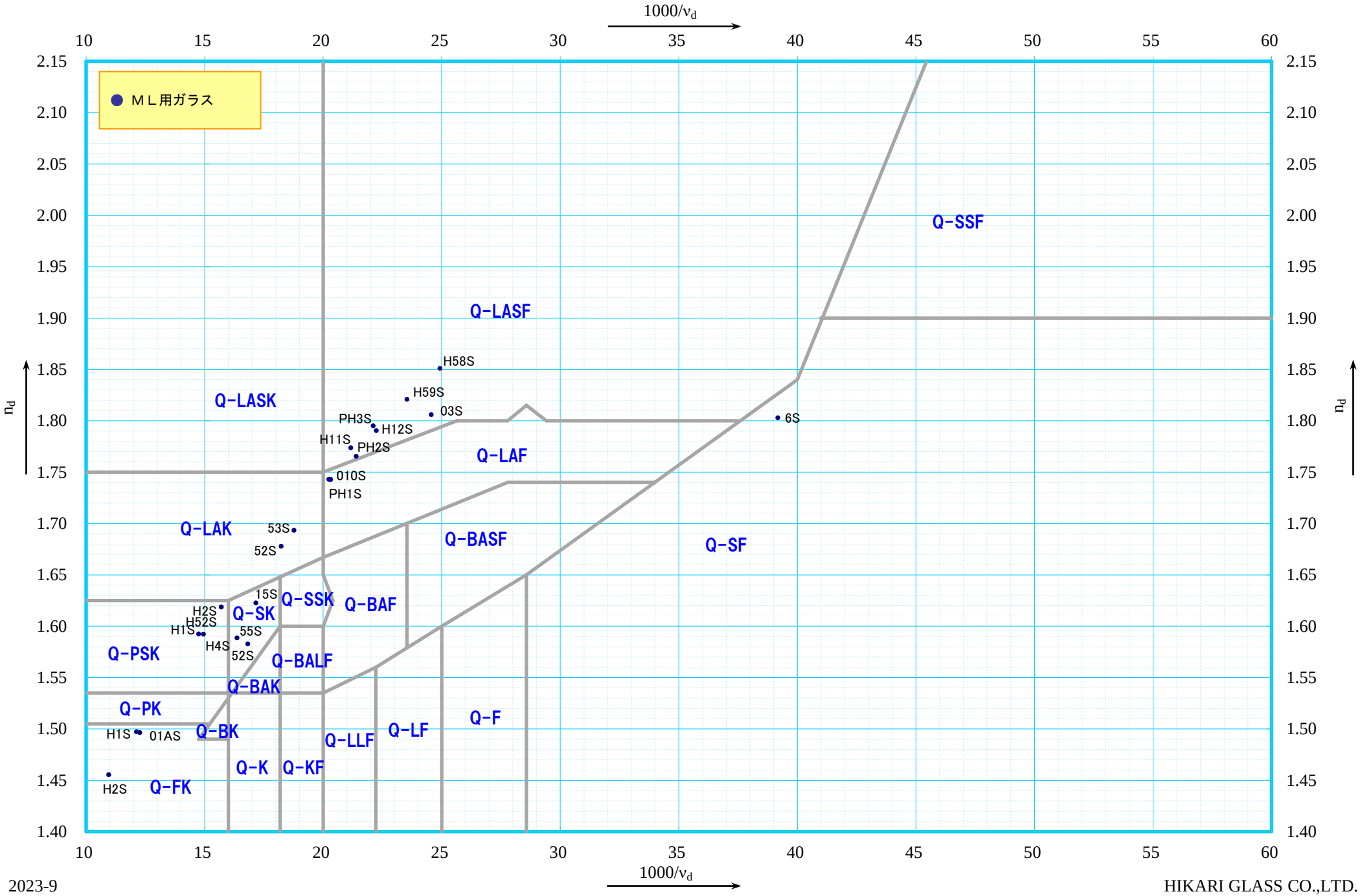
Optical glass for mold lens n_e-ν_e diagram



2023-9

HIKARI GLASS CO.,LTD.

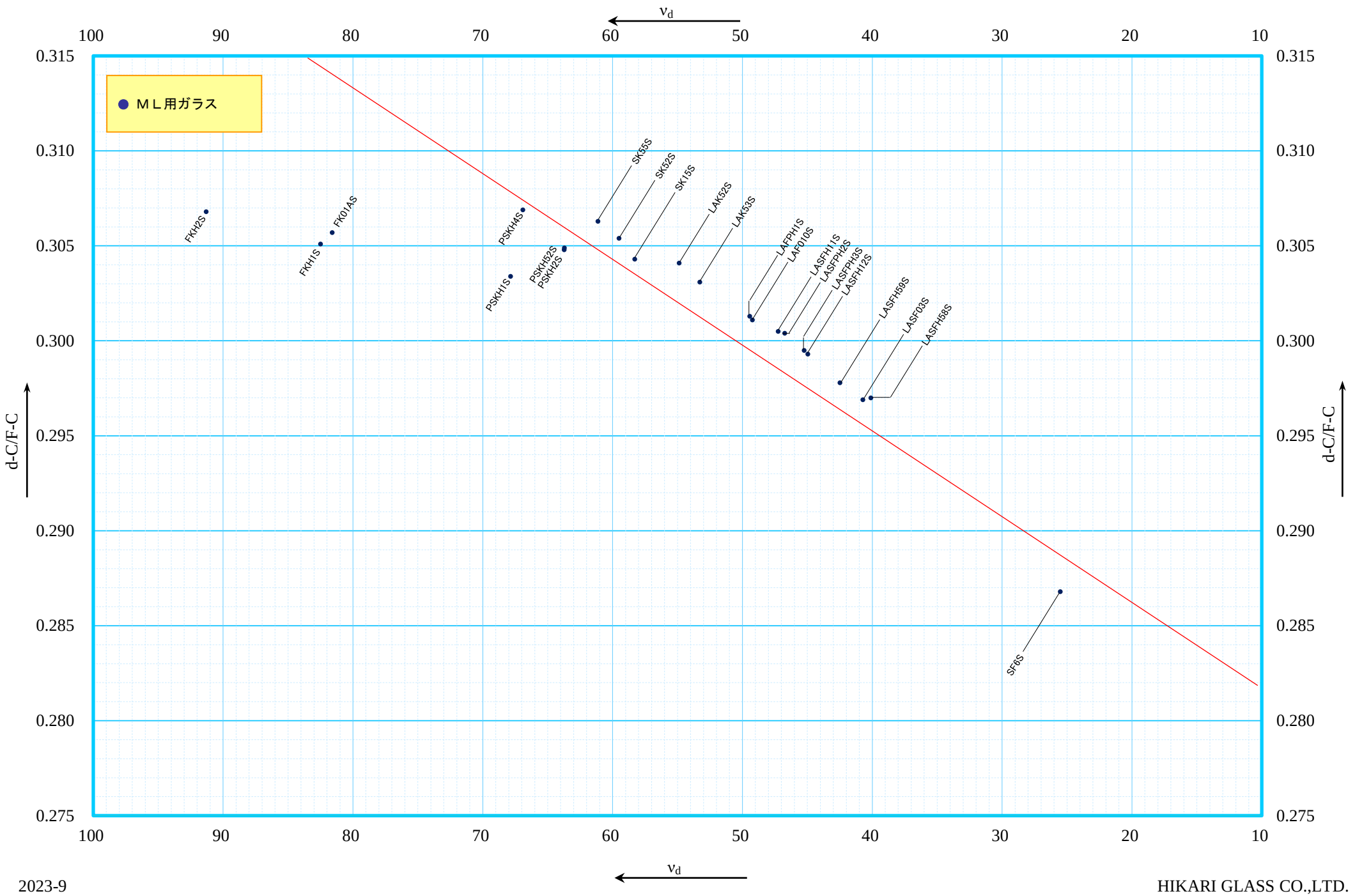
Optical glass for mold lens n_d-1000/ν_d diagram



2023-9

HIKARI GLASS CO.,LTD.

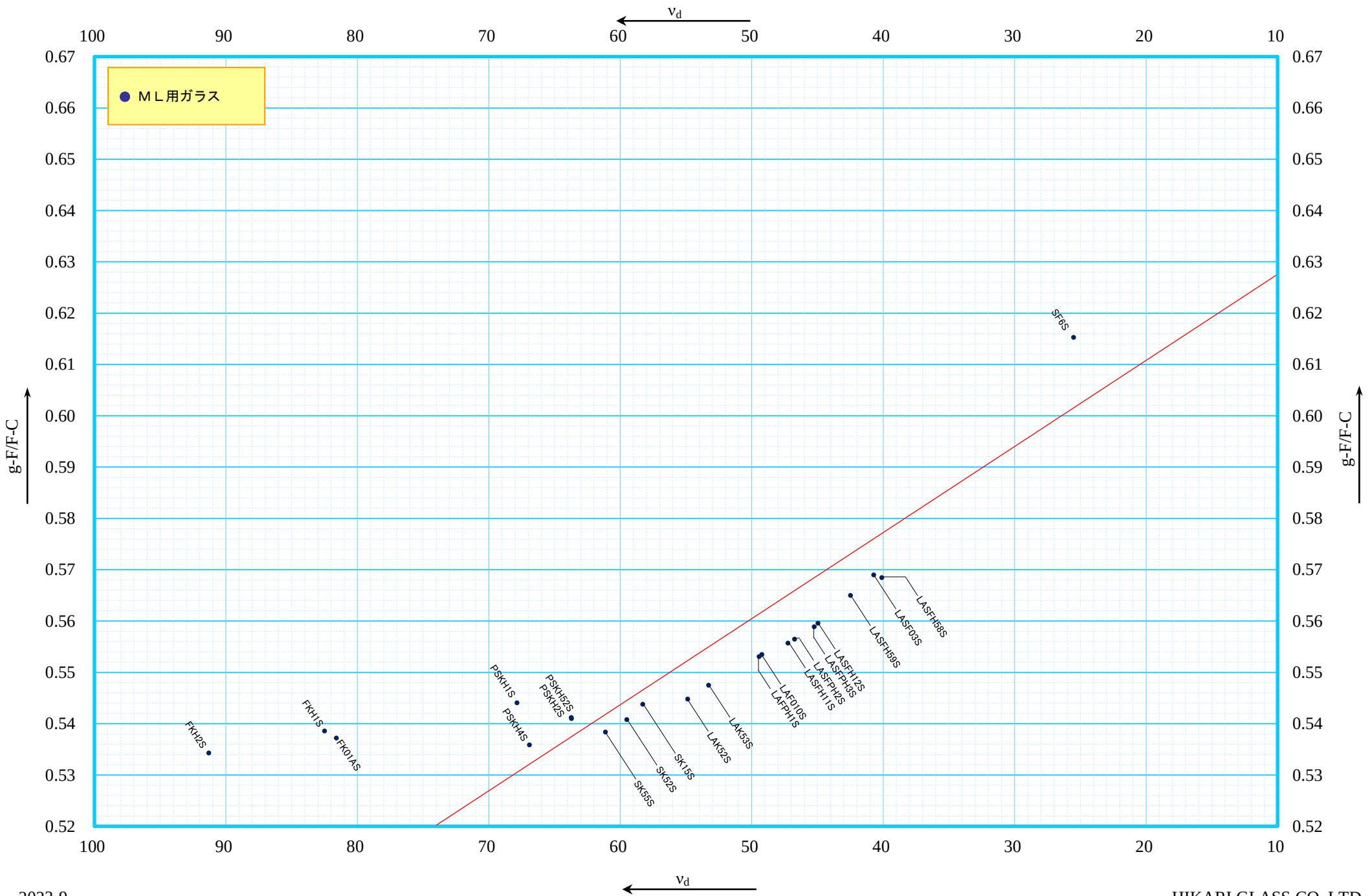
Optical glass for mold lens d-C/F-C - ν_d diagram



2023-9

HIKARI GLASS CO.,LTD.

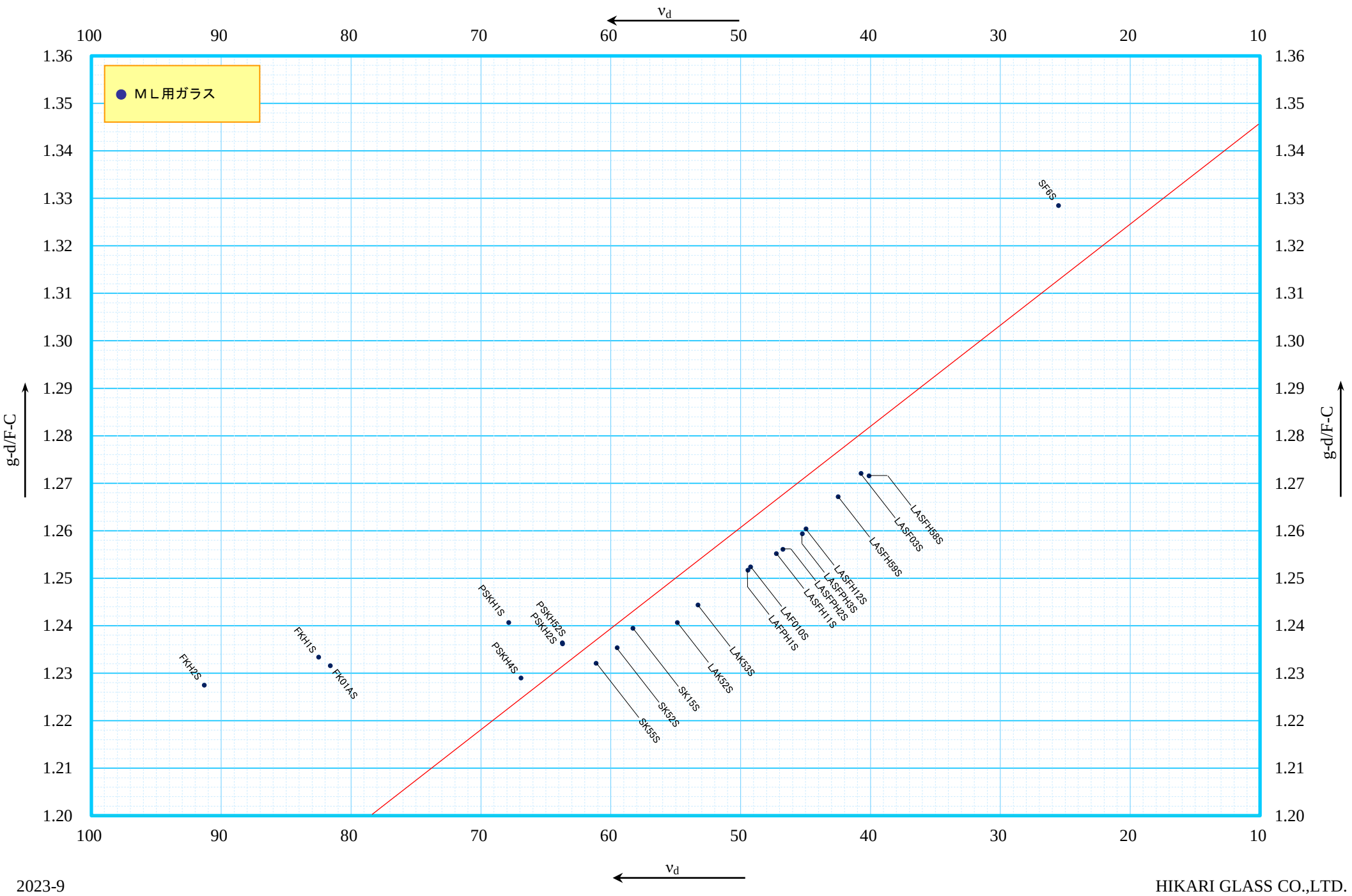
Optical glass for mold lens g-F/F-C — ν_d diagram



2023-9

HIKARI GLASS CO.,LTD.

Optical glass for mold lens g-d/F-C — ν_d diagram



2023-9

HIKARI GLASS CO.,LTD.

【モールドレンズ用光学ガラス】

データ改訂履歴

年−月−日	硝種他	内　　容
2009-9-1	09版カタログ発行	(1)物性値追加・修正, (2)硝種名変更("Q-")
2012-4-1	3硝種	削除（Q-SK5S, Q-LASFH18S, Q-LASFH19S）
	3硝種	開発（Q-SK55S, Q-LASFH58S, Q-LASFH59S）
2015-4-1	全硝種	着色度を2桁から3桁へ変更
	Q-SF6S	生産頻度を変更
	2硝種	削除（Q-SK12S, Q-LAK13S）
	4硝種	開発（Q-PSKH4S, Q-SK15S, Q-SK52S, Q-LAK53S）
2016-4-1	3硝種	開発（Q-LAFPH1S, Q-LASFPH2S, Q-LASFPH3S）
2018-4-1	2硝種	開発（Q-FK01AS, Q-FKH1S）
	4硝種	生産頻度を変更
2018-9-1	Q-LASF03S	常温膨張係数を変更（71→52）
2019-4-1	Q-PSKH2S	削除
	Q-PSKH52S	開発
	全硝種	透過率データを更新（着色度, 内部透過, 内部透過率, CCI）
2020-4-1	全硝種	熱的性質(歪点,徐冷点,軟化点)を追加
2022-7-1	3硝種	生産頻度を変更
2023-9-1	Q−PSKH2S	再掲

注）データは予告なく変更されることがあります。

【Optical glass for mold lens】

Revision history of data

Y-M-D	Glass type	Note
2009-9-1	Release 09 version catalog	(1)Addition and correction of data, (2)changing the name of all glass types ("Q-")
2012-4-1	3 glass types	Deleted (Q-SK5S, Q-LASFH18S, Q-LASFH19S)
	3 glass types	Developped (Q-SK55S, Q-LASFH58S, Q-LASFH59S)
2015-4-1	All glass types	Changing color code from two digits to three
	Q-SF6S	Changing production frequency
	2 glass types	Deleted（Q-SK12S, Q-LAK13S）
	4 glass types	Developped（Q-PSKH4S, Q-SK15S, Q-SK52S, Q-LAK53S）
2016-4-1	3 glass types	Developped（Q-LAFPH1S, Q-LASFPH2S, Q-LASFPH3S）
2018-4-1	2 glass types	Developped（Q-FK01AS, Q-FKH1S）
	4 glass types	Changing production frequency
2018-9-1	Q-LASF03S	Thermal properties CTE(-30,70) [1E-7/℃]（71→52）
2019-4-1	Q-PSKH2S	Deleted
	Q-PSKH52S	Developped
	All glass types	Changing transmittance data（color code, internal CC, internal transmittance and CCI）
2020-4-1	All glass types	Addition of　Thermal properties(Strain point,Annealing point,Softening point)
2022-7-1	3 glass types	Changing production frequency
2023-9-1	Q-PSKH2S	Reprinted

Note：Data are subject to change without prior notice.

Q-FK01AS

n_d = 1.496530 n_e = 1.497983

ν_d = 81.60 ν_e = 81.21

Glass code (d)
497816
Glass code (e)
498812

Spectral l.	Refractive idx
2.058	1.48134
1.970	1.48210
1.530	1.48558
1.129	1.48863
1.064	1.48918
t	1.48963
s	1.49136
A'	1.492538
r	1.493608
C	1.494670
C'	1.494967
He-Ne	1.495243
D	1.496476
d	1.496530
e	1.497983
F	1.500755
F'	1.501099
g	1.504024
h	1.506715
0.389	1.508346
i	1.511254

Coef. disp. form. (pwr ser.)	
A0	2.21653488E+00
A1	-5.54625268E-03
A2	-3.61726027E-05
A3	8.33951250E-03
A4	1.02472408E-04
A5	-1.61216982E-06
A6	1.29777392E-07
A7	0.00000000E+00
A8	0.00000000E+00

Partial dispersion	
F-C	0.006085
F'-C'	0.006132
C-t	0.005039
C-A'	0.002132
d-C	0.001860
e-C	0.003313
g-d	0.007494
g-F	0.003269
h-g	0.002691
i-g	0.007230
C'-t	0.005336
e-C'	0.003016
F'-e	0.003116
i-F'	0.010155

Relative partial dispersion	
C-t／F-C	0.8281
C-A'／F-C	0.3504
d-C／F-C	0.3057
e-C／F-C	0.5445
g-d／F-C	1.2316
g-F／F-C	0.5372
h-g／F-C	0.4422
i-g／F-C	1.1882
C'-t／F'-C'	0.8702
e-C'／F'-C'	0.4918
F'-e／F'-C'	0.5082
i-F'／F'-C'	1.6561

Deviation of relative partial disp.	
ΔPdC	-0.0084
ΔPgF	0.0298

Internal CC (80%/5%)
330/282
Color Code (80%/5%)
335/285
CCI

B	0.00
G	0.11
R	0.04

Thermal properties	
CTE(-30,70) [1E-7/℃]	120
CTE(100,300) [1E-7/℃]	146
Tg [℃]	459
At [℃]	490
StP [℃]	415
AP [℃]	446
SP [℃]	542
Ht cndct. [W/m･K]	0.770
Sp. heat [kJ/kg･K]	0.658
Ht diffus. [1E-6 m2/sec]	0.322

Chemical properties [class]	
Acid res. (surface)	5
Alkaline detergent res.	4
Climate resistance	1
Water res. (powder)	1
Acid res. (powder)	3

Mechanical properties	
Knoop hardness	344 (3)
Abrasion hardness	447
Young's mod. [GPa]	71.6
Shear mod. [GPa]	27.6
Poisson's ratio	0.297
Stress optical coef. [1E-5 nm/cm／Pa]	0.81

Internal trans. (10mm)	
λ [nm]	τ
280	0.04
290	0.11
300	0.24
310	0.44
320	0.65
330	0.80
340	0.902
350	0.953
360	0.978
370	0.990
380	0.995
390	0.997
400	0.997
420	0.996
440	0.996
460	0.997
480	0.998
500	0.999
550	0.999
600	0.998
650	0.997
700	0.999
800	0.999
900	0.999
1000	0.999
1200	0.999
1400	0.999
1600	0.998
1800	0.999
2000	0.999
2200	0.999
2400	0.998

Specific gravity
3.65

Relative Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90(ref.)	-6.4	-6.4	-6.4	-6.3	-6.2	-6.2	-6.2	-6.1	-6.1	-6.0	-5.8	-5.8	-5.7	-5.5	-5.4
60 to 80(ref.)	-6.3	-6.3	-6.2	-6.1	-6.1	-6.0	-6.0	-6.0	-5.9	-5.9	-5.7	-5.7	-5.5	-5.3	-5.3
40 to 60	-6.1	-6.0	-5.9	-5.9	-5.8	-5.8	-5.8	-5.8	-5.7	-5.6	-5.5	-5.5	-5.3	-5.1	-5.0
20 to 40	-5.8	-5.8	-5.7	-5.6	-5.6	-5.6	-5.5	-5.5	-5.5	-5.4	-5.3	-5.2	-5.1	-4.9	-4.8
0 to 20	-5.5	-5.5	-5.4	-5.4	-5.3	-5.3	-5.3	-5.2	-5.2	-5.1	-5.0	-5.0	-4.8	-4.6	-4.5
-20 to 0	-5.2	-5.1	-5.1	-5.0	-5.0	-4.9	-4.9	-4.9	-4.9	-4.8	-4.7	-4.6	-4.5	-4.3	-4.2
-40 to -20	-4.8	-4.8	-4.7	-4.6	-4.6	-4.6	-4.5	-4.5	-4.5	-4.4	-4.3	-4.3	-4.1	-3.9	-3.9
-60 to -40(ref.)	-4.3	-4.3	-4.2	-4.2	-4.1	-4.1	-4.1	-4.1	-4.0	-3.9	-3.8	-3.8	-3.6	-3.5	-3.4
-70 to -60(ref.)	-3.9	-3.8	-3.8	-3.7	-3.7	-3.7	-3.6	-3.6	-3.6	-3.5	-3.4	-3.4	-3.2	-3.1	-3.0

Absolute Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90	-7.4	-7.3	-7.3	-7.2	-7.1	-7.1	-7.1	-7.1	-7.0	-6.9	-6.8	-6.8	-6.6	-6.4	-6.4
60 to 80	-7.3	-7.3	-7.2	-7.1	-7.1	-7.0	-7.0	-7.0	-6.9	-6.9	-6.7	-6.7	-6.6	-6.4	-6.3
40 to 60	-7.2	-7.2	-7.1	-7.0	-7.0	-6.9	-6.9	-6.9	-6.9	-6.8	-6.7	-6.6	-6.5	-6.3	-6.2
20～40	-7.1	-7.1	-7.0	-6.9	-6.9	-6.9	-6.8	-6.8	-6.8	-6.7	-6.6	-6.6	-6.4	-6.2	-6.2
0 to 20	-7.0	-7.0	-6.9	-6.8	-6.8	-6.8	-6.7	-6.7	-6.7	-6.6	-6.5	-6.5	-6.3	-6.2	-6.1
-20 to 0	-6.9	-6.9	-6.8	-6.7	-6.7	-6.7	-6.7	-6.6	-6.6	-6.5	-6.4	-6.4	-6.2	-6.1	-6.0
-40 to -20	-6.8	-6.8	-6.7	-6.7	-6.6	-6.6	-6.6	-6.6	-6.5	-6.5	-6.3	-6.3	-6.2	-6.0	-5.9
-60 to -40	-6.7	-6.7	-6.6	-6.6	-6.5	-6.5	-6.5	-6.5	-6.4	-6.4	-6.3	-6.2	-6.1	-6.0	-5.9
-70 to -60	-6.6	-6.6	-6.5	-6.5	-6.5	-6.4	-6.4	-6.4	-6.4	-6.3	-6.2	-6.2	-6.0	-5.9	-5.8

Coef. disp. form. (frac. eq.)(ref.)	
P1	1.25044570E-01
Q1	1.33505878E+02
P2	5.86958669E-03
Q2	-2.83028591E-02
P3	2.82649760E-01
Q3	5.57104558E-03

Fitting error of disp. form. σ [1E-6]		
	Visible	Infrared
Power ser. eq.	0.4	4.3
Frac. eq. (ref.)	1.1	4.3

Prod. Freq. (A to D)	D

Similar glass type			
OHARA	-	HOYA	-
C.D.G.M	-	SCHOTT	-

2022-7-1	Prod. Freq
2020-4-1	StP,AP,SP
2019-4-1	Transmittance

Q-FKH1S

n_d = 1.497310 n_e = 1.498749

ν_d = 82.51 ν_e = 82.10

Glass code (d)
497825
Glass code (e)
499821

Spectral l.	Refractive idx
2.058	1.48282
1.970	1.48351
1.530	1.48671
1.129	1.48958
1.064	1.49010
t	1.49054
s	1.49222
A'	1.493370
r	1.494423
C	1.495471
C'	1.495764
He-Ne	1.496037
D	1.497256
d	1.497310
e	1.498749
F	1.501498
F'	1.501839
g	1.504744
h	1.507419
0.389	1.509041
i	1.511933

Coef. disp. form. (pwr ser.)	
A0	2.21873981E+00
A1	-5.09428315E-03
A2	-2.14995729E-05
A3	8.37486232E-03
A4	7.95531396E-05
A5	1.36269370E-06
A6	-1.10317618E-08
A7	0.00000000E+00
A8	0.00000000E+00

Partial dispersion	
F-C	0.006027
F'-C'	0.006075
C-t	0.004934
C-A'	0.002101
d-C	0.001839
e-C	0.003278
g-d	0.007434
g-F	0.003246
h-g	0.002675
i-g	0.007189
C'-t	0.005227
e-C'	0.002985
F'-e	0.003090
i-F'	0.010094

Relative partial dispersion	
C-t／F-C	0.8186
C-A'／F-C	0.3486
d-C／F-C	0.3051
e-C／F-C	0.5439
g-d／F-C	1.2334
g-F／F-C	0.5386
h-g／F-C	0.4438
i-g／F-C	1.1928
C'-t／F'-C'	0.8604
e-C'／F'-C'	0.4914
F'-e／F'-C'	0.5086
i-F'／F'-C'	1.6616

Deviation of relative partial disp.	
ΔPdC	-0.0093
ΔPgF	0.0327

Internal CC (80%/5%)
328/270
Color Code (80%/5%)
335/270
CCI

B	0.00
G	0.11
R	0.08

Thermal properties	
CTE(-30,70) [1E-7/℃]	129
CTE(100,300) [1E-7/℃]	152
Tg [℃]	479
At [℃]	510
StP [℃]	434
AP [℃]	464
SP [℃]	561
Ht cndct. [W/m･K]	0.832
Sp. heat [kJ/kg･K]	0.596
Ht diffus. [1E-6 m2/sec]	0.361

Chemical properties [class]	
Acid res. (surface)	6
Alkaline detergent res.	4
Climate resistance	1
Water res. (powder)	2
Acid res. (powder)	3

Mechanical properties	
Knoop hardness	391 (4)
Abrasion hardness	449
Young's mod. [GPa]	77.4
Shear mod. [GPa]	29.7
Poisson's ratio	0.302
Stress optical coef. [1E-5 nm/cm／Pa]	0.69

Internal trans. (10mm)	
λ [nm]	τ
280	0.10
290	0.18
300	0.33
310	0.51
320	0.69
330	0.82
340	0.912
350	0.962
360	0.977
370	0.988
380	0.994
390	0.995
400	0.996
420	0.995
440	0.995
460	0.996
480	0.997
500	0.998
550	0.998
600	0.998
650	0.998
700	0.997
800	0.995
900	0.993
1000	0.995
1200	0.998
1400	0.999
1600	0.995
1800	0.991
2000	0.994
2200	0.988
2400	0.984

Specific gravity
3.86

Relative Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90(ref.)	-7.1	-7.1	-7.1	-7.0	-6.9	-6.9	-6.9	-6.8	-6.8	-6.7	-6.5	-6.5	-6.3	-6.1	-6.0
60 to 80(ref.)	-7.0	-6.9	-6.9	-6.8	-6.8	-6.7	-6.7	-6.7	-6.6	-6.5	-6.4	-6.4	-6.2	-6.0	-5.9
40 to 60	-6.7	-6.7	-6.7	-6.6	-6.6	-6.5	-6.5	-6.5	-6.4	-6.3	-6.2	-6.1	-6.0	-5.8	-5.7
20 to 40	-6.5	-6.5	-6.4	-6.4	-6.3	-6.2	-6.2	-6.2	-6.2	-6.1	-5.9	-5.9	-5.7	-5.6	-5.4
0 to 20	-6.2	-6.2	-6.1	-6.1	-6.0	-6.0	-5.9	-5.9	-5.9	-5.8	-5.6	-5.6	-5.5	-5.3	-5.2
-20 to 0	-5.9	-5.9	-5.8	-5.7	-5.7	-5.6	-5.6	-5.6	-5.5	-5.5	-5.3	-5.3	-5.1	-5.0	-4.9
-40 to -20	-5.5	-5.5	-5.4	-5.3	-5.3	-5.2	-5.2	-5.2	-5.2	-5.1	-4.9	-4.9	-4.8	-4.6	-4.5
-60 to -40(ref.)	-5.0	-5.0	-4.9	-4.9	-4.8	-4.8	-4.8	-4.7	-4.7	-4.6	-4.5	-4.5	-4.3	-4.2	-4.1
-70 to -60(ref.)	-4.6	-4.6	-4.5	-4.4	-4.4	-4.3	-4.3	-4.3	-4.3	-4.2	-4.0	-4.0	-3.9	-3.8	-3.7

Absolute Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90	-8.0	-8.0	-8.0	-7.9	-7.9	-7.8	-7.8	-7.8	-7.7	-7.6	-7.5	-7.4	-7.3	-7.1	-6.9
60 to 80	-8.0	-8.0	-7.9	-7.8	-7.8	-7.7	-7.7	-7.7	-7.6	-7.6	-7.4	-7.4	-7.2	-7.0	-6.9
40 to 60	-7.9	-7.9	-7.8	-7.7	-7.7	-7.6	-7.6	-7.6	-7.6	-7.5	-7.3	-7.3	-7.1	-7.0	-6.8
20～40	-7.8	-7.8	-7.7	-7.6	-7.6	-7.6	-7.5	-7.5	-7.5	-7.4	-7.2	-7.2	-7.1	-6.9	-6.8
0 to 20	-7.7	-7.7	-7.6	-7.6	-7.5	-7.5	-7.4	-7.4	-7.4	-7.3	-7.2	-7.1	-7.0	-6.8	-6.7
-20 to 0	-7.6	-7.6	-7.5	-7.5	-7.4	-7.4	-7.4	-7.3	-7.3	-7.2	-7.1	-7.1	-6.9	-6.8	-6.7
-40 to -20	-7.5	-7.5	-7.4	-7.4	-7.3	-7.3	-7.3	-7.2	-7.2	-7.1	-7.0	-7.0	-6.8	-6.7	-6.6
-60 to -40	-7.4	-7.4	-7.3	-7.3	-7.2	-7.2	-7.2	-7.2	-7.1	-7.0	-6.9	-6.9	-6.8	-6.7	-6.6
-70 to -60	-7.3	-7.3	-7.2	-7.2	-7.2	-7.1	-7.1	-7.1	-7.0	-7.0	-6.9	-6.8	-6.7	-6.6	-6.5

Coef. disp. form. (frac. eq.)(ref.)	
P1	1.71008014E-01
Q1	1.98750035E+02
P2	1.18652960E-01
Q2	9.51028518E-03
P3	1.70240596E-01
Q3	1.65237521E-03

Fitting error of disp. form. σ [1E-6]		
	Visible	Infrared
Power ser. eq.	0.3	2.3
Frac. eq. (ref.)	0.3	2.3

Prod. Freq. (A to D)	A

Similar glass type			
OHARA	-	HOYA	-
C.D.G.M	-	SCHOTT	-

2020-4-1	StP,AP,SP
2019-4-1	Transmittance
2018-4-1	1st edition

HIKARI GLASS CO., LTD.

Q-FKH2S

n_d = 1.455620 n_e = 1.456812

ν_d = 91.31 ν_e = 90.89

Glass code (d)
456913
Glass code (e)
457909

Spectral l.	Refractive idx
2.058	1.44294
1.970	1.44357
1.530	1.44649
1.129	1.44906
1.064	1.44952
t	1.44990
s	1.45135
A'	1.452324
r	1.453212
C	1.454089
C'	1.454334
He-Ne	1.454561
D	1.455575
d	1.455620
e	1.456812
F	1.459079
F'	1.459360
g	1.461745
h	1.463935
0.389	1.465261
i	1.467620

Partial dispersion	
F-C	0.004990
F'-C'	0.005026
C-t	0.004189
C-A'	0.001765
d-C	0.001531
e-C	0.002723
g-d	0.006125
g-F	0.002666
h-g	0.002190
i-g	0.005875
C'-t	0.004434
e-C'	0.002478
F'-e	0.002548
i-F'	0.008260

Relative partial dispersion	
C-t／F-C	0.8395
C-A'／F-C	0.3537
d-C／F-C	0.3068
e-C／F-C	0.5457
g-d／F-C	1.2275
g-F／F-C	0.5343
h-g／F-C	0.4389
i-g／F-C	1.1774
C'-t／F'-C'	0.8822
e-C'／F'-C'	0.4930
F'-e／F'-C'	0.5070
i-F'／F'-C'	1.6435

Deviation of relative partial disp.	
ΔPdC	−0.0116
ΔPgF	0.0431

Internal CC (80%/5%)
341/299
Color Code (80%/5%)
345/300
CCI

B	0.00
G	0.19
R	0.13

Thermal properties	
CTE(−30,70) [1E-7/℃]	134
CTE(100,300) [1E-7/℃]	160
Tg [℃]	454
At [℃]	482
StP [℃]	410
AP [℃]	437
SP [℃]	530
Ht cndct. [W/m·K]	0.868
Sp. heat [kJ/kg·K]	0.684
Ht diffus. [1E-6 m2/sec]	0.345

Chemical properties [class]	
Acid res. (surface)	7
Alkaline detergent res.	4
Climate resistance	1
Water res. (powder)	1
Acid res. (powder)	3

Mechanical properties	
Knoop hardness	335 (3)
Abrasion hardness	404
Young's mod. [GPa]	71.4
Shear mod. [GPa]	27.3
Poisson's ratio	0.305
Stress optical coef. [1E-5 nm/cm／Pa]	0.82

Internal trans. (10mm)	
λ [nm]	τ
280	−
290	−
300	0.06
310	0.18
320	0.39
330	0.61
340	0.79
350	0.89
360	0.949
370	0.976
380	0.988
390	0.993
400	0.995
420	0.994
440	0.994
460	0.996
480	0.996
500	0.998
550	0.999
600	0.998
650	0.997
700	0.998
800	0.996
900	0.994
1000	0.994
1200	0.995
1400	0.994
1600	0.994
1800	0.991
2000	0.995
2200	0.994
2400	0.998

Specific gravity
3.67

Coef. disp. form. (pwr ser.)	
A0	2.10025148E+00
A1	−4.58689757E-03
A2	−2.09903123E-05
A3	6.85727645E-03
A4	2.32345667E-05
A5	4.89859472E-06
A6	−1.82336191E-07
A7	0.00000000E+00
A8	0.00000000E+00

Relative Δn/ΔT [1E-6/℃]															
Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90(ref.)	−6.9	−6.9	−6.9	−6.8	−6.8	−6.7	−6.7	−6.7	−6.6	−6.5	−6.4	−6.4	−6.3	−6.1	−6.0
60 to 80(ref.)	−6.8	−6.7	−6.7	−6.6	−6.6	−6.5	−6.5	−6.5	−6.5	−6.4	−6.3	−6.3	−6.1	−6.0	−5.9
40 to 60	−6.5	−6.5	−6.5	−6.4	−6.4	−6.3	−6.3	−6.3	−6.2	−6.2	−6.1	−6.0	−5.9	−5.8	−5.7
20 to 40	−6.3	−6.3	−6.2	−6.2	−6.1	−6.1	−6.1	−6.0	−6.0	−5.9	−5.8	−5.8	−5.7	−5.5	−5.4
0 to 20	−6.0	−6.0	−5.9	−5.9	−5.8	−5.8	−5.8	−5.8	−5.7	−5.7	−5.5	−5.5	−5.4	−5.3	−5.2
−20 to 0	−5.6	−5.6	−5.6	−5.5	−5.5	−5.5	−5.4	−5.4	−5.4	−5.3	−5.2	−5.2	−5.1	−4.9	−4.9
−40 to −20	−5.2	−5.2	−5.2	−5.1	−5.1	−5.1	−5.1	−5.0	−5.0	−4.9	−4.8	−4.8	−4.7	−4.6	−4.5
−60 to −40(ref.)	−4.8	−4.7	−4.7	−4.7	−4.6	−4.6	−4.6	−4.6	−4.5	−4.5	−4.4	−4.4	−4.2	−4.1	−4.0
−70 to −60(ref.)	−4.3	−4.3	−4.3	−4.2	−4.2	−4.2	−4.2	−4.2	−4.1	−4.1	−3.9	−3.9	−3.8	−3.7	−3.6

Absolute Δn/ΔT [1E-6/℃]															
Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90	−7.8	−7.8	−7.7	−7.7	−7.7	−7.6	−7.6	−7.6	−7.5	−7.5	−7.3	−7.3	−7.2	−7.0	−7.0
60 to 80	−7.7	−7.7	−7.7	−7.6	−7.6	−7.5	−7.5	−7.5	−7.5	−7.4	−7.3	−7.3	−7.1	−7.0	−6.9
40 to 60	−7.6	−7.6	−7.6	−7.5	−7.5	−7.4	−7.4	−7.4	−7.4	−7.3	−7.2	−7.2	−7.0	−6.9	−6.8
20〜40	−7.5	−7.5	−7.5	−7.4	−7.4	−7.3	−7.3	−7.3	−7.3	−7.2	−7.1	−7.1	−7.0	−6.8	−6.7
0 to 20	−7.4	−7.4	−7.3	−7.3	−7.3	−7.2	−7.2	−7.2	−7.2	−7.1	−7.0	−7.0	−6.9	−6.8	−6.7
−20 to 0	−7.3	−7.3	−7.2	−7.2	−7.2	−7.1	−7.1	−7.1	−7.1	−7.0	−6.9	−6.9	−6.8	−6.7	−6.6
−40 to −20	−7.2	−7.2	−7.1	−7.1	−7.1	−7.0	−7.0	−7.0	−7.0	−6.9	−6.8	−6.8	−6.7	−6.6	−6.5
−60 to −40	−7.1	−7.1	−7.0	−7.0	−7.0	−6.9	−6.9	−6.9	−6.9	−6.8	−6.7	−6.7	−6.6	−6.5	−6.4
−70 to −60	−7.0	−7.0	−7.0	−6.9	−6.9	−6.9	−6.9	−6.9	−6.8	−6.8	−6.7	−6.7	−6.6	−6.5	−6.4

Coef. disp. form. (frac. eq.)(ref.)	
P1	−
Q1	−
P2	−
Q2	−
P3	−
Q3	−

Fitting error of disp. form. σ [1E-6]		
	Visible	Infrared
Power ser. eq.	0.3	9.5
Frac. eq. (ref.)	−	−

Prod. Freq. (A to D)	B

Similar glass type			
OHARA	−	HOYA	−
C.D.G.M	−	SCHOTT	−

2020-4-1	StP,AP,SP
2019-4-1	Transmittance
2018-4-1	Prod. Freq

HIKARI GLASS CO., LTD.

Q-PSKH1S

n_d = 1.592550 n_e = 1.594633

ν_d = 67.86 ν_e = 67.50

Glass code (d)
593679
Glass code (e)
595675

Spectral l.	Refractive idx
2.058	1.57281
1.970	1.57370
1.530	1.57784
1.129	1.58164
1.064	1.58235
t	1.58295
s	1.58528
A'	1.586903
r	1.588401
C	1.589901
C'	1.590322
He-Ne	1.590715
D	1.592472
d	1.592550
e	1.594633
F	1.598633
F'	1.599131
g	1.603384
h	1.607317
0.389	1.609711
i	–

Partial dispersion	
F-C	0.008732
F'-C'	0.008809
C-t	0.006952
C-A'	0.002998
d-C	0.002649
e-C	0.004732
g-d	0.010834
g-F	0.004751
h-g	0.003933
i-g	–
C'-t	0.007373
e-C'	0.004311
F'-e	0.004498
i-F'	–

Relative partial dispersion	
C-t／F-C	0.7962
C-A'／F-C	0.3433
d-C／F-C	0.3034
e-C／F-C	0.5419
g-d／F-C	1.2407
g-F／F-C	0.5441
h-g／F-C	0.4504
i-g／F-C	–
C'-t／F'-C'	0.8370
e-C'／F'-C'	0.4894
F'-e／F'-C'	0.5106
i-F'／F'-C'	–

Deviation of relative partial disp.	
ΔPdC	−0.0045
ΔPgF	0.0136

Internal CC (80%/5%)
344/274
Color Code (80%/5%)
355/275
CCI

B	0.00
G	0.20
R	0.18

Thermal properties	
CTE(−30,70) [1E-7/℃]	114
CTE(100,300) [1E-7/℃]	132
Tg [℃]	564
At [℃]	591
StP [℃]	516
AP [℃]	545
SP [℃]	639
Ht cndct. [W/m·K]	0.663
Sp. heat [kJ/kg·K]	0.522
Ht diffus. [1E-6 m2/sec]	0.309

Chemical properties [class]	
Acid res. (surface)	3
Alkaline detergent res.	3
Climate resistance	1
Water res. (powder)	1
Acid res. (powder)	1

Mechanical properties	
Knoop hardness	290 (3)
Abrasion hardness	540
Young's mod. [GPa]	76.0
Shear mod. [GPa]	29.3
Poisson's ratio	0.298
Stress optical coef. [1E-5 nm/cm／Pa]	0.60

Internal trans. (10mm)	
λ [nm]	τ
280	0.06
290	0.10
300	0.18
310	0.29
320	0.45
330	0.61
340	0.76
350	0.86
360	0.927
370	0.962
380	0.980
390	0.989
400	0.992
420	0.994
440	0.994
460	0.995
480	0.996
500	0.998
550	0.999
600	0.998
650	0.998
700	0.997
800	0.996
900	0.996
1000	0.997
1200	0.998
1400	0.999
1600	0.999
1800	0.997
2000	0.993
2200	0.989
2400	0.983

Specific gravity
4.1

Coef. disp. form. (pwr ser.)	
A0	2.50007622E+00
A1	−6.71624527E-03
A2	−5.14442840E-05
A3	1.28098993E-02
A4	1.58900364E-04
A5	6.45646017E-07
A6	1.36642151E-07
A7	0.00000000E+00
A8	0.00000000E+00

Relative Δn/ΔT [1E-6/℃]															
Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90(ref.)	−6.1	−6.1	−6.0	−5.9	−5.9	−5.8	−5.8	−5.8	−5.7	−5.6	−5.4	−5.3	−5.0	−4.7	−4.5
60 to 80(ref.)	−6.1	−6.0	−5.9	−5.9	−5.8	−5.8	−5.8	−5.7	−5.7	−5.5	−5.3	−5.3	−5.0	−4.7	−4.5
40 to 60	−6.0	−6.0	−5.9	−5.8	−5.8	−5.7	−5.7	−5.7	−5.6	−5.5	−5.3	−5.2	−5.0	−4.7	−4.5
20 to 40	−5.9	−5.9	−5.8	−5.7	−5.7	−5.6	−5.6	−5.6	−5.5	−5.4	−5.2	−5.1	−4.9	−4.6	−4.4
0 to 20	−5.7	−5.7	−5.6	−5.6	−5.5	−5.5	−5.4	−5.4	−5.3	−5.2	−5.0	−5.0	−4.8	−4.5	−4.3
−20 to 0	−5.5	−5.5	−5.4	−5.4	−5.3	−5.3	−5.3	−5.2	−5.2	−5.1	−4.9	−4.8	−4.6	−4.4	−4.2
−40 to −20	−5.3	−5.3	−5.2	−5.1	−5.1	−5.0	−5.0	−5.0	−4.9	−4.8	−4.6	−4.6	−4.4	−4.1	−4.0
−60 to −40(ref.)	−4.9	−4.9	−4.8	−4.8	−4.7	−4.7	−4.7	−4.6	−4.6	−4.5	−4.3	−4.3	−4.0	−3.8	−3.7
−70 to −60(ref.)	−4.6	−4.6	−4.5	−4.5	−4.4	−4.3	−4.3	−4.3	−4.2	−4.1	−4.0	−3.9	−3.7	−3.5	−3.4

Absolute Δn/ΔT [1E-6/℃]															
Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90	−7.1	−7.1	−7.0	−6.9	−6.9	−6.8	−6.8	−6.8	−6.7	−6.6	−6.4	−6.3	−6.1	−5.8	−5.6
60 to 80	−7.1	−7.1	−7.0	−7.0	−6.9	−6.9	−6.8	−6.8	−6.7	−6.6	−6.4	−6.4	−6.1	−5.9	−5.7
40 to 60	−7.2	−7.2	−7.1	−7.0	−7.0	−6.9	−6.9	−6.9	−6.8	−6.7	−6.5	−6.5	−6.2	−6.0	−5.8
20〜40	−7.2	−7.2	−7.2	−7.1	−7.0	−7.0	−7.0	−7.0	−6.9	−6.8	−6.6	−6.6	−6.3	−6.1	−5.9
0 to 20	−7.3	−7.3	−7.2	−7.2	−7.1	−7.0	−7.0	−7.0	−6.9	−6.8	−6.7	−6.6	−6.4	−6.2	−6.0
−20 to 0	−7.4	−7.3	−7.3	−7.2	−7.2	−7.1	−7.1	−7.1	−7.0	−6.9	−6.7	−6.7	−6.5	−6.3	−6.1
−40 to −20	−7.4	−7.4	−7.3	−7.3	−7.2	−7.2	−7.2	−7.1	−7.1	−7.0	−6.8	−6.8	−6.6	−6.4	−6.2
−60 to −40	−7.5	−7.5	−7.4	−7.3	−7.3	−7.2	−7.2	−7.2	−7.1	−7.1	−6.9	−6.9	−6.7	−6.5	−6.3
−70 to −60	−7.5	−7.5	−7.4	−7.4	−7.3	−7.3	−7.3	−7.3	−7.2	−7.1	−7.0	−6.9	−6.7	−6.5	−6.4

Coef. disp. form. (frac. eq.)(ref.)	
P1	1.07610379E-01
Q1	1.08426062E+02
P2	3.92191498E-02
Q2	1.71487165E-02
P3	2.94126331E-01
Q3	4.17899731E-03

Fitting error of disp. form. σ [1E-6]		
	Visible	Infrared
Power ser. eq.	0.4	6.9
Frac. eq. (ref.)	0.6	7.3

Prod. Freq. (A to D)	A

Similar glass type			
OHARA	–	HOYA	–
C.D.G.M	–	SCHOTT	–

2020-4-1	StP,AP,SP
2019-4-1	Transmittance
2015-4-1	Color Code

HIKARI GLASS CO., LTD.

Q-PSKH2S

n_d = 1.618750 n_e = 1.621066

ν_d = 63.74 ν_e = 63.45

Glass code (d)
619637
Glass code (e)
621635

Spectral l.	Refractive idx
2.058	1.59451
1.970	1.59574
1.530	1.60134
1.129	1.60620
1.064	1.60707
t	1.60779
s	1.61054
A'	1.612404
r	1.614103
C	1.615791
C'	1.616262
He-Ne	1.616702
D	1.618663
d	1.618750
e	1.621066
F	1.625499
F'	1.626050
g	1.630753
h	1.635100
0.389	1.637745
i	1.642481

Partial dispersion	
F-C	0.009708
F'-C'	0.009788
C-t	0.007999
C-A'	0.003387
d-C	0.002959
e-C	0.005275
g-d	0.012003
g-F	0.005254
h-g	0.004347
i-g	0.011728
C'-t	0.008470
e-C'	0.004804
F'-e	0.004984
i-F'	0.016431

Relative partial dispersion	
C-t／F-C	0.8240
C-A'／F-C	0.3489
d-C／F-C	0.3048
e-C／F-C	0.5434
g-d／F-C	1.2364
g-F／F-C	0.5412
h-g／F-C	0.4478
i-g／F-C	1.2081
C'-t／F'-C'	0.8653
e-C'／F'-C'	0.4908
F'-e／F'-C'	0.5092
i-F'／F'-C'	1.6787

Deviation of relative partial disp.	
ΔPdC	−0.0012
ΔPgF	0.0038

Internal CC (80%/5%)
333/290
Color Code (80%/5%)
345/290
CCI

B	0.00
G	0.22
R	0.17

Thermal properties	
CTE(−30,70) [1E-7/℃]	93
CTE(100,300) [1E-7/℃]	114
Tg [℃]	509
At [℃]	552
StP [℃]	469
AP [℃]	500
SP [℃]	619
Ht cndct. [W/m･K]	0.709
Sp. heat [kJ/kg･K]	0.606
Ht diffus. [1E-6 m2/sec]	0.332

Chemical properties [class]	
Acid res. (surface)	5
Alkaline detergent res.	4
Climate resistance	1
Water res. (powder)	1
Acid res. (powder)	4

Mechanical properties	
Knoop hardness	388 (4)
Abrasion hardness	350
Young's mod. [GPa]	78.4
Shear mod. [GPa]	30.6
Poisson's ratio	0.282
Stress optical coef. [1E-5 nm/cm／Pa]	1.68

Internal trans. (10mm)	
λ [nm]	τ
280	0.01
290	0.05
300	0.18
310	0.39
320	0.61
330	0.76
340	0.87
350	0.924
360	0.956
370	0.974
380	0.984
390	0.988
400	0.991
420	0.992
440	0.992
460	0.994
480	0.995
500	0.996
550	0.997
600	0.996
650	0.996
700	0.997
800	0.996
900	0.997
1000	0.997
1200	0.997
1400	0.995
1600	0.990
1800	0.975
2000	0.953
2200	0.900
2400	0.84

Specific gravity
3.52

Coef. disp. form. (pwr ser.)	
A0	2.58079919E+00
A1	−9.46942822E-03
A2	−8.88975012E-05
A3	1.42435389E-02
A4	1.81224951E-04
A5	1.94681195E-06
A6	8.51820873E-08
A7	0.00000000E+00
A8	0.00000000E+00

Relative Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90(ref.)	−2.5	−2.4	−2.4	−2.2	−2.1	−2.1	−2.0	−2.0	−1.9	−1.8	−1.5	−1.4	−1.1	−0.8	−0.6
60 to 80(ref.)	−2.5	−2.5	−2.3	−2.3	−2.2	−2.1	−2.1	−2.1	−1.9	−1.8	−1.5	−1.5	−1.2	−0.9	−0.7
40 to 60	−2.5	−2.5	−2.4	−2.3	−2.2	−2.1	−2.1	−2.1	−2.0	−1.9	−1.6	−1.6	−1.3	−1.0	−0.8
20 to 40	−2.5	−2.5	−2.4	−2.3	−2.2	−2.2	−2.1	−2.1	−2.0	−1.9	−1.6	−1.6	−1.3	−1.0	−0.8
0 to 20	−2.5	−2.5	−2.4	−2.3	−2.2	−2.1	−2.1	−2.1	−2.0	−1.9	−1.6	−1.6	−1.3	−1.0	−0.9
−20 to 0	−2.4	−2.4	−2.3	−2.2	−2.1	−2.1	−2.0	−2.0	−1.9	−1.8	−1.6	−1.5	−1.3	−1.0	−0.8
−40 to −20	−2.2	−2.2	−2.1	−2.0	−2.0	−1.9	−1.9	−1.9	−1.8	−1.7	−1.5	−1.4	−1.2	−0.9	−0.8
−60 to −40(ref.)	−2.0	−2.0	−1.9	−1.8	−1.7	−1.7	−1.7	−1.6	−1.6	−1.4	−1.2	−1.2	−1.0	−0.7	−0.6
−70 to −60(ref.)	−1.7	−1.7	−1.6	−1.6	−1.5	−1.4	−1.4	−1.4	−1.3	−1.2	−1.0	−1.0	−0.7	−0.5	−0.4

Absolute Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90	−3.5	−3.4	−3.3	−3.2	−3.2	−3.1	−3.0	−3.0	−2.9	−2.8	−2.5	−2.5	−2.2	−1.8	−1.6
60 to 80	−3.6	−3.6	−3.4	−3.4	−3.3	−3.2	−3.2	−3.2	−3.0	−2.9	−2.7	−2.6	−2.3	−2.0	−1.8
40 to 60	−3.7	−3.7	−3.6	−3.5	−3.5	−3.4	−3.4	−3.3	−3.2	−3.1	−2.9	−2.8	−2.5	−2.2	−2.0
20〜40	−3.9	−3.9	−3.8	−3.7	−3.6	−3.6	−3.5	−3.5	−3.4	−3.3	−3.1	−3.0	−2.8	−2.5	−2.3
0 to 20	−4.1	−4.0	−4.0	−3.9	−3.8	−3.7	−3.7	−3.7	−3.6	−3.5	−3.3	−3.2	−3.0	−2.7	−2.5
−20 to 0	−4.2	−4.2	−4.1	−4.1	−4.0	−3.9	−3.9	−3.9	−3.8	−3.7	−3.5	−3.5	−3.2	−3.0	−2.8
−40 to −20	−4.4	−4.4	−4.3	−4.2	−4.2	−4.1	−4.1	−4.1	−4.0	−3.9	−3.7	−3.7	−3.4	−3.2	−3.0
−60 to −40	−4.6	−4.5	−4.5	−4.4	−4.3	−4.3	−4.3	−4.2	−4.2	−4.1	−3.9	−3.9	−3.6	−3.4	−3.3
−70 to −60	−4.7	−4.7	−4.6	−4.5	−4.5	−4.4	−4.4	−4.4	−4.3	−4.2	−4.0	−4.0	−3.8	−3.6	−3.5

Coef. disp. form. (frac. eq.)(ref.)	
P1	1.22023995E-01
Q1	9.01520619E+01
P2	7.64803847E-02
Q2	1.43077787E-02
P3	2.68618641E-01
Q3	3.51371230E-03

Fitting error of disp. form. σ [1E-6]		
	Visible	Infrared
Power ser. eq.	0.3	5.5
Frac. eq. (ref.)	0.3	5.4

Prod. Freq. (A to D)	A

Similar glass type			
OHARA	−	HOYA	−
C.D.G.M	−	SCHOTT	−

2023-9-1	Reprinted
2019-4-1	Deleted
2015-4-1	Color Code

HIKARI GLASS CO., LTD.

Q-PSKH4S

n_d = 1.592450 n_e = 1.594563

ν_d = 66.92 ν_e = 66.68

Glass code (d)
592669
Glass code (e)
595667

Spectral l.	Refractive idx
2.058	1.56830
1.970	1.56963
1.530	1.57560
1.129	1.58060
1.064	1.58147
t	1.58218
s	1.58483
A'	1.586587
r	1.588172
C	1.589733
C'	1.590168
He-Ne	1.590572
D	1.592371
d	1.592450
e	1.594563
F	1.598586
F'	1.599085
g	1.603330
h	1.607241
0.389	1.609616
i	1.613858

Coef. disp. form. (pwr ser.)	
A0	2.50116352E+00
A1	-1.00351892E-02
A2	-1.18900724E-04
A3	1.27884411E-02
A4	1.28777777E-04
A5	3.72070629E-06
A6	-3.09763293E-08
A7	0.00000000E+00
A8	0.00000000E+00

Partial dispersion	
F-C	0.008853
F'-C'	0.008917
C-t	0.007556
C-A'	0.003146
d-C	0.002717
e-C	0.004830
g-d	0.010880
g-F	0.004744
h-g	0.003911
i-g	0.010528
C'-t	0.007991
e-C'	0.004395
F'-e	0.004522
i-F'	0.014773

Relative partial dispersion	
C-t／F-C	0.8535
C-A'／F-C	0.3554
d-C／F-C	0.3069
e-C／F-C	0.5456
g-d／F-C	1.2290
g-F／F-C	0.5359
h-g／F-C	0.4418
i-g／F-C	1.1892
C'-t／F'-C'	0.8962
e-C'／F'-C'	0.4929
F'-e／F'-C'	0.5071
i-F'／F'-C'	1.6567

Deviation of relative partial disp.	
ΔPdC	-0.0005
ΔPgF	0.0038

Internal CC (80%/5%)
335/287
Color Code (80%/5%)
345/290
CCI

B	0.00
G	0.20
R	0.19

Thermal properties	
CTE(-30,70) [1E-7/℃]	90
CTE(100,300) [1E-7/℃]	114
Tg [℃]	497
At [℃]	531
StP [℃]	448
AP [℃]	479
SP [℃]	582
Ht cndct. [W/m･K]	0.761
Sp. heat [kJ/kg･K]	0.619
Ht diffus. [1E-6 m2/sec]	0.375

Chemical properties [class]	
Acid res. (surface)	4
Alkaline detergent res.	4
Climate resistance	2
Water res. (powder)	2
Acid res. (powder)	5

Mechanical properties	
Knoop hardness	416 (4)
Abrasion hardness	267
Young's mod. [GPa]	81.6
Shear mod. [GPa]	32.0
Poisson's ratio	0.274
Stress optical coef. [1E-5 nm/cm／Pa]	1.56

Internal trans. (10mm)	
λ [nm]	τ
280	0.02
290	0.07
300	0.20
310	0.39
320	0.58
330	0.74
340	0.85
350	0.917
360	0.955
370	0.975
380	0.985
390	0.990
400	0.992
420	0.994
440	0.994
460	0.995
480	0.996
500	0.997
550	0.998
600	0.999
650	0.998
700	0.998
800	0.997
900	0.997
1000	0.997
1200	0.998
1400	0.995
1600	0.986
1800	0.968
2000	0.945
2200	0.87
2400	0.81

Specific gravity
3.28

Relative Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90(ref.)	-1.9	-1.9	-1.9	-1.8	-1.7	-1.6	-1.6	-1.5	-1.4	-1.3	-1.1	-1.1	-0.7	-0.4	-0.3
60 to 80(ref.)	-1.9	-1.9	-1.8	-1.8	-1.7	-1.6	-1.6	-1.6	-1.5	-1.4	-1.1	-1.1	-0.8	-0.5	-0.4
40 to 60	-1.9	-1.9	-1.9	-1.8	-1.7	-1.6	-1.6	-1.6	-1.5	-1.4	-1.2	-1.1	-0.8	-0.6	-0.4
20 to 40	-1.9	-1.9	-1.8	-1.7	-1.7	-1.6	-1.6	-1.6	-1.5	-1.4	-1.1	-1.1	-0.8	-0.6	-0.5
0 to 20	-1.8	-1.8	-1.8	-1.7	-1.6	-1.5	-1.5	-1.5	-1.4	-1.3	-1.1	-1.1	-0.8	-0.6	-0.4
-20 to 0	-1.7	-1.7	-1.6	-1.6	-1.5	-1.4	-1.4	-1.4	-1.3	-1.2	-1.0	-1.0	-0.7	-0.5	-0.4
-40 to -20	-1.5	-1.5	-1.5	-1.4	-1.3	-1.3	-1.2	-1.2	-1.1	-1.1	-0.9	-0.8	-0.6	-0.4	-0.3
-60 to -40(ref.)	-1.3	-1.3	-1.2	-1.1	-1.1	-1.0	-1.0	-1.0	-0.9	-0.8	-0.6	-0.6	-0.4	-0.1	-0.1
-70 to -60(ref.)	-1.0	-1.0	-0.9	-0.9	-0.8	-0.7	-0.7	-0.7	-0.6	-0.5	-0.4	-0.3	-0.1	0.1	0.2

Absolute Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90	-2.9	-2.9	-2.8	-2.7	-2.7	-2.6	-2.6	-2.5	-2.4	-2.3	-2.1	-2.1	-1.8	-1.5	-1.3
60 to 80	-3.0	-3.0	-2.9	-2.8	-2.8	-2.7	-2.7	-2.6	-2.6	-2.5	-2.2	-2.2	-1.9	-1.6	-1.5
40 to 60	-3.1	-3.1	-3.1	-3.0	-2.9	-2.8	-2.8	-2.8	-2.7	-2.6	-2.4	-2.4	-2.1	-1.8	-1.7
20～40	-3.3	-3.3	-3.2	-3.1	-3.0	-3.0	-3.0	-2.9	-2.9	-2.8	-2.6	-2.5	-2.3	-2.0	-1.9
0 to 20	-3.4	-3.4	-3.3	-3.3	-3.2	-3.1	-3.1	-3.1	-3.0	-2.9	-2.7	-2.7	-2.4	-2.2	-2.1
-20 to 0	-3.5	-3.5	-3.5	-3.4	-3.3	-3.3	-3.3	-3.2	-3.2	-3.1	-2.9	-2.9	-2.6	-2.4	-2.3
-40 to -20	-3.7	-3.7	-3.6	-3.5	-3.5	-3.4	-3.4	-3.4	-3.3	-3.2	-3.1	-3.0	-2.8	-2.6	-2.5
-60 to -40	-3.8	-3.8	-3.7	-3.7	-3.6	-3.6	-3.5	-3.5	-3.5	-3.4	-3.2	-3.2	-3.0	-2.8	-2.7
-70 to -60	-3.9	-3.9	-3.8	-3.8	-3.7	-3.7	-3.7	-3.6	-3.6	-3.5	-3.4	-3.3	-3.1	-2.9	-2.9

Coef. disp. form. (frac. eq.)(ref.)	
P1	1.17509715E-01
Q1	7.86977681E+01
P2	2.36387680E-02
Q2	1.95824976E-02
P3	3.09886091E-01
Q3	4.59554193E-03

Fitting error of disp. form. σ [1E-6]		
	Visible	Infrared
Power ser. eq.	0.4	5.5
Frac. eq. (ref.)	0.5	5.4

Prod. Freq. (A to D)	A

Similar glass type			
OHARA	-	HOYA	-
C.D.G.M	-	SCHOTT	-

2020-4-1	StP,AP,SP
2019-4-1	Transmittance
2015-4-1	1st edition

HIKARI GLASS CO., LTD.

Q-PSKH52S

n_d = 1.618750 n_e = 1.621066

ν_d = 63.73 ν_e = 63.45

Glass code (d)
619637
Glass code (e)
621635

Spectral l.	Refractive idx
2.058	1.59442
1.970	1.59566
1.530	1.60129
1.129	1.60619
1.064	1.60706
t	1.60778
s	1.61054
A'	1.612402
r	1.614102
C	1.615790
C'	1.616262
He-Ne	1.616702
D	1.618663
d	1.618750
e	1.621066
F	1.625499
F'	1.626050
g	1.630752
h	1.635099
0.389	1.637743
i	1.642477

Partial dispersion	
F-C	0.009709
F'-C'	0.009788
C-t	0.008009
C-A'	0.003388
d-C	0.002960
e-C	0.005276
g-d	0.012002
g-F	0.005253
h-g	0.004347
i-g	0.011725
C'-t	0.008481
e-C'	0.004804
F'-e	0.004984
i-F'	0.016427

Relative partial dispersion	
C-t／F-C	0.8249
C-A'／F-C	0.3490
d-C／F-C	0.3049
e-C／F-C	0.5434
g-d／F-C	1.2362
g-F／F-C	0.5410
h-g／F-C	0.4477
i-g／F-C	1.2076
C'-t／F'-C'	0.8665
e-C'／F'-C'	0.4908
F'-e／F'-C'	0.5092
i-F'／F'-C'	1.6783

Deviation of relative partial disp.	
ΔPdC	−0.0011
ΔPgF	0.0036

Internal CC (80%/5%)
332/284
Color Code (80%/5%)
345/285
CCI

B	0.00
G	0.22
R	0.19

Thermal properties	
CTE(−30,70) [1E-7/℃]	86
CTE(100,300) [1E-7/℃]	109
Tg [℃]	529
At [℃]	572
StP [℃]	479
AP [℃]	513
SP [℃]	634
Ht cndct. [W/m･K]	0.654
Sp. heat [kJ/kg･K]	0.576
Ht diffus. [1E-6 m2/sec]	0.324

Chemical properties [class]	
Acid res. (surface)	4
Alkaline detergent res.	4
Climate resistance	1
Water res. (powder)	1
Acid res. (powder)	4

Mechanical properties	
Knoop hardness	393 (4)
Abrasion hardness	328
Young's mod. [GPa]	79.7
Shear mod. [GPa]	31.0
Poisson's ratio	0.285
Stress optical coef. [1E-5 nm/cm／Pa]	1.55

Internal trans. (10mm)	
λ [nm]	τ
280	0.03
290	0.10
300	0.26
310	0.45
320	0.64
330	0.77
340	0.87
350	0.926
360	0.959
370	0.977
380	0.986
390	0.991
400	0.994
420	0.994
440	0.994
460	0.996
480	0.997
500	0.998
550	0.999
600	0.999
650	0.998
700	0.998
800	0.998
900	0.998
1000	0.998
1200	0.999
1400	0.998
1600	0.994
1800	0.981
2000	0.965
2200	0.920
2400	0.87

Specific gravity
3.51

Coef. disp. form. (pwr ser.)	
A0	2.58093502E+00
A1	−9.59665919E−03
A2	−8.21742644E−05
A3	1.41837329E−02
A4	1.94644982E−04
A5	4.47243666E−07
A6	1.47296513E−07
A7	0.00000000E+00
A8	0.00000000E+00

Relative Δn/ΔT [1E-6/℃]															
Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90(ref.)	−1.8	−1.7	−1.7	−1.5	−1.4	−1.3	−1.3	−1.3	−1.1	−1.0	−0.7	−0.7	−0.4	−0.1	0.2
60 to 80(ref.)	−1.8	−1.8	−1.7	−1.6	−1.5	−1.4	−1.4	−1.3	−1.2	−1.1	−0.8	−0.8	−0.5	−0.2	0.0
40 to 60	−1.9	−1.8	−1.7	−1.6	−1.6	−1.5	−1.4	−1.4	−1.3	−1.2	−0.9	−0.9	−0.6	−0.3	−0.1
20 to 40	−1.9	−1.9	−1.8	−1.7	−1.6	−1.5	−1.5	−1.4	−1.3	−1.2	−1.0	−0.9	−0.6	−0.4	−0.2
0 to 20	−1.9	−1.9	−1.7	−1.7	−1.6	−1.5	−1.5	−1.5	−1.3	−1.2	−1.0	−0.9	−0.7	−0.4	−0.2
−20 to 0	−1.8	−1.8	−1.7	−1.6	−1.5	−1.5	−1.4	−1.4	−1.3	−1.2	−1.0	−0.9	−0.7	−0.4	−0.2
−40 to −20	−1.7	−1.7	−1.6	−1.5	−1.4	−1.3	−1.3	−1.3	−1.2	−1.1	−0.9	−0.8	−0.6	−0.3	−0.2
−60 to −40(ref.)	−1.5	−1.4	−1.4	−1.3	−1.2	−1.1	−1.1	−1.1	−1.0	−0.9	−0.7	−0.7	−0.4	−0.2	0.0
−70 to −60(ref.)	−1.2	−1.2	−1.1	−1.0	−1.0	−0.9	−0.9	−0.9	−0.8	−0.7	−0.5	−0.4	−0.2	0.0	0.2

Absolute Δn/ΔT [1E-6/℃]															
Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90	−2.8	−2.7	−2.6	−2.5	−2.4	−2.3	−2.3	−2.3	−2.2	−2.0	−1.7	−1.7	−1.4	−1.1	−0.9
60 to 80	−2.9	−2.9	−2.8	−2.7	−2.6	−2.5	−2.5	−2.4	−2.3	−2.2	−1.9	−1.9	−1.6	−1.3	−1.1
40 to 60	−3.1	−3.1	−3.0	−2.9	−2.8	−2.7	−2.7	−2.6	−2.5	−2.4	−2.1	−2.1	−1.8	−1.6	−1.4
20〜40	−3.3	−3.3	−3.2	−3.1	−3.0	−2.9	−2.9	−2.9	−2.7	−2.6	−2.4	−2.4	−2.1	−1.8	−1.6
0 to 20	−3.5	−3.4	−3.3	−3.3	−3.2	−3.1	−3.1	−3.1	−3.0	−2.8	−2.6	−2.6	−2.3	−2.1	−1.9
−20 to 0	−3.7	−3.6	−3.5	−3.5	−3.4	−3.3	−3.3	−3.3	−3.2	−3.1	−2.9	−2.8	−2.6	−2.4	−2.2
−40 to −20	−3.8	−3.8	−3.7	−3.7	−3.6	−3.5	−3.5	−3.5	−3.4	−3.3	−3.1	−3.1	−2.8	−2.6	−2.5
−60 to −40	−4.0	−4.0	−3.9	−3.9	−3.8	−3.7	−3.7	−3.7	−3.6	−3.5	−3.3	−3.3	−3.1	−2.9	−2.7
−70 to −60	−4.2	−4.2	−4.1	−4.0	−4.0	−3.9	−3.9	−3.9	−3.8	−3.7	−3.5	−3.5	−3.3	−3.1	−2.9

Coef. disp. form. (frac. eq.)(ref.)	
P1	1.18516610E−01
Q1	8.69879063E+01
P2	7.20012698E−02
Q2	1.46327404E−02
P3	2.73103611E−01
Q3	3.60163368E−03

Fitting error of disp. form. σ [1E-6]		
	Visible	Infrared
Power ser. eq.	0.4	4.6
Frac. eq. (ref.)	0.5	6.9

Prod. Freq. (A to D)	D

Similar glass type			
OHARA	−	HOYA	−
C.D.G.M	−	SCHOTT	−

2022-7-1	Prod. Freq
2020-4-1	StP,AP,SP
2019-4-1	1st edition

HIKARI GLASS CO., LTD.

Q-SK15S

n_d = 1.622910 n_e = 1.625458

ν_d = 58.30 ν_e = 58.05

Glass code (d)
623583
Glass code (e)
625581

Spectral l.	Refractive idx
2.058	1.59608
1.970	1.59746
1.530	1.60372
1.129	1.60912
1.064	1.61008
t	1.61087
s	1.61390
A'	1.615943
r	1.617808
C	1.619659
C'	1.620177
He-Ne	1.620660
D	1.622815
d	1.622910
e	1.625458
F	1.630343
F'	1.630952
g	1.636153
h	1.640976
0.389	1.643919
i	1.649203

Coef. disp. form. (pwr ser.)	
A0	2.59073686E+00
A1	-1.06523029E-02
A2	-9.98472173E-05
A3	1.54224112E-02
A4	2.52371925E-04
A5	-9.42642262E-07
A6	3.09905553E-07
A7	0.00000000E+00
A8	0.00000000E+00

Partial dispersion	
F-C	0.010684
F'-C'	0.010775
C-t	0.008784
C-A'	0.003716
d-C	0.003251
e-C	0.005799
g-d	0.013243
g-F	0.005810
h-g	0.004823
i-g	0.013050
C'-t	0.009302
e-C'	0.005281
F'-e	0.005494
i-F'	0.018251

Relative partial dispersion	
C-t／F-C	0.8222
C-A'／F-C	0.3478
d-C／F-C	0.3043
e-C／F-C	0.5428
g-d／F-C	1.2395
g-F／F-C	0.5438
h-g／F-C	0.4514
i-g／F-C	1.2215
C'-t／F'-C'	0.8633
e-C'／F'-C'	0.4901
F'-e／F'-C'	0.5099
i-F'／F'-C'	1.6938

Deviation of relative partial disp.	
ΔPdC	0.0008
ΔPgF	-0.0027

Internal CC (80%/5%)
328/270
Color Code (80%/5%)
340/270
CCI

B	0.00
G	0.18
R	0.15

Thermal properties	
CTE(-30,70) [1E-7/℃]	71
CTE(100,300) [1E-7/℃]	86
Tg [℃]	540
At [℃]	573
StP [℃]	490
AP [℃]	524
SP [℃]	649
Ht cndct. [W/m･K]	0.859
Sp. heat [kJ/kg･K]	0.644
Ht diffus. [1E-6 m2/sec]	0.410

Chemical properties [class]	
Acid res. (surface)	5
Alkaline detergent res.	4
Climate resistance	3
Water res. (powder)	1
Acid res. (powder)	4

Mechanical properties	
Knoop hardness	517 (5)
Abrasion hardness	132
Young's mod. [GPa]	95.4
Shear mod. [GPa]	37.5
Poisson's ratio	0.274
Stress optical coef. [1E-5 nm/cm／Pa]	1.76

Internal trans. (10mm)	
λ [nm]	τ
280	0.10
290	0.21
300	0.38
310	0.55
320	0.70
330	0.82
340	0.89
350	0.938
360	0.965
370	0.980
380	0.988
390	0.991
400	0.994
420	0.995
440	0.994
460	0.996
480	0.997
500	0.998
550	0.999
600	0.999
650	0.998
700	0.998
800	0.996
900	0.995
1000	0.996
1200	0.998
1400	0.993
1600	0.992
1800	0.984
2000	0.973
2200	0.924
2400	0.80

Specific gravity
3.25

Relative Δn/ΔT [1E-6/℃]															
Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90(ref.)	3.2	3.3	3.4	3.6	3.7	3.8	3.8	3.9	4.0	4.2	4.6	4.7	5.1	5.5	5.8
60 to 80(ref.)	3.1	3.2	3.3	3.4	3.6	3.7	3.7	3.7	3.9	4.1	4.5	4.5	4.9	5.4	5.6
40 to 60	3.0	3.1	3.2	3.3	3.4	3.5	3.6	3.6	3.7	3.9	4.3	4.3	4.7	5.1	5.4
20 to 40	2.9	3.0	3.1	3.2	3.3	3.4	3.4	3.5	3.6	3.8	4.1	4.2	4.6	5.0	5.2
0 to 20	2.9	2.9	3.0	3.1	3.2	3.3	3.4	3.4	3.5	3.7	4.0	4.1	4.4	4.8	5.0
-20 to 0	2.9	2.9	3.0	3.1	3.2	3.3	3.3	3.4	3.5	3.6	4.0	4.0	4.4	4.7	4.9
-40 to -20	2.9	3.0	3.1	3.2	3.3	3.3	3.4	3.4	3.5	3.7	4.0	4.0	4.3	4.7	4.9
-60 to -40(ref.)	3.1	3.1	3.2	3.3	3.4	3.5	3.5	3.5	3.6	3.8	4.1	4.1	4.4	4.7	4.9
-70 to -60(ref.)	3.3	3.3	3.4	3.5	3.6	3.7	3.7	3.7	3.8	4.0	4.2	4.3	4.6	4.9	5.0

Absolute Δn/ΔT [1E-6/℃]															
Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90	2.2	2.3	2.4	2.6	2.7	2.8	2.8	2.8	3.0	3.2	3.6	3.6	4.1	4.5	4.8
60 to 80	2.1	2.1	2.2	2.3	2.5	2.6	2.6	2.6	2.8	3.0	3.3	3.4	3.8	4.2	4.5
40 to 60	1.8	1.8	2.0	2.1	2.2	2.3	2.3	2.3	2.5	2.7	3.0	3.1	3.5	3.9	4.1
20～40	1.5	1.6	1.7	1.8	1.9	2.0	2.0	2.1	2.2	2.4	2.7	2.7	3.1	3.5	3.7
0 to 20	1.3	1.3	1.4	1.5	1.6	1.7	1.7	1.8	1.9	2.1	2.4	2.4	2.8	3.1	3.4
-20 to 0	1.0	1.1	1.2	1.3	1.3	1.4	1.5	1.5	1.6	1.8	2.1	2.1	2.4	2.8	3.0
-40 to -20	0.8	0.8	0.9	1.0	1.1	1.2	1.2	1.2	1.3	1.5	1.7	1.8	2.1	2.4	2.6
-60 to -40	0.5	0.5	0.6	0.7	0.8	0.9	0.9	0.9	1.0	1.2	1.4	1.4	1.7	2.0	2.2
-70 to -60	0.3	0.3	0.4	0.5	0.6	0.7	0.7	0.7	0.8	0.9	1.2	1.2	1.5	1.8	1.9

Coef. disp. form. (frac. eq.)(ref.)	
P1	1.39092543E-01
Q1	9.15185578E+01
P2	3.27748556E-02
Q2	-1.27593030E-02
P3	3.13749678E-01
Q3	8.33106741E-03

Fitting error of disp. form. σ [1E-6]		
	Visible	Infrared
Power ser. eq.	0.6	4.2
Frac. eq. (ref.)	2.7	4.4

Prod. Freq. (A to D)	A

Similar glass type			
OHARA	-	HOYA	-
C.D.G.M	-	SCHOTT	-

2020-4-1	StP,AP,SP
2019-4-1	Transmittance
2015-4-1	1st edition

HIKARI GLASS CO., LTD.

Q-SK52S

n_d = 1.582860 n_e = 1.585196

ν_d = 59.51 ν_e = 59.27

Glass code (d)
583595
Glass code (e)
585593

Spectral l.	Refractive idx
2.058	1.55741
1.970	1.55876
1.530	1.56484
1.129	1.57002
1.064	1.57093
t	1.57168
s	1.57452
A'	1.576429
r	1.578158
C	1.579869
C'	1.580346
He-Ne	1.580791
D	1.582773
d	1.582860
e	1.585196
F	1.589664
F'	1.590220
g	1.594961
h	1.599351
0.389	1.602026
i	1.606821

Partial dispersion	
F-C	0.009795
F'-C'	0.009874
C-t	0.008187
C-A'	0.003440
d-C	0.002991
e-C	0.005327
g-d	0.012101
g-F	0.005297
h-g	0.004390
i-g	0.011860
C'-t	0.008664
e-C'	0.004850
F'-e	0.005024
i-F'	0.016601

Relative partial dispersion	
C-t／F-C	0.8358
C-A'／F-C	0.3512
d-C／F-C	0.3054
e-C／F-C	0.5438
g-d／F-C	1.2354
g-F／F-C	0.5408
h-g／F-C	0.4482
i-g／F-C	1.2108
C'-t／F'-C'	0.8775
e-C'／F'-C'	0.4912
F'-e／F'-C'	0.5088
i-F'／F'-C'	1.6813

Deviation of relative partial disp.	
ΔPdC	0.0013
ΔPgF	-0.0037

Internal CC (80%/5%)
325/275
Color Code (80%/5%)
335/275
CCI

B	0.00
G	0.16
R	0.15

Thermal properties	
CTE(-30,70) [1E-7/℃]	62
CTE(100,300) [1E-7/℃]	88
Tg [℃]	508
At [℃]	553
StP [℃]	456
AP [℃]	489
SP [℃]	621
Ht cndct. [W/m･K]	1.100
Sp. heat [kJ/kg･K]	0.769
Ht diffus. [1E-6 m2/sec]	0.508

Chemical properties [class]	
Acid res. (surface)	4
Alkaline detergent res.	3
Climate resistance	1
Water res. (powder)	2
Acid res. (powder)	3

Mechanical properties	
Knoop hardness	579 (6)
Abrasion hardness	108
Young's mod. [GPa]	85.3
Shear mod. [GPa]	32.9
Poisson's ratio	0.296
Stress optical coef. [1E-5 nm/cm／Pa]	2.42

Internal trans. (10mm)	
λ [nm]	τ
280	0.08
290	0.19
300	0.38
310	0.58
320	0.74
330	0.85
340	0.920
350	0.957
360	0.975
370	0.985
380	0.989
390	0.992
400	0.994
420	0.995
440	0.995
460	0.996
480	0.998
500	0.998
550	0.999
600	0.999
650	0.999
700	0.998
800	0.999
900	0.999
1000	0.999
1200	0.999
1400	0.998
1600	0.995
1800	0.986
2000	0.980
2200	0.936
2400	0.86

Specific gravity
2.8

Coef. disp. form. (pwr ser.)	
A0	2.46682919E+00
A1	-1.00692159E-02
A2	-1.10027728E-04
A3	1.40726622E-02
A4	1.36654094E-04
A5	8.57488472E-06
A6	-1.75474987E-07
A7	0.00000000E+00
A8	0.00000000E+00

Relative Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90(ref.)	4.3	4.3	4.4	4.6	4.7	4.8	4.8	4.9	5.0	5.2	5.5	5.6	6.0	6.5	6.7
60 to 80(ref.)	4.2	4.2	4.4	4.5	4.6	4.7	4.7	4.8	4.9	5.1	5.4	5.5	5.9	6.3	6.5
40 to 60	4.1	4.1	4.3	4.4	4.5	4.6	4.6	4.6	4.8	4.9	5.3	5.3	5.7	6.1	6.3
20 to 40	4.0	4.0	4.2	4.3	4.4	4.5	4.5	4.5	4.7	4.8	5.1	5.2	5.6	5.9	6.2
0 to 20	4.0	4.0	4.1	4.2	4.3	4.4	4.4	4.5	4.6	4.7	5.1	5.1	5.5	5.8	6.0
-20 to 0	4.0	4.0	4.1	4.2	4.3	4.4	4.4	4.4	4.6	4.7	5.0	5.1	5.4	5.8	6.0
-40 to -20	4.0	4.1	4.2	4.3	4.4	4.4	4.5	4.5	4.6	4.7	5.0	5.1	5.4	5.8	6.0
-60 to -40(ref.)	4.2	4.2	4.3	4.4	4.5	4.6	4.6	4.6	4.7	4.9	5.2	5.2	5.5	5.8	6.0
-70 to -60(ref.)	4.4	4.4	4.5	4.6	4.7	4.8	4.8	4.8	4.9	5.1	5.3	5.4	5.7	6.0	6.2

Absolute Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90	3.3	3.4	3.5	3.6	3.7	3.8	3.8	3.9	4.0	4.2	4.5	4.6	5.0	5.4	5.7
60 to 80	3.1	3.2	3.3	3.4	3.5	3.6	3.7	3.7	3.8	4.0	4.3	4.4	4.8	5.2	5.4
40 to 60	2.9	2.9	3.1	3.2	3.3	3.4	3.4	3.4	3.5	3.7	4.0	4.1	4.5	4.9	5.1
20～40	2.7	2.7	2.8	2.9	3.0	3.1	3.1	3.1	3.3	3.4	3.7	3.8	4.2	4.5	4.7
0 to 20	2.4	2.4	2.6	2.6	2.7	2.8	2.9	2.9	3.0	3.1	3.4	3.5	3.8	4.2	4.4
-20 to 0	2.2	2.2	2.3	2.4	2.5	2.6	2.6	2.6	2.7	2.9	3.2	3.2	3.5	3.9	4.1
-40 to -20	1.9	2.0	2.1	2.1	2.2	2.3	2.3	2.4	2.5	2.6	2.9	2.9	3.2	3.5	3.7
-60 to -40	1.7	1.7	1.8	1.9	2.0	2.0	2.1	2.1	2.2	2.3	2.6	2.6	2.9	3.2	3.4
-70 to -60	1.5	1.5	1.6	1.7	1.8	1.8	1.9	1.9	2.0	2.1	2.3	2.4	2.7	3.0	3.1

Coef. disp. form. (frac. eq.)(ref.)	
P1	-
Q1	-
P2	-
Q2	-
P3	-
Q3	-

Fitting error of disp. form. σ [1E-6]		
	Visible	Infrared
Power ser. eq.	0.4	7.0
Frac. eq. (ref.)	-	-

Prod. Freq. (A to D)	A

Similar glass type			
OHARA	-	HOYA	-
C.D.G.M	-	SCHOTT	-

2020-4-1	StP,AP,SP
2019-4-1	Transmittance
2015-4-1	1st edition

HIKARI GLASS CO., LTD.

Q-SK55S

n_d = 1.588870 n_e = 1.591168

ν_d = 61.14 ν_e = 60.91

Glass code (d)
589611
Glass code (e)
591609

Spectral l.	Refractive idx
2.058	1.56288
1.970	1.56430
1.530	1.57068
1.129	1.57605
1.064	1.57698
t	1.57774
s	1.58061
A'	1.582509
r	1.584226
C	1.585920
C'	1.586391
He-Ne	1.586830
D	1.588784
d	1.588870
e	1.591168
F	1.595552
F'	1.596097
g	1.600738
h	1.605028
0.389	1.607639
i	1.612315

Partial dispersion	
F-C	0.009632
F'-C'	0.009706
C-t	0.008177
C-A'	0.003411
d-C	0.002950
e-C	0.005248
g-d	0.011868
g-F	0.005186
h-g	0.004290
i-g	0.011577
C'-t	0.008648
e-C'	0.004777
F'-e	0.004929
i-F'	0.016218

Relative partial dispersion	
C-t／F-C	0.8489
C-A'／F-C	0.3541
d-C／F-C	0.3063
e-C／F-C	0.5449
g-d／F-C	1.2321
g-F／F-C	0.5384
h-g／F-C	0.4454
i-g／F-C	1.2019
C'-t／F'-C'	0.8910
e-C'／F'-C'	0.4922
F'-e／F'-C'	0.5078
i-F'／F'-C'	1.6709

Deviation of relative partial disp.	
ΔPdC	0.0015
ΔPgF	-0.0034

Internal CC (80%/5%)
327/273
Color Code (80%/5%)
340/275
CCI

B	0.00
G	0.17
R	0.15

Thermal properties	
CTE(-30,70) [1E-7/℃]	66
CTE(100,300) [1E-7/℃]	87
Tg [℃]	520
At [℃]	556
StP [℃]	472
AP [℃]	505
SP [℃]	628
Ht cndct. [W/m･K]	0.891
Sp. heat [kJ/kg･K]	0.601
Ht diffus. [1E-6 m2/sec]	0.503

Chemical properties [class]	
Acid res. (surface)	6
Alkaline detergent res.	3
Climate resistance	5
Water res. (powder)	2
Acid res. (powder)	4

Mechanical properties	
Knoop hardness	589 (6)
Abrasion hardness	99
Young's mod. [GPa]	97.1
Shear mod. [GPa]	39.2
Poisson's ratio	0.240
Stress optical coef. [1E-5 nm/cm／Pa]	2.33

Internal trans. (10mm)	
λ [nm]	τ
280	0.08
290	0.18
300	0.35
310	0.55
320	0.72
330	0.83
340	0.906
350	0.949
360	0.972
370	0.984
380	0.990
390	0.993
400	0.994
420	0.994
440	0.994
460	0.995
480	0.997
500	0.998
550	0.998
600	0.998
650	0.998
700	0.998
800	0.998
900	0.999
1000	0.999
1200	0.999
1400	0.996
1600	0.996
1800	0.990
2000	0.980
2200	0.935
2400	0.84

Specific gravity
2.95

Coef. disp. form. (pwr ser.)	
A0	2.48678163E+00
A1	-1.06945057E-02
A2	-1.21587496E-04
A3	1.38678388E-02
A4	1.28599548E-04
A5	8.04132494E-06
A6	-1.64917822E-07
A7	0.00000000E+00
A8	0.00000000E+00

Relative Δn/ΔT [1E-6/℃]															
Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90(ref.)	3.2	3.3	3.3	3.5	3.6	3.7	3.7	3.8	3.9	4.0	4.4	4.4	4.8	5.2	5.3
60 to 80(ref.)	3.1	3.2	3.3	3.4	3.5	3.6	3.6	3.7	3.8	3.9	4.2	4.3	4.7	5.0	5.2
40 to 60	3.1	3.1	3.2	3.3	3.4	3.5	3.5	3.6	3.7	3.8	4.1	4.2	4.5	4.9	5.0
20 to 40	3.0	3.0	3.1	3.2	3.3	3.4	3.5	3.5	3.6	3.7	4.0	4.1	4.4	4.7	4.9
0 to 20	3.0	3.0	3.1	3.2	3.3	3.4	3.4	3.4	3.6	3.7	4.0	4.0	4.3	4.6	4.8
-20 to 0	3.0	3.0	3.1	3.2	3.3	3.4	3.4	3.5	3.6	3.7	3.9	4.0	4.3	4.6	4.7
-40 to -20	3.1	3.1	3.2	3.3	3.4	3.5	3.5	3.5	3.6	3.7	4.0	4.0	4.3	4.6	4.8
-60 to -40(ref.)	3.3	3.3	3.4	3.5	3.6	3.7	3.7	3.7	3.8	3.9	4.1	4.2	4.5	4.7	4.9
-70 to -60(ref.)	3.5	3.5	3.6	3.7	3.8	3.9	3.9	3.9	4.0	4.1	4.3	4.4	4.6	4.9	5.0

Absolute Δn/ΔT [1E-6/℃]															
Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90	2.2	2.3	2.4	2.5	2.6	2.7	2.7	2.8	2.9	3.0	3.4	3.4	3.8	4.1	4.3
60 to 80	2.1	2.1	2.2	2.3	2.4	2.5	2.6	2.6	2.7	2.9	3.2	3.2	3.6	3.9	4.1
40 to 60	1.9	1.9	2.0	2.1	2.2	2.3	2.3	2.3	2.5	2.6	2.9	2.9	3.3	3.6	3.8
20～40	1.6	1.7	1.8	1.9	2.0	2.1	2.1	2.1	2.2	2.3	2.6	2.7	3.0	3.3	3.5
0 to 20	1.4	1.4	1.6	1.6	1.7	1.8	1.8	1.9	2.0	2.1	2.3	2.4	2.7	3.0	3.2
-20 to 0	1.2	1.2	1.3	1.4	1.5	1.6	1.6	1.6	1.7	1.8	2.1	2.1	2.4	2.7	2.8
-40 to -20	1.0	1.0	1.1	1.2	1.3	1.3	1.4	1.4	1.5	1.6	1.8	1.8	2.1	2.4	2.5
-60 to -40	0.8	0.8	0.9	1.0	1.0	1.1	1.1	1.1	1.2	1.3	1.5	1.6	1.8	2.1	2.2
-70 to -60	0.6	0.6	0.7	0.8	0.9	0.9	0.9	1.0	1.0	1.1	1.3	1.4	1.6	1.9	2.0

Coef. disp. form. (frac. eq.)(ref.)	
P1	1.41791078E-01
Q1	8.79402140E+01
P2	1.80161529E-02
Q2	2.41895821E-02
P3	3.13394163E-01
Q3	5.13888539E-03

Fitting error of disp. form. σ [1E-6]		
	Visible	Infrared
Power ser. eq.	0.5	6.8
Frac. eq. (ref.)	0.7	6.9

Prod. Freq. (A to D)	B

Similar glass type			
OHARA	-	HOYA	-
C.D.G.M	-	SCHOTT	-

2020-4-1	StP,AP,SP
2019-4-1	Transmittance
2015-4-1	Color Code

HIKARI GLASS CO., LTD.

Q-SF6S

n_d = 1.803010 n_e = 1.810419

ν_d = 25.53 ν_e = 25.33

Glass code (d)
803255
Glass code (e)
810253

Spectral l.	Refractive idx
2.058	1.75204
1.970	1.75358
1.530	1.76123
1.129	1.76962
1.064	1.77140
t	1.77296
s	1.77948
A'	1.784373
r	1.789094
C	1.793991
C'	1.795392
He-Ne	1.796712
D	1.802739
d	1.803010
e	1.810419
F	1.825442
F'	1.827390
g	1.844793
h	1.862304
0.389	1.873765
i	–

Partial dispersion	
F-C	0.031451
F'-C'	0.031998
C-t	0.021034
C-A'	0.009618
d-C	0.009019
e-C	0.016428
g-d	0.041783
g-F	0.019351
h-g	0.017511
i-g	–
C'-t	0.022435
e-C'	0.015027
F'-e	0.016971
i-F'	–

Internal CC (80%/5%)
398/363
Color Code (80%/5%)
440/365
CCI

B	0.00
G	3.24
R	3.41

Thermal properties	
CTE(-30,70) [1E-7/℃]	86
CTE(100,300) [1E-7/℃]	110
Tg [℃]	571
At [℃]	611
StP [℃]	524
AP [℃]	558
SP [℃]	679
Ht cndct. [W/m·K]	1.070
Sp. heat [kJ/kg·K]	0.662
Ht diffus. [1E-6 m2/sec]	0.484

Internal trans. (10mm)	
λ [nm]	τ
280	–
290	–
300	–
310	–
320	–
330	–
340	–
350	–
360	–
370	0.20
380	0.50
390	0.71
400	0.82
420	0.918
440	0.954
460	0.971
480	0.980
500	0.984
550	0.991
600	0.994
650	0.995
700	0.996
800	0.995
900	0.995
1000	0.996
1200	0.998
1400	0.999
1600	0.990
1800	0.975
2000	0.966
2200	0.936
2400	0.89

Coef. disp. form. (pwr ser.)	
A0	3.11291202E+00
A1	-1.25998729E-02
A2	0.00000000E+00
A3	4.20929946E-02
A4	2.89961240E-03
A5	-3.73431538E-04
A6	9.67592867E-05
A7	-9.85184772E-06
A8	5.06525233E-07

Relative partial dispersion	
C-t／F-C	0.6688
C-A'／F-C	0.3058
d-C／F-C	0.2868
e-C／F-C	0.5223
g-d／F-C	1.3285
g-F／F-C	0.6153
h-g／F-C	0.5568
i-g／F-C	–
C'-t／F'-C'	0.7011
e-C'／F'-C'	0.4696
F'-e／F'-C'	0.5304
i-F'／F'-C'	–

Deviation of relative partial disp.	
ΔPdC	-0.0020
ΔPgF	0.0138

Chemical properties [class]	
Acid res. (surface)	1
Alkaline detergent res.	1
Climate resistance	1
Water res. (powder)	2
Acid res. (powder)	1

Mechanical properties	
Knoop hardness	482 (5)
Abrasion hardness	182
Young's mod. [GPa]	119.8
Shear mod. [GPa]	47.4
Poisson's ratio	0.264
Stress optical coef. [1E-5 nm/cm／Pa]	2.95

Specific gravity
3.34

Relative Δn/ΔT [1E-6/℃]															
Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90(ref.)	-0.8	-0.7	-0.4	0.0	0.3	0.7	0.8	0.9	1.4	2.1	3.6	3.8	6.0	8.6	10.6
60 to 80(ref.)	-1.0	-0.8	-0.4	-0.2	0.2	0.5	0.6	0.7	1.2	1.9	3.3	3.6	5.6	8.1	10.0
40 to 60	-1.1	-1.0	-0.6	-0.3	0.0	0.3	0.4	0.5	1.0	1.6	3.0	3.2	5.1	7.5	9.3
20 to 40	-1.2	-1.1	-0.7	-0.4	-0.1	0.2	0.3	0.4	0.8	1.4	2.7	2.9	4.7	6.9	8.7
0 to 20	-1.2	-1.1	-0.8	-0.5	-0.2	0.1	0.2	0.3	0.7	1.2	2.4	2.6	4.3	6.4	8.0
-20 to 0	-1.2	-1.1	-0.8	-0.5	-0.3	0.0	0.1	0.2	0.6	1.1	2.2	2.4	4.0	5.9	7.5
-40 to -20	-1.1	-1.1	-0.7	-0.5	-0.2	0.0	0.1	0.2	0.6	1.0	2.1	2.2	3.7	5.5	7.0
-60 to -40(ref.)	-1.0	-0.9	-0.6	-0.3	-0.1	0.2	0.2	0.3	0.7	1.1	2.0	2.2	3.6	5.3	6.6
-70 to -60(ref.)	-0.8	-0.7	-0.4	-0.1	0.1	0.3	0.4	0.5	0.8	1.2	2.1	2.2	3.5	5.1	6.4

Absolute Δn/ΔT [1E-6/℃]															
Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90	-1.9	-1.8	-1.4	-1.1	-0.8	-0.4	-0.3	-0.2	0.3	0.9	2.5	2.7	4.8	7.4	9.4
60 to 80	-2.1	-2.0	-1.7	-1.4	-1.0	-0.7	-0.6	-0.5	0.0	0.6	2.1	2.3	4.4	6.8	8.7
40 to 60	-2.4	-2.3	-2.0	-1.7	-1.4	-1.0	-0.9	-0.8	-0.4	0.2	1.6	1.8	3.7	6.1	7.9
20～40	-2.7	-2.6	-2.3	-2.0	-1.7	-1.4	-1.3	-1.2	-0.8	-0.2	1.1	1.3	3.1	5.3	7.0
0 to 20	-3.0	-2.9	-2.5	-2.3	-2.0	-1.7	-1.6	-1.5	-1.1	-0.6	0.6	0.8	2.4	4.5	6.1
-20 to 0	-3.2	-3.2	-2.8	-2.6	-2.3	-2.1	-2.0	-1.9	-1.5	-1.0	0.1	0.2	1.8	3.7	5.3
-40 to -20	-3.5	-3.4	-3.1	-2.9	-2.6	-2.4	-2.3	-2.2	-1.9	-1.4	-0.4	-0.3	1.2	3.0	4.4
-60 to -40	-3.8	-3.7	-3.4	-3.2	-3.0	-2.7	-2.7	-2.6	-2.3	-1.9	-0.9	-0.8	0.5	2.2	3.5
-70 to -60	-4.0	-3.9	-3.6	-3.4	-3.2	-3.0	-2.9	-2.9	-2.5	-2.2	-1.3	-1.2	0.1	1.6	2.9

Coef. disp. form. (frac. eq.)(ref.)	
P1	9.56339875E-02
Q1	7.18831680E+01
P2	2.73999397E-02
Q2	6.14448767E-02
P3	3.85604213E-01
Q3	8.88657407E-03

Fitting error of disp. form. σ [1E-6]		
	Visible	Infrared
Power ser. eq.	0.9	5.0
Frac. eq. (ref.)	2.9	15.8

Prod. Freq. (A to D)	C

Similar glass type			
OHARA	–	HOYA	–
C.D.G.M	–	SCHOTT	–

2020-4-1	StP,AP,SP
2019-4-1	Transmittance
2015-4-1	Color Code, Prod. Freq

HIKARI GLASS CO., LTD.

Q-LAK52S

n_d = 1.677980 n_e = 1.680924

ν_d = 54.89 ν_e = 54.66

Glass code (d)
678549
Glass code (e)
681547

Spectral l.	Refractive idx
2.058	1.64682
1.970	1.64844
1.530	1.65577
1.129	1.66204
1.064	1.66315
t	1.66407
s	1.66757
A'	1.669931
r	1.672085
C	1.674224
C'	1.674822
He-Ne	1.675380
D	1.677870
d	1.677980
e	1.680924
F	1.686575
F'	1.687280
g	1.693304
h	1.698901
0.389	1.702320
i	1.708466

Coef. disp. form. (pwr ser.)	
A0	2.76405609E+00
A1	-1.26400636E-02
A2	-1.60322951E-04
A3	1.84903089E-02
A4	2.67778201E-04
A5	5.29803264E-06
A6	1.21335917E-07
A7	0.00000000E+00
A8	0.00000000E+00

Partial dispersion	
F-C	0.012351
F'-C'	0.012458
C-t	0.010153
C-A'	0.004293
d-C	0.003756
e-C	0.006700
g-d	0.015324
g-F	0.006729
h-g	0.005597
i-g	0.015162
C'-t	0.010751
e-C'	0.006102
F'-e	0.006356
i-F'	0.021186

Relative partial dispersion	
C-t／F-C	0.8220
C-A'／F-C	0.3476
d-C／F-C	0.3041
e-C／F-C	0.5425
g-d／F-C	1.2407
g-F／F-C	0.5448
h-g／F-C	0.4532
i-g／F-C	1.2276
C'-t／F'-C'	0.8630
e-C'／F'-C'	0.4898
F'-e／F'-C'	0.5102
i-F'／F'-C'	1.7006

Deviation of relative partial disp.	
ΔPdC	0.0021
ΔPgF	-0.0074

Internal CC (80%/5%)
342/277
Color Code (80%/5%)
360/280
CCI

B	0.00
G	0.21
R	0.21

Thermal properties	
CTE(-30,70) [1E-7/℃]	59
CTE(100,300) [1E-7/℃]	79
Tg [℃]	559
At [℃]	597
StP [℃]	511
AP [℃]	541
SP [℃]	653
Ht cndct. [W/m･K]	0.976
Sp. heat [kJ/kg･K]	0.666
Ht diffus. [1E-6 m2/sec]	0.413

Chemical properties [class]	
Acid res. (surface)	5
Alkaline detergent res.	4
Climate resistance	1
Water res. (powder)	1
Acid res. (powder)	4

Mechanical properties	
Knoop hardness	566 (6)
Abrasion hardness	104
Young's mod. [GPa]	106.9
Shear mod. [GPa]	41.6
Poisson's ratio	0.284
Stress optical coef. [1E-5 nm/cm／Pa]	2.19

Internal trans. (10mm)	
λ [nm]	τ
280	0.06
290	0.12
300	0.21
310	0.34
320	0.50
330	0.65
340	0.78
350	0.86
360	0.921
370	0.954
380	0.974
390	0.983
400	0.989
420	0.994
440	0.995
460	0.997
480	0.998
500	0.999
550	0.999
600	0.999
650	0.999
700	0.998
800	0.988
900	0.999
1000	0.996
1200	0.999
1400	0.992
1600	0.990
1800	0.979
2000	0.957
2200	0.88
2400	0.66

Specific gravity
3.55

Relative Δn/ΔT [1E-6/℃]															
Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90(ref.)	4.3	4.4	4.5	4.6	4.7	4.9	4.9	4.9	5.1	5.3	5.8	5.8	6.3	6.7	7.0
60 to 80(ref.)	4.2	4.2	4.4	4.5	4.6	4.7	4.8	4.8	5.0	5.2	5.6	5.7	6.1	6.5	6.8
40 to 60	4.1	4.1	4.3	4.4	4.5	4.6	4.6	4.7	4.8	5.0	5.4	5.5	5.9	6.3	6.6
20 to 40	4.0	4.0	4.1	4.2	4.4	4.5	4.5	4.5	4.7	4.9	5.3	5.3	5.8	6.2	6.4
0 to 20	3.9	3.9	4.1	4.2	4.3	4.4	4.4	4.5	4.6	4.8	5.2	5.2	5.6	6.0	6.3
-20 to 0	3.9	3.9	4.1	4.1	4.2	4.4	4.4	4.4	4.6	4.8	5.1	5.2	5.6	5.9	6.2
-40 to -20	3.9	4.0	4.1	4.2	4.3	4.4	4.4	4.5	4.6	4.8	5.1	5.2	5.6	5.9	6.2
-60 to -40(ref.)	4.1	4.1	4.2	4.3	4.4	4.5	4.6	4.6	4.7	4.9	5.2	5.3	5.7	6.0	6.2
-70 to -60(ref.)	4.3	4.3	4.4	4.5	4.6	4.7	4.7	4.8	4.9	5.1	5.4	5.4	5.8	6.1	6.4

Absolute Δn/ΔT [1E-6/℃]															
Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90	3.3	3.3	3.5	3.6	3.7	3.8	3.9	3.9	4.1	4.3	4.7	4.7	5.2	5.6	5.9
60 to 80	3.1	3.1	3.3	3.4	3.5	3.6	3.6	3.7	3.8	4.0	4.5	4.5	4.9	5.4	5.6
40 to 60	2.8	2.8	3.0	3.1	3.2	3.3	3.3	3.4	3.5	3.7	4.1	4.2	4.6	5.0	5.3
20～40	2.5	2.6	2.7	2.8	2.9	3.0	3.1	3.1	3.2	3.4	3.8	3.8	4.3	4.6	4.9
0 to 20	2.2	2.3	2.4	2.5	2.6	2.7	2.8	2.8	2.9	3.1	3.5	3.5	3.9	4.3	4.5
-20 to 0	2.0	2.0	2.1	2.2	2.3	2.4	2.5	2.5	2.6	2.8	3.1	3.2	3.6	3.9	4.2
-40 to -20	1.7	1.7	1.9	1.9	2.0	2.1	2.2	2.2	2.3	2.5	2.8	2.9	3.2	3.6	3.8
-60 to -40	1.4	1.5	1.6	1.7	1.7	1.8	1.9	1.9	2.0	2.2	2.5	2.5	2.9	3.2	3.4
-70 to -60	1.2	1.3	1.4	1.4	1.5	1.6	1.6	1.7	1.8	1.9	2.3	2.3	2.6	2.9	3.1

Coef. disp. form. (frac. eq.)(ref.)	
P1	1.18769620E-01
Q1	7.08583056E+01
P2	5.80400344E-02
Q2	1.89171164E-02
P3	3.12263556E-01
Q3	4.30169943E-03

Fitting error of disp. form. σ [1E-6]		
	Visible	Infrared
Power ser. eq.	0.4	3.6
Frac. eq. (ref.)	0.4	3.8

Prod. Freq. (A to D)	A

Similar glass type			
OHARA	-	HOYA	-
C.D.G.M	-	SCHOTT	-

2020-4-1	StP,AP,SP
2019-4-1	Transmittance
2015-4-1	Color Code

HIKARI GLASS CO., LTD.

Q-LAK53S

n_d = 1.693430 n_e = 1.696531

ν_d = 53.30 ν_e = 53.06

Glass code (d)
693533
Glass code (e)
697531

Spectral l.	Refractive idx
2.058	1.66228
1.970	1.66382
1.530	1.67082
1.129	1.67696
1.064	1.67807
t	1.67900
s	1.68256
A'	1.685007
r	1.687250
C	1.689487
C'	1.690114
He-Ne	1.690699
D	1.693314
d	1.693430
e	1.696531
F	1.702497
F'	1.703241
g	1.709620
h	1.715558
0.389	1.719189
i	1.725726

Partial dispersion	
F-C	0.013010
F'-C'	0.013127
C-t	0.010490
C-A'	0.004480
d-C	0.003943
e-C	0.007044
g-d	0.016190
g-F	0.007123
h-g	0.005938
i-g	0.016106
C'-t	0.011117
e-C'	0.006417
F'-e	0.006710
i-F'	0.022485

Relative partial dispersion	
C-t／F-C	0.8063
C-A'／F-C	0.3444
d-C／F-C	0.3031
e-C／F-C	0.5414
g-d／F-C	1.2444
g-F／F-C	0.5475
h-g／F-C	0.4564
i-g／F-C	1.2380
C'-t／F'-C'	0.8469
e-C'／F'-C'	0.4888
F'-e／F'-C'	0.5112
i-F'／F'-C'	1.7129

Deviation of relative partial disp.	
ΔPdC	0.0018
ΔPgF	-0.0074

Internal CC (80%/5%)
345/289
Color Code (80%/5%)
360/290
CCI

B	0.00
G	0.28
R	0.27

Thermal properties	
CTE(-30,70) [1E-7/℃]	67
CTE(100,300) [1E-7/℃]	88
Tg [℃]	539
At [℃]	578
StP [℃]	496
AP [℃]	526
SP [℃]	638
Ht cndct. [W/m･K]	0.958
Sp. heat [kJ/kg･K]	0.630
Ht diffus. [1E-6 m2/sec]	0.415

Chemical properties [class]	
Acid res. (surface)	5
Alkaline detergent res.	3
Climate resistance	1
Water res. (powder)	1
Acid res. (powder)	4

Mechanical properties	
Knoop hardness	555 (6)
Abrasion hardness	118
Young's mod. [GPa]	108.1
Shear mod. [GPa]	42.0
Poisson's ratio	0.287
Stress optical coef. [1E-5 nm/cm／Pa]	2.12

Internal trans. (10mm)	
λ [nm]	τ
280	0.02
290	0.06
300	0.15
310	0.29
320	0.45
330	0.61
340	0.75
350	0.85
360	0.912
370	0.949
380	0.970
390	0.981
400	0.987
420	0.991
440	0.993
460	0.995
480	0.997
500	0.998
550	0.999
600	0.998
650	0.999
700	0.999
800	0.998
900	0.997
1000	0.998
1200	0.999
1400	0.997
1600	0.994
1800	0.985
2000	0.970
2200	0.920
2400	0.73

Specific gravity
3.66

Coef. disp. form. (pwr ser.)	
A0	2.81181751E+00
A1	-1.18938304E-02
A2	-1.65919133E-04
A3	1.99255052E-02
A4	2.37580562E-04
A5	1.29438052E-05
A6	-1.59492635E-07
A7	0.00000000E+00
A8	0.00000000E+00

Relative Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90(ref.)	3.6	3.6	3.8	4.0	4.1	4.3	4.3	4.3	4.5	4.7	5.2	5.3	5.9	6.4	6.7
60 to 80(ref.)	3.5	3.6	3.7	3.9	4.0	4.1	4.2	4.2	4.4	4.6	5.1	5.1	5.7	6.2	6.5
40 to 60	3.4	3.4	3.6	3.7	3.9	4.0	4.1	4.1	4.3	4.5	4.9	5.0	5.5	6.0	6.3
20 to 40	3.4	3.4	3.5	3.7	3.8	3.9	4.0	4.0	4.2	4.4	4.8	4.9	5.4	5.9	6.1
0 to 20	3.3	3.3	3.5	3.6	3.7	3.9	3.9	3.9	4.1	4.3	4.7	4.8	5.3	5.7	6.0
-20 to 0	3.3	3.3	3.5	3.6	3.7	3.9	3.9	3.9	4.1	4.3	4.7	4.7	5.2	5.7	5.9
-40 to -20	3.4	3.4	3.6	3.7	3.8	3.9	4.0	4.0	4.1	4.3	4.7	4.8	5.2	5.7	5.9
-60 to -40(ref.)	3.6	3.6	3.7	3.8	4.0	4.1	4.1	4.2	4.3	4.5	4.8	4.9	5.4	5.8	6.0
-70 to -60(ref.)	3.8	3.8	3.9	4.1	4.2	4.3	4.3	4.3	4.5	4.7	5.0	5.1	5.5	5.9	6.1

Absolute Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90	2.6	2.6	2.8	2.9	3.1	3.2	3.2	3.3	3.5	3.7	4.1	4.2	4.8	5.3	5.6
60 to 80	2.4	2.4	2.6	2.7	2.9	3.0	3.0	3.1	3.3	3.5	3.9	4.0	4.5	5.0	5.3
40 to 60	2.2	2.2	2.3	2.5	2.6	2.7	2.8	2.8	3.0	3.2	3.6	3.7	4.2	4.7	4.9
20～40	1.9	1.9	2.1	2.2	2.3	2.5	2.5	2.5	2.7	2.9	3.3	3.4	3.9	4.3	4.6
0 to 20	1.7	1.7	1.8	1.9	2.1	2.2	2.2	2.3	2.4	2.6	3.0	3.0	3.5	4.0	4.2
-20 to 0	1.4	1.4	1.5	1.7	1.8	1.9	1.9	2.0	2.1	2.3	2.7	2.7	3.2	3.6	3.9
-40 to -20	1.2	1.2	1.3	1.4	1.5	1.6	1.7	1.7	1.8	2.0	2.4	2.4	2.9	3.3	3.5
-60 to -40	0.9	0.9	1.0	1.1	1.3	1.4	1.4	1.4	1.6	1.7	2.1	2.1	2.6	3.0	3.1
-70 to -60	0.7	0.7	0.8	0.9	1.1	1.2	1.2	1.2	1.3	1.5	1.8	1.9	2.3	2.7	2.9

Coef. disp. form. (frac. eq.)(ref.)	
P1	1.16729408E-01
Q1	7.46755288E+01
P2	2.89929132E-02
Q2	2.46983860E-02
P3	3.47592030E-01
Q3	5.29696921E-03

Fitting error of disp. form. σ [1E-6]		
	Visible	Infrared
Power ser. eq.	0.5	9.5
Frac. eq. (ref.)	0.8	9.1

Prod. Freq. (A to D)	A

Similar glass type			
OHARA	-	HOYA	-
C.D.G.M	-	SCHOTT	-

2020-4-1	StP,AP,SP
2019-4-1	Transmittance
2015-4-1	1st edition

HIKARI GLASS CO., LTD.

Q-LAF010S

n_d = 1.743000 n_e = 1.746593

ν_d = 49.25 ν_e = 49.00

Glass code (d)
743493
Glass code (e)
747490

Spectral l.	Refractive idx
2.058	1.70964
1.970	1.71115
1.530	1.71813
1.129	1.72449
1.064	1.72568
t	1.72668
s	1.73061
A'	1.733353
r	1.735899
C	1.738458
C'	1.739177
He-Ne	1.739850
D	1.742866
d	1.743000
e	1.746593
F	1.753545
F'	1.754415
g	1.761895
h	1.768890
0.389	1.773183
i	1.780938

Partial dispersion	
F-C	0.015087
F'-C'	0.015238
C-t	0.011778
C-A'	0.005105
d-C	0.004542
e-C	0.008135
g-d	0.018895
g-F	0.008350
h-g	0.006995
i-g	0.019043
C'-t	0.012497
e-C'	0.007416
F'-e	0.007822
i-F'	0.026523

Relative partial dispersion	
C-t／F-C	0.7807
C-A'／F-C	0.3384
d-C／F-C	0.3011
e-C／F-C	0.5392
g-d／F-C	1.2524
g-F／F-C	0.5535
h-g／F-C	0.4636
i-g／F-C	1.2622
C'-t／F'-C'	0.8201
e-C'／F'-C'	0.4867
F'-e／F'-C'	0.5133
i-F'／F'-C'	1.7406

Deviation of relative partial disp.	
ΔPdC	0.0016
ΔPgF	-0.0083

Internal CC (80%/5%)
347/275
Color Code (80%/5%)
370/275

CCI	
B	0.00
G	0.36
R	0.37

Thermal properties	
CTE(-30,70) [1E-7/℃]	54
CTE(100,300) [1E-7/℃]	71
Tg [℃]	560
At [℃]	592
StP [℃]	514
AP [℃]	543
SP [℃]	654
Ht cndct. [W/m･K]	0.849
Sp. heat [kJ/kg･K]	0.547
Ht diffus. [1E-6 m2/sec]	0.415

Chemical properties [class]	
Acid res. (surface)	5
Alkaline detergent res.	4
Climate resistance	1
Water res. (powder)	1
Acid res. (powder)	3

Mechanical properties	
Knoop hardness	612 (6)
Abrasion hardness	73
Young's mod. [GPa]	108.1
Shear mod. [GPa]	41.3
Poisson's ratio	0.309
Stress optical coef. [1E-5 nm/cm／Pa]	2.52

Internal trans. (10mm)	
λ [nm]	τ
280	0.08
290	0.16
300	0.25
310	0.34
320	0.48
330	0.62
340	0.74
350	0.83
360	0.89
370	0.935
380	0.960
390	0.974
400	0.982
420	0.989
440	0.992
460	0.994
480	0.997
500	0.998
550	0.998
600	0.999
650	0.999
700	0.999
800	0.999
900	0.998
1000	0.998
1200	0.998
1400	0.995
1600	0.990
1800	0.977
2000	0.953
2200	0.89
2400	0.68

Specific gravity
4.29

Coef. disp. form. (pwr ser.)	
A0	2.97048240E+00
A1	-1.18584636E-02
A2	-1.66775197E-04
A3	2.36062466E-02
A4	3.56836115E-04
A5	1.23565080E-05
A6	1.07206448E-07
A7	0.00000000E+00
A8	0.00000000E+00

Relative Δn/ΔT [1E-6/℃]															
Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90(ref.)	8.1	8.2	8.4	8.7	8.9	9.1	9.1	9.2	9.4	9.8	10.4	10.5	11.2	12.0	12.5
60 to 80(ref.)	8.0	8.0	8.3	8.5	8.7	8.9	9.0	9.0	9.3	9.6	10.2	10.3	11.0	11.7	12.2
40 to 60	7.8	7.9	8.1	8.3	8.5	8.7	8.7	8.8	9.0	9.3	9.9	10.0	10.7	11.4	11.9
20 to 40	7.6	7.7	8.0	8.2	8.3	8.5	8.6	8.6	8.9	9.1	9.7	9.8	10.5	11.2	11.6
0 to 20	7.5	7.6	7.8	8.0	8.2	8.4	8.4	8.5	8.7	9.0	9.5	9.6	10.3	11.0	11.4
-20 to 0	7.5	7.6	7.8	8.0	8.1	8.3	8.4	8.4	8.6	8.9	9.4	9.5	10.1	10.8	11.2
-40 to -20	7.5	7.6	7.8	8.0	8.1	8.3	8.3	8.4	8.6	8.9	9.4	9.4	10.1	10.7	11.1
-60 to -40(ref.)	7.6	7.7	7.9	8.1	8.2	8.4	8.4	8.5	8.7	8.9	9.4	9.5	10.1	10.7	11.1
-70 to -60(ref.)	7.8	7.8	8.1	8.2	8.4	8.5	8.6	8.6	8.8	9.1	9.6	9.6	10.2	10.8	11.2

Absolute Δn/ΔT [1E-6/℃]															
Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90	7.0	7.1	7.4	7.6	7.8	8.0	8.0	8.1	8.4	8.7	9.3	9.4	10.1	10.9	11.4
60 to 80	6.8	6.9	7.1	7.3	7.5	7.7	7.8	7.8	8.1	8.4	9.0	9.1	9.8	10.5	11.0
40 to 60	6.5	6.6	6.8	7.0	7.2	7.4	7.4	7.5	7.7	8.0	8.6	8.7	9.4	10.1	10.5
20～40	6.2	6.2	6.5	6.7	6.8	7.0	7.1	7.1	7.3	7.6	8.2	8.3	8.9	9.6	10.1
0 to 20	5.8	5.9	6.1	6.3	6.5	6.7	6.7	6.7	7.0	7.2	7.8	7.9	8.5	9.2	9.6
-20 to 0	5.5	5.6	5.8	6.0	6.1	6.3	6.3	6.4	6.6	6.9	7.4	7.4	8.1	8.7	9.1
-40 to -20	5.2	5.2	5.5	5.6	5.8	5.9	6.0	6.0	6.2	6.5	7.0	7.0	7.6	8.2	8.6
-60 to -40	4.9	4.9	5.1	5.3	5.4	5.6	5.6	5.7	5.9	6.1	6.6	6.6	7.2	7.8	8.2
-70 to -60	4.6	4.7	4.9	5.0	5.2	5.3	5.4	5.4	5.6	5.8	6.3	6.3	6.9	7.4	7.8

Coef. disp. form. (frac. eq.)(ref.)	
P1	1.02889335E-01
Q1	7.07717253E+01
P2	3.99262106E-02
Q2	2.45708717E-02
P3	3.56547103E-01
Q3	5.24737051E-03

Fitting error of disp. form. σ [1E-6]		
	Visible	Infrared
Power ser. eq.	0.6	8.4
Frac. eq. (ref.)	0.8	7.9

Prod. Freq. (A to D)	A

Similar glass type			
OHARA	-	HOYA	-
C.D.G.M	-	SCHOTT	-

2020-4-1	StP,AP,SP
2019-4-1	Transmittance
2015-4-1	Color Code

HIKARI GLASS CO., LTD.

Q-LAFPH1S

n_d = 1.743104 n_e = 1.746684

ν_d = 49.44 ν_e = 49.19

Glass code (d)
743494
Glass code (e)
747492

Spectral l.	Refractive idx
2.058	1.70904
1.970	1.71064
1.530	1.71795
1.129	1.72452
1.064	1.72574
t	1.72675
s	1.73072
A'	1.733473
r	1.736020
C	1.738575
C'	1.739293
He-Ne	1.739963
D	1.742971
d	1.743104
e	1.746684
F	1.753606
F'	1.754473
g	1.761919
h	1.768884
0.389	1.773159
i	1.780885

Coef. disp. form. (pwr ser.)	
A0	2.97184328E+00
A1	-1.26569714E-02
A2	-1.62723834E-04
A3	2.32616036E-02
A4	4.03316269E-04
A5	6.85871554E-06
A6	3.74016912E-07
A7	0.00000000E+00
A8	0.00000000E+00

Partial dispersion	
F-C	0.015031
F'-C'	0.015180
C-t	0.011824
C-A'	0.005102
d-C	0.004529
e-C	0.008109
g-d	0.018815
g-F	0.008313
h-g	0.006965
i-g	0.018966
C'-t	0.012542
e-C'	0.007391
F'-e	0.007789
i-F'	0.026412

Relative partial dispersion	
C-t／F-C	0.7866
C-A'／F-C	0.3394
d-C／F-C	0.3013
e-C／F-C	0.5395
g-d／F-C	1.2517
g-F／F-C	0.5531
h-g／F-C	0.4634
i-g／F-C	1.2618
C'-t／F'-C'	0.8262
e-C'／F'-C'	0.4869
F'-e／F'-C'	0.5131
i-F'／F'-C'	1.7399

Deviation of relative partial disp.	
ΔPdC	0.0018
ΔPgF	-0.0084

Internal CC (80%/5%)	
343/298	
Color Code (80%/5%)	
370/300	
CCI	
B	-
G	-
R	-

Thermal properties	
CTE(-30,70) [1E-7/℃]	52
CTE(100,300) [1E-7/℃]	70
Tg [℃]	562
At [℃]	596
StP [℃]	517
AP [℃]	546
SP [℃]	653
Ht cndct. [W/m･K]	0.901
Sp. heat [kJ/kg･K]	0.542
Ht diffus. [1E-6 m2/sec]	0.391

Chemical properties [class]	
Acid res. (surface)	6
Alkaline detergent res.	4
Climate resistance	1
Water res. (powder)	1
Acid res. (powder)	4

Mechanical properties	
Knoop hardness	581 (6)
Abrasion hardness	73
Young's mod. [GPa]	109.7
Shear mod. [GPa]	42.0
Poisson's ratio	0.306
Stress optical coef. [1E-5 nm/cm／Pa]	2.33

Internal trans. (10mm)	
λ [nm]	τ
280	-
290	-
300	0.07
310	0.28
320	0.50
330	0.66
340	0.77
350	0.86
360	0.910
370	0.946
380	0.967
390	0.979
400	0.985
420	0.991
440	0.994
460	0.996
480	0.999
500	0.999
550	0.999
600	0.999
650	0.999
700	0.999
800	0.999
900	0.999
1000	0.999
1200	0.999
1400	0.999
1600	0.995
1800	0.984
2000	0.962
2200	0.902
2400	0.67

Specific gravity
4.25

Relative Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90(ref.)	7.6	7.7	7.9	8.1	8.3	8.5	8.5	8.6	8.9	9.2	9.8	9.9	10.6	11.3	11.8
60 to 80(ref.)	7.5	7.5	7.8	7.9	8.1	8.3	8.4	8.4	8.7	9.0	9.6	9.7	10.4	11.1	11.6
40 to 60	7.3	7.4	7.6	7.7	7.9	8.1	8.2	8.2	8.5	8.8	9.4	9.5	10.1	10.8	11.3
20 to 40	7.2	7.2	7.4	7.6	7.8	8.0	8.0	8.1	8.3	8.6	9.2	9.3	9.9	10.5	11.0
0 to 20	7.1	7.1	7.3	7.5	7.7	7.8	7.9	7.9	8.2	8.5	9.0	9.1	9.7	10.3	10.8
-20 to 0	7.0	7.1	7.3	7.4	7.6	7.8	7.8	7.9	8.1	8.4	8.9	9.0	9.6	10.2	10.6
-40 to -20	7.1	7.1	7.3	7.4	7.6	7.8	7.8	7.9	8.1	8.4	8.9	8.9	9.5	10.1	10.5
-60 to -40(ref.)	7.2	7.2	7.4	7.6	7.7	7.9	7.9	8.0	8.2	8.4	8.9	9.0	9.6	10.1	10.5
-70 to -60(ref.)	7.4	7.4	7.6	7.7	7.9	8.0	8.1	8.1	8.3	8.6	9.1	9.1	9.7	10.2	10.6

Absolute Δn/ΔT [1E-6/℃]

Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90	6.5	6.6	6.8	7.0	7.2	7.4	7.4	7.5	7.8	8.1	8.7	8.8	9.5	10.2	10.7
60 to 80	6.3	6.4	6.6	6.8	6.9	7.1	7.2	7.2	7.5	7.8	8.4	8.5	9.2	9.9	10.3
40 to 60	6.0	6.1	6.3	6.4	6.6	6.8	6.8	6.9	7.1	7.4	8.0	8.1	8.8	9.4	9.9
20～40	5.7	5.7	5.9	6.1	6.3	6.4	6.5	6.5	6.8	7.1	7.6	7.7	8.3	9.0	9.4
0 to 20	5.4	5.4	5.6	5.8	5.9	6.1	6.1	6.2	6.4	6.7	7.3	7.3	7.9	8.5	8.9
-20 to 0	5.1	5.1	5.3	5.4	5.6	5.8	5.8	5.9	6.1	6.3	6.9	6.9	7.5	8.1	8.5
-40 to -20	4.7	4.8	5.0	5.1	5.3	5.4	5.5	5.5	5.7	6.0	6.5	6.5	7.1	7.6	8.0
-60 to -40	4.4	4.5	4.7	4.8	4.9	5.1	5.1	5.2	5.4	5.6	6.1	6.2	6.7	7.2	7.6
-70 to -60	4.2	4.2	4.4	4.5	4.7	4.8	4.9	4.9	5.1	5.3	5.8	5.9	6.4	6.9	7.2

Coef. disp. form. (frac. eq.)(ref.)	
P1	1.07190484E-01
Q1	6.96573791E+01
P2	5.52725706E-02
Q2	2.22994441E-02
P3	3.41344693E-01
Q3	4.66344025E-03

Fitting error of disp. form. σ [1E-6]		
	Visible	Infrared
Power ser. eq.	0.6	3.9
Frac. eq. (ref.)	0.6	4.4

Prod. Freq. (A to D)	A

Similar glass type			
OHARA	-	HOYA	-
C.D.G.M	-	SCHOTT	-

2020-4-1	StP,AP,SP
2019-4-1	Transmittance
2015-4-1	1st edition

HIKARI GLASS CO., LTD.

Q-LASF03S

n_d = 1.806040 n_e = 1.810741

ν_d = 40.74 ν_e = 40.48

Glass code (d)
806407
Glass code (e)
811405

Spectral l.	Refractive idx
2.058	1.76735
1.970	1.76887
1.530	1.77600
1.129	1.78298
1.064	1.78435
t	1.78553
s	1.79027
A'	1.793683
r	1.796898
C	1.800166
C'	1.801090
He-Ne	1.801957
D	1.805866
d	1.806040
e	1.810741
F	1.819952
F'	1.821116
g	1.831210
h	1.840809
0.389	1.846783
i	1.857743

Coef. disp. form. (pwr ser.)	
A0	3.16995830E+00
A1	-1.21536830E-02
A2	-1.27440597E-04
A3	3.09253962E-02
A4	7.33513997E-04
A5	6.01908390E-06
A6	2.17380961E-06
A7	0.00000000E+00
A8	0.00000000E+00

Partial dispersion	
F-C	0.019786
F'-C'	0.020026
C-t	0.014639
C-A'	0.006483
d-C	0.005874
e-C	0.010575
g-d	0.025170
g-F	0.011258
h-g	0.009599
i-g	0.026533
C'-t	0.015563
e-C'	0.009651
F'-e	0.010375
i-F'	0.036627

Relative partial dispersion	
C-t／F-C	0.7399
C-A'／F-C	0.3277
d-C／F-C	0.2969
e-C／F-C	0.5345
g-d／F-C	1.2721
g-F／F-C	0.5690
h-g／F-C	0.4851
i-g／F-C	1.3410
C'-t／F'-C'	0.7771
e-C'／F'-C'	0.4819
F'-e／F'-C'	0.5181
i-F'／F'-C'	1.8290

Deviation of relative partial disp.	
ΔPdC	0.0013
ΔPgF	-0.0070

Internal CC (80%/5%)
360/322
Color Code (80%/5%)
390/320
CCI

B	-
G	-
R	-

Thermal properties	
CTE(-30,70) [1E-7/℃]	52
CTE(100,300) [1E-7/℃]	72
Tg [℃]	568
At [℃]	603
StP [℃]	524
AP [℃]	555
SP [℃]	670
Ht cndct. [W/m･K]	0.706
Sp. heat [kJ/kg･K]	0.430
Ht diffus. [1E-6 m2/sec]	0.370

Chemical properties [class]	
Acid res. (surface)	4
Alkaline detergent res.	3
Climate resistance	1
Water res. (powder)	1
Acid res. (powder)	3

Mechanical properties	
Knoop hardness	623 (6)
Abrasion hardness	77
Young's mod. [GPa]	109.4
Shear mod. [GPa]	41.8
Poisson's ratio	0.310
Stress optical coef. [1E-5 nm/cm／Pa]	2.55

Internal trans. (10mm)	
λ [nm]	τ
280	-
290	-
300	-
310	-
320	0.03
330	0.24
340	0.50
350	0.69
360	0.80
370	0.88
380	0.922
390	0.947
400	0.963
420	0.977
440	0.983
460	0.987
480	0.989
500	0.992
550	0.994
600	0.993
650	0.993
700	0.993
800	0.994
900	0.994
1000	0.995
1200	0.996
1400	0.995
1600	0.993
1800	0.986
2000	0.973
2200	0.942
2400	0.80

Specific gravity
4.48

Relative Δn/ΔT [1E-6/℃]															
Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90(ref.)	9.1	9.2	9.4	9.8	10.0	10.3	10.4	10.5	10.9	11.3	12.2	12.4	13.5	14.7	15.4
60 to 80(ref.)	8.9	9.0	9.3	9.5	9.8	10.1	10.2	10.3	10.6	11.1	12.0	12.1	13.2	14.3	15.0
40 to 60	8.7	8.8	9.0	9.3	9.6	9.8	9.9	10.0	10.3	10.7	11.6	11.7	12.8	13.9	14.5
20 to 40	8.5	8.6	8.8	9.1	9.3	9.6	9.7	9.7	10.1	10.5	11.3	11.4	12.5	13.5	14.1
0 to 20	8.4	8.4	8.6	8.9	9.1	9.4	9.5	9.5	9.9	10.2	11.0	11.1	12.1	13.1	13.7
-20 to 0	8.3	8.3	8.5	8.8	9.0	9.2	9.3	9.4	9.7	10.1	10.8	10.9	11.9	12.8	13.3
-40 to -20	8.2	8.3	8.5	8.7	8.9	9.2	9.2	9.3	9.6	10.0	10.7	10.8	11.7	12.6	13.1
-60 to -40(ref.)	8.3	8.3	8.5	8.8	9.0	9.2	9.3	9.3	9.6	10.0	10.7	10.8	11.6	12.5	12.9
-70 to -60(ref.)	8.4	8.5	8.7	8.9	9.1	9.3	9.4	9.4	9.7	10.0	10.7	10.8	11.6	12.5	12.9

Absolute Δn/ΔT [1E-6/℃]															
Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90	8.0	8.1	8.4	8.6	8.9	9.2	9.3	9.4	9.7	10.2	11.1	11.2	12.4	13.5	14.2
60 to 80	7.7	7.8	8.1	8.3	8.6	8.9	9.0	9.0	9.4	9.8	10.7	10.8	11.9	13.0	13.7
40 to 60	7.4	7.4	7.7	7.9	8.2	8.5	8.5	8.6	8.9	9.4	10.2	10.3	11.4	12.4	13.1
20～40	7.0	7.0	7.3	7.5	7.8	8.0	8.1	8.2	8.5	8.9	9.7	9.8	10.8	11.8	12.4
0 to 20	6.6	6.6	6.9	7.1	7.3	7.6	7.7	7.7	8.0	8.4	9.2	9.3	10.3	11.2	11.8
-20 to 0	6.2	6.3	6.5	6.7	6.9	7.2	7.2	7.3	7.6	8.0	8.7	8.8	9.7	10.6	11.2
-40 to -20	5.8	5.9	6.1	6.3	6.5	6.7	6.8	6.9	7.1	7.5	8.2	8.3	9.2	10.0	10.5
-60 to -40	5.5	5.5	5.7	5.9	6.1	6.3	6.4	6.4	6.7	7.0	7.7	7.8	8.6	9.4	9.9
-70 to -60	5.2	5.2	5.4	5.6	5.8	6.0	6.0	6.1	6.4	6.7	7.3	7.4	8.2	9.0	9.4

Coef. disp. form. (frac. eq.)(ref.)	
P1	1.06685910E-01
Q1	7.84959792E+01
P2	2.55453961E-02
Q2	3.84971138E-02
P3	3.94179537E-01
Q3	6.35402469E-03

Fitting error of disp. form. σ [1E-6]		
	Visible	Infrared
Power ser. eq.	0.7	6.3
Frac. eq. (ref.)	0.6	6.7

Prod. Freq. (A to D)	A

Similar glass type			
OHARA	-	HOYA	-
C.D.G.M	-	SCHOTT	-

2020-4-1	StP,AP,SP
2019-4-1	Transmittance
2018-9-1	CTE(-30,70)

Q-LASFH11S

n_d = 1.773870 n_e = 1.777769

ν_d = 47.25 ν_e = 47.01

Glass code (d)
774473
Glass code (e)
778470

Spectral l.	Refractive idx
2.058	1.73794
1.970	1.73956
1.530	1.74703
1.129	1.75387
1.064	1.75515
t	1.75623
s	1.76047
A'	1.763430
r	1.766181
C	1.768949
C'	1.769728
He-Ne	1.770456
D	1.773725
d	1.773870
e	1.777769
F	1.785326
F'	1.786274
g	1.794427
h	1.802070
0.389	1.806771
i	–

Partial dispersion	
F-C	0.016377
F'-C'	0.016546
C-t	0.012720
C-A'	0.005519
d-C	0.004921
e-C	0.008820
g-d	0.020557
g-F	0.009101
h-g	0.007643
i-g	–
C'-t	0.013499
e-C'	0.008041
F'-e	0.008505
i-F'	–

Relative partial dispersion	
C-t／F-C	0.7767
C-A'／F-C	0.3370
d-C／F-C	0.3005
e-C／F-C	0.5386
g-d／F-C	1.2552
g-F／F-C	0.5557
h-g／F-C	0.4667
i-g／F-C	–
C'-t／F'-C'	0.8158
e-C'／F'-C'	0.4860
F'-e／F'-C'	0.5140
i-F'／F'-C'	–

Deviation of relative partial disp.	
ΔPdC	0.0020
ΔPgF	-0.0094

Internal CC (80%/5%)
339/273
Color Code (80%/5%)
365/275
CCI

B	0.00
G	0.27
R	0.26

Thermal properties	
CTE(-30,70) [1E-7/℃]	60
CTE(100,300) [1E-7/℃]	75
Tg [℃]	566
At [℃]	610
StP [℃]	523
AP [℃]	554
SP [℃]	667
Ht cndct. [W/m･K]	0.917
Sp. heat [kJ/kg･K]	0.542
Ht diffus. [1E-6 m2/sec]	0.365

Chemical properties [class]	
Acid res. (surface)	4
Alkaline detergent res.	2
Climate resistance	1
Water res. (powder)	1
Acid res. (powder)	3

Mechanical properties	
Knoop hardness	668 (7)
Abrasion hardness	69
Young's mod. [GPa]	107.2
Shear mod. [GPa]	41.2
Poisson's ratio	0.302
Stress optical coef. [1E-5 nm/cm／Pa]	2.19

Internal trans. (10mm)	
λ [nm]	τ
280	0.11
290	0.22
300	0.32
310	0.38
320	0.56
330	0.71
340	0.80
350	0.87
360	0.924
370	0.954
380	0.972
390	0.982
400	0.987
420	0.992
440	0.995
460	0.996
480	0.998
500	0.998
550	0.999
600	0.999
650	0.999
700	0.998
800	0.997
900	0.996
1000	0.996
1200	0.997
1400	0.997
1600	0.992
1800	0.981
2000	0.963
2200	0.918
2400	0.72

Specific gravity
4.64

Coef. disp. form. (pwr ser.)	
A0	3.07264726E+00
A1	-1.31831327E-02
A2	-1.35807482E-04
A3	2.56144151E-02
A4	4.99234278E-04
A5	4.16805552E-06
A6	7.01662918E-07
A7	0.00000000E+00
A8	0.00000000E+00

Relative Δn/ΔT [1E-6/℃]															
Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90(ref.)	6.8	6.9	7.1	7.3	7.5	7.7	7.8	7.9	8.1	8.5	9.2	9.2	10.1	10.9	11.4
60 to 80(ref.)	6.6	6.7	7.0	7.2	7.4	7.6	7.6	7.7	8.0	8.3	8.9	9.0	9.8	10.6	11.1
40 to 60	6.5	6.6	6.8	7.0	7.2	7.4	7.4	7.5	7.7	8.1	8.7	8.8	9.5	10.3	10.7
20 to 40	6.4	6.4	6.7	6.8	7.0	7.2	7.3	7.3	7.6	7.9	8.5	8.5	9.3	9.9	10.4
0 to 20	6.3	6.3	6.6	6.7	6.9	7.1	7.1	7.2	7.4	7.7	8.3	8.3	9.0	9.7	10.1
-20 to 0	6.2	6.3	6.5	6.7	6.8	7.0	7.1	7.1	7.3	7.6	8.1	8.2	8.9	9.5	9.8
-40 to -20	6.3	6.3	6.5	6.7	6.9	7.0	7.1	7.1	7.3	7.6	8.1	8.2	8.8	9.3	9.7
-60 to -40(ref.)	6.4	6.5	6.7	6.8	7.0	7.1	7.2	7.2	7.4	7.6	8.1	8.2	8.8	9.3	9.6
-70 to -60(ref.)	6.6	6.6	6.8	7.0	7.1	7.3	7.3	7.4	7.6	7.8	8.3	8.3	8.9	9.4	9.7

Absolute Δn/ΔT [1E-6/℃]															
Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90	5.7	5.8	6.0	6.2	6.4	6.6	6.7	6.8	7.0	7.4	8.0	8.1	8.9	9.7	10.2
60 to 80	5.5	5.5	5.8	6.0	6.2	6.4	6.4	6.5	6.8	7.1	7.7	7.8	8.6	9.4	9.8
40 to 60	5.2	5.2	5.5	5.6	5.8	6.0	6.1	6.1	6.4	6.7	7.3	7.4	8.1	8.8	9.3
20～40	4.8	4.9	5.1	5.3	5.5	5.7	5.7	5.8	6.0	6.3	6.9	7.0	7.7	8.3	8.8
0 to 20	4.5	4.6	4.8	5.0	5.1	5.3	5.4	5.4	5.6	5.9	6.5	6.5	7.2	7.8	8.2
-20 to 0	4.2	4.3	4.5	4.6	4.8	5.0	5.0	5.1	5.3	5.5	6.1	6.1	6.7	7.3	7.7
-40 to -20	3.9	4.0	4.2	4.3	4.5	4.6	4.7	4.7	4.9	5.2	5.6	5.7	6.3	6.8	7.2
-60 to -40	3.6	3.7	3.8	4.0	4.1	4.3	4.3	4.4	4.5	4.8	5.2	5.3	5.8	6.3	6.6
-70 to -60	3.4	3.4	3.6	3.7	3.9	4.0	4.0	4.1	4.3	4.5	4.9	5.0	5.5	6.0	6.2

Coef. disp. form. (frac. eq.)(ref.)	
P1	1.19883894E-01
Q1	7.82325824E+01
P2	5.95526753E-02
Q2	2.28375819E-02
P3	3.49042354E-01
Q3	4.69309032E-03

Fitting error of disp. form. σ [1E-6]		
	Visible	Infrared
Power ser. eq.	0.6	5.9
Frac. eq. (ref.)	0.6	6.7

Prod. Freq. (A to D)	A

Similar glass type			
OHARA	–	HOYA	–
C.D.G.M	–	SCHOTT	–

2020-4-1	StP,AP,SP
2019-4-1	Transmittance
2018-4-1	Prod. Freq

HIKARI GLASS CO., LTD.

Q-LASFH12S

n_d = 1.790630 n_e = 1.794812

ν_d = 44.98 ν_e = 44.74

Glass code (d)
791450
Glass code (e)
795447

Spectral l.	Refractive idx
2.058	1.75381
1.970	1.75536
1.530	1.76263
1.129	1.76952
1.064	1.77084
t	1.77195
s	1.77638
A'	1.779505
r	1.782423
C	1.785370
C'	1.786201
He-Ne	1.786978
D	1.790475
d	1.790630
e	1.794812
F	1.802946
F'	1.803968
g	1.812782
h	1.821078
0.389	1.826196
i	–

Partial dispersion	
F-C	0.017576
F'-C'	0.017767
C-t	0.013416
C-A'	0.005865
d-C	0.005260
e-C	0.009442
g-d	0.022152
g-F	0.009836
h-g	0.008296
i-g	–
C'-t	0.014247
e-C'	0.008611
F'-e	0.009156
i-F'	–

Relative partial dispersion	
C-t／F-C	0.7633
C-A'／F-C	0.3337
d-C／F-C	0.2993
e-C／F-C	0.5372
g-d／F-C	1.2604
g-F／F-C	0.5596
h-g／F-C	0.4720
i-g／F-C	–
C'-t／F'-C'	0.8019
e-C'／F'-C'	0.4847
F'-e／F'-C'	0.5153
i-F'／F'-C'	–

Deviation of relative partial disp.	
ΔPdC	0.0018
ΔPgF	-0.0093

Internal CC (80%/5%)
348/303
Color Code (80%/5%)
380/305
CCI

B	0.00
G	0.49
R	0.51

Thermal properties	
CTE(-30,70) [1E-7/℃]	58
CTE(100,300) [1E-7/℃]	76
Tg [℃]	560
At [℃]	608
StP [℃]	519
AP [℃]	550
SP [℃]	666
Ht cndct. [W/m･K]	0.898
Sp. heat [kJ/kg･K]	0.517
Ht diffus. [1E-6 m2/sec]	0.371

Chemical properties [class]	
Acid res. (surface)	4
Alkaline detergent res.	1
Climate resistance	1
Water res. (powder)	1
Acid res. (powder)	3

Mechanical properties	
Knoop hardness	621 (6)
Abrasion hardness	72
Young's mod. [GPa]	119.6
Shear mod. [GPa]	46.0
Poisson's ratio	0.299
Stress optical coef. [1E-5 nm/cm／Pa]	2.20

Internal trans. (10mm)	
λ [nm]	τ
280	–
290	–
300	0.03
310	0.14
320	0.36
330	0.57
340	0.71
350	0.81
360	0.88
370	0.928
380	0.954
390	0.969
400	0.977
420	0.985
440	0.989
460	0.992
480	0.995
500	0.996
550	0.998
600	0.998
650	0.998
700	0.998
800	0.997
900	0.997
1000	0.997
1200	0.998
1400	0.998
1600	0.994
1800	0.985
2000	0.968
2200	0.935
2400	0.77

Specific gravity
4.68

Coef. disp. form. (pwr ser.)	
A0	3.12617289E+00
A1	-1.31750117E-02
A2	-5.65591169E-05
A3	2.74060420E-02
A4	6.35024687E-04
A5	-3.03984369E-06
A6	1.40200840E-06
A7	0.00000000E+00
A8	0.00000000E+00

Relative Δn/ΔT [1E-6/℃]															
Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90(ref.)	6.6	6.7	6.9	7.2	7.4	7.7	7.7	7.8	8.1	8.4	9.2	9.3	10.1	11.0	11.6
60 to 80(ref.)	6.5	6.5	6.9	7.1	7.3	7.5	7.6	7.6	7.9	8.3	9.0	9.1	9.9	10.7	11.3
40 to 60	6.3	6.4	6.7	6.9	7.1	7.3	7.4	7.4	7.7	8.0	8.7	8.8	9.6	10.4	10.9
20 to 40	6.2	6.3	6.5	6.7	6.9	7.1	7.2	7.3	7.5	7.8	8.5	8.6	9.3	10.1	10.6
0 to 20	6.1	6.2	6.4	6.6	6.8	7.0	7.1	7.1	7.4	7.7	8.3	8.4	9.1	9.9	10.3
-20 to 0	6.0	6.1	6.4	6.6	6.8	6.9	7.0	7.1	7.3	7.6	8.2	8.3	9.0	9.7	10.1
-40 to -20	6.1	6.2	6.4	6.6	6.8	7.0	7.0	7.1	7.3	7.6	8.1	8.2	8.9	9.5	10.0
-60 to -40(ref.)	6.2	6.3	6.5	6.7	6.9	7.1	7.1	7.2	7.4	7.7	8.2	8.3	8.9	9.5	10.0
-70 to -60(ref.)	6.4	6.5	6.7	6.9	7.0	7.2	7.3	7.3	7.5	7.8	8.3	8.4	9.0	9.6	10.0

Absolute Δn/ΔT [1E-6/℃]															
Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90	5.5	5.6	5.9	6.1	6.3	6.6	6.6	6.7	7.0	7.3	8.0	8.1	9.0	9.8	10.4
60 to 80	5.3	5.4	5.6	5.9	6.1	6.3	6.4	6.4	6.7	7.0	7.7	7.8	8.6	9.5	10.0
40 to 60	5.0	5.0	5.3	5.5	5.7	5.9	6.0	6.1	6.3	6.7	7.3	7.4	8.2	9.0	9.5
20～40	4.6	4.7	5.0	5.2	5.4	5.6	5.6	5.7	6.0	6.3	6.9	7.0	7.7	8.5	9.0
0 to 20	4.3	4.4	4.7	4.9	5.0	5.2	5.3	5.3	5.6	5.9	6.5	6.6	7.3	8.0	8.5
-20 to 0	4.0	4.1	4.3	4.5	4.7	4.9	4.9	5.0	5.2	5.5	6.1	6.2	6.8	7.5	8.0
-40 to -20	3.7	3.8	4.0	4.2	4.4	4.5	4.6	4.6	4.9	5.1	5.7	5.7	6.4	7.0	7.4
-60 to -40	3.4	3.5	3.7	3.9	4.0	4.2	4.2	4.3	4.5	4.7	5.3	5.3	5.9	6.5	6.9
-70 to -60	3.1	3.2	3.4	3.6	3.8	3.9	4.0	4.0	4.2	4.5	4.9	5.0	5.6	6.2	6.5

Coef. disp. form. (frac. eq.)(ref.)	
P1	1.75366360E-01
Q1	1.18044579E+02
P2	5.61572070E-02
Q2	2.51310454E-02
P3	3.58585847E-01
Q3	4.88199048E-03

Fitting error of disp. form. σ [1E-6]		
	Visible	Infrared
Power ser. eq.	0.7	6.8
Frac. eq. (ref.)	0.8	10.7

Prod. Freq. (A to D)	B

Similar glass type			
OHARA	–	HOYA	–
C.D.G.M	–	SCHOTT	–

2020-4-1	StP,AP,SP
2019-4-1	Transmittance
2018-4-1	Prod. Freq

HIKARI GLASS CO., LTD.

Q-LASFH58S

n_d = 1.851080 n_e = 1.856120

ν_d = 40.12 ν_e = 39.88

Glass code (d)
851401
Glass code (e)
856399

Spectral l.	Refractive idx
2.058	1.80962
1.970	1.81124
1.530	1.81888
1.129	1.82635
1.064	1.82783
t	1.82909
s	1.83417
A'	1.837830
r	1.841276
C	1.844781
C'	1.845773
He-Ne	1.846702
D	1.850893
d	1.851080
e	1.856120
F	1.865992
F'	1.867240
g	1.878051
h	1.888325
0.389	1.894715
i	1.906431

Partial dispersion	
F-C	0.021211
F'-C'	0.021467
C-t	0.015694
C-A'	0.006951
d-C	0.006299
e-C	0.011339
g-d	0.026971
g-F	0.012059
h-g	0.010274
i-g	0.028380
C'-t	0.016686
e-C'	0.010347
F'-e	0.011120
i-F'	0.039191

Relative partial dispersion	
C-t／F-C	0.7399
C-A'／F-C	0.3277
d-C／F-C	0.2970
e-C／F-C	0.5346
g-d／F-C	1.2716
g-F／F-C	0.5685
h-g／F-C	0.4844
i-g／F-C	1.3380
C'-t／F'-C'	0.7773
e-C'／F'-C'	0.4820
F'-e／F'-C'	0.5180
i-F'／F'-C'	1.8256

Deviation of relative partial disp.	
ΔPdC	0.0017
ΔPgF	-0.0085

Internal CC (80%/5%)
368/328
Color Code (70%/5%)
375/330

CCI	
B	0.00
G	1.07
R	1.11

Thermal properties	
CTE(-30,70) [1E-7/℃]	61
CTE(100,300) [1E-7/℃]	76
Tg [℃]	589
At [℃]	631
StP [℃]	548
AP [℃]	579
SP [℃]	695
Ht cndct. [W/m･K]	0.846
Sp. heat [kJ/kg･K]	0.444
Ht diffus. [1E-6 m2/sec]	0.379

Chemical properties [class]	
Acid res. (surface)	4
Alkaline detergent res.	1
Climate resistance	1
Water res. (powder)	1
Acid res. (powder)	2

Mechanical properties	
Knoop hardness	611 (6)
Abrasion hardness	63
Young's mod. [GPa]	122.2
Shear mod. [GPa]	47.0
Poisson's ratio	0.301
Stress optical coef. [1E-5 nm/cm／Pa]	1.95

Internal trans. (10mm)	
λ [nm]	τ
280	-
290	-
300	-
310	-
320	-
330	0.07
340	0.26
350	0.51
360	0.70
370	0.82
380	0.89
390	0.930
400	0.949
420	0.970
440	0.980
460	0.985
480	0.990
500	0.994
550	0.997
600	0.998
650	0.998
700	0.998
800	0.999
900	0.999
1000	0.999
1200	0.999
1400	0.999
1600	0.997
1800	0.991
2000	0.976
2200	0.940
2400	0.79

Specific gravity
5.03

Coef. disp. form. (pwr ser.)	
A0	3.32552726E+00
A1	-1.32706113E-02
A2	-1.49120991E-04
A3	3.39899628E-02
A4	8.11209445E-04
A5	5.79662969E-06
A6	2.35145894E-06
A7	0.00000000E+00
A8	0.00000000E+00

Relative Δn/ΔT [1E-6/℃]															
Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90(ref.)	5.7	5.8	6.0	6.3	6.6	6.8	6.9	7.0	7.4	7.8	8.7	8.8	9.9	11.0	11.7
60 to 80(ref.)	5.6	5.7	6.0	6.2	6.4	6.7	6.7	6.8	7.2	7.6	8.5	8.6	9.6	10.7	11.4
40 to 60	5.4	5.5	5.8	6.0	6.2	6.5	6.5	6.6	6.9	7.3	8.2	8.3	9.3	10.3	11.0
20 to 40	5.3	5.4	5.6	5.8	6.1	6.3	6.4	6.4	6.7	7.1	7.9	8.1	9.0	9.9	10.6
0 to 20	5.2	5.3	5.5	5.7	5.9	6.2	6.2	6.3	6.6	7.0	7.7	7.8	8.7	9.6	10.2
-20 to 0	5.2	5.2	5.5	5.7	5.9	6.1	6.2	6.2	6.5	6.9	7.6	7.7	8.5	9.4	9.9
-40 to -20	5.2	5.3	5.5	5.7	5.9	6.1	6.2	6.2	6.5	6.8	7.5	7.6	8.4	9.2	9.7
-60 to -40(ref.)	5.3	5.4	5.6	5.8	6.0	6.2	6.3	6.3	6.6	6.9	7.6	7.7	8.4	9.2	9.7
-70 to -60(ref.)	5.5	5.6	5.8	6.0	6.2	6.4	6.4	6.5	6.7	7.1	7.7	7.8	8.5	9.2	9.7

Absolute Δn/ΔT [1E-6/℃]															
Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90	4.6	4.7	5.0	5.2	5.4	5.7	5.8	5.8	6.2	6.6	7.5	7.6	8.7	9.8	10.5
60 to 80	4.3	4.4	4.7	4.9	5.2	5.4	5.5	5.6	5.9	6.3	7.2	7.3	8.3	9.4	10.1
40 to 60	4.0	4.1	4.4	4.6	4.8	5.1	5.1	5.2	5.5	5.9	6.8	6.9	7.8	8.8	9.5
20～40	3.7	3.8	4.0	4.2	4.5	4.7	4.8	4.8	5.1	5.5	6.3	6.4	7.3	8.3	8.9
0 to 20	3.4	3.5	3.7	3.9	4.1	4.3	4.4	4.5	4.8	5.1	5.9	6.0	6.8	7.7	8.3
-20 to 0	3.1	3.1	3.4	3.6	3.7	4.0	4.0	4.1	4.4	4.7	5.4	5.5	6.3	7.2	7.7
-40 to -20	2.7	2.8	3.0	3.2	3.4	3.6	3.7	3.7	4.0	4.3	5.0	5.1	5.8	6.6	7.1
-60 to -40	2.4	2.5	2.7	2.9	3.0	3.2	3.3	3.3	3.6	3.9	4.5	4.6	5.4	6.1	6.5
-70 to -60	2.2	2.3	2.5	2.6	2.8	3.0	3.0	3.1	3.3	3.6	4.2	4.3	5.0	5.7	6.1

Coef. disp. form. (frac. eq.)(ref.)	
P1	1.02240636E-01
Q1	7.31619862E+01
P2	2.59099510E-02
Q2	3.79977305E-02
P3	4.10764462E-01
Q3	6.40344197E-03

Fitting error of disp. form. σ [1E-6]		
	Visible	Infrared
Power ser. eq.	0.9	5.4
Frac. eq. (ref.)	0.7	6.4

Prod. Freq. (A to D)	A

Similar glass type			
OHARA	-	HOYA	-
C.D.G.M	-	SCHOTT	-

2020-4-1	StP,AP,SP
2019-4-1	Transmittance
2015-4-1	Color Code

HIKARI GLASS CO., LTD.

Q-LASFH59S

n_d = 1.820980 n_e = 1.825572

ν_d = 42.50 ν_e = 42.25

Glass code (d)
821425
Glass code (e)
826423

Spectral l.	Refractive idx
2.058	1.78242
1.970	1.78396
1.530	1.79121
1.129	1.79825
1.064	1.79962
t	1.80079
s	1.80550
A'	1.808860
r	1.812021
C	1.815228
C'	1.816134
He-Ne	1.816983
D	1.820810
d	1.820980
e	1.825572
F	1.834544
F'	1.835675
g	1.845457
h	1.854712
0.389	1.860446
i	1.870915

Partial dispersion	
F-C	0.019316
F'-C'	0.019541
C-t	0.014436
C-A'	0.006368
d-C	0.005752
e-C	0.010344
g-d	0.024477
g-F	0.010913
h-g	0.009255
i-g	0.025458
C'-t	0.015342
e-C'	0.009438
F'-e	0.010103
i-F'	0.035240

Relative partial dispersion	
C-t／F-C	0.7474
C-A'／F-C	0.3297
d-C／F-C	0.2978
e-C／F-C	0.5355
g-d／F-C	1.2672
g-F／F-C	0.5650
h-g／F-C	0.4791
i-g／F-C	1.3180
C'-t／F'-C'	0.7851
e-C'／F'-C'	0.4830
F'-e／F'-C'	0.5170
i-F'／F'-C'	1.8034

Deviation of relative partial disp.	
ΔPdC	0.0014
ΔPgF	-0.0081

Internal CC (80%/5%)
360/314
Color Code (80%/5%)
400/315
CCI

B	0.00
G	0.82
R	0.87

Thermal properties	
CTE(-30,70) [1E-7/℃]	60
CTE(100,300) [1E-7/℃]	77
Tg [℃]	596
At [℃]	640
StP [℃]	552
AP [℃]	584
SP [℃]	700
Ht cndct. [W/m･K]	0.722
Sp. heat [kJ/kg･K]	0.404
Ht diffus. [1E-6 m2/sec]	0.372

Chemical properties [class]	
Acid res. (surface)	2
Alkaline detergent res.	1
Climate resistance	1
Water res. (powder)	1
Acid res. (powder)	3

Mechanical properties	
Knoop hardness	615 (6)
Abrasion hardness	68
Young's mod. [GPa]	116.2
Shear mod. [GPa]	44.4
Poisson's ratio	0.308
Stress optical coef. [1E-5 nm/cm／Pa]	2.00

Internal trans. (10mm)	
λ [nm]	τ
280	-
290	-
300	-
310	-
320	0.13
330	0.33
340	0.53
350	0.69
360	0.80
370	0.88
380	0.920
390	0.950
400	0.961
420	0.976
440	0.983
460	0.987
480	0.992
500	0.995
550	0.997
600	0.998
650	0.998
700	0.998
800	0.997
900	0.995
1000	0.996
1200	0.997
1400	0.995
1600	0.991
1800	0.985
2000	0.973
2200	0.942
2400	0.80

Specific gravity
4.81

Coef. disp. form. (pwr ser.)	
A0	3.22581362E+00
A1	-1.28335027E-02
A2	-9.26420505E-05
A3	3.04553203E-02
A4	7.47766899E-04
A5	-1.21365984E-06
A6	1.90023535E-06
A7	0.00000000E+00
A8	0.00000000E+00

Relative Δn/ΔT [1E-6/℃]															
Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90(ref.)	6.7	6.8	7.0	7.3	7.6	7.8	7.9	7.9	8.3	8.7	9.5	9.6	10.5	11.5	12.1
60 to 80(ref.)	6.6	6.6	6.9	7.1	7.4	7.6	7.7	7.8	8.1	8.5	9.2	9.3	10.2	11.2	11.8
40 to 60	6.4	6.4	6.7	6.9	7.2	7.4	7.5	7.5	7.8	8.2	8.9	9.0	9.9	10.8	11.4
20 to 40	6.2	6.3	6.5	6.7	7.0	7.2	7.3	7.3	7.6	8.0	8.7	8.8	9.6	10.5	11.1
0 to 20	6.1	6.2	6.4	6.6	6.8	7.0	7.1	7.2	7.5	7.8	8.5	8.6	9.4	10.3	10.8
-20 to 0	6.0	6.1	6.3	6.5	6.7	6.9	7.0	7.1	7.3	7.7	8.3	8.4	9.2	10.0	10.6
-40 to -20	6.0	6.1	6.3	6.5	6.7	6.9	7.0	7.0	7.3	7.6	8.3	8.3	9.1	9.9	10.4
-60 to -40(ref.)	6.1	6.2	6.4	6.6	6.8	7.0	7.1	7.1	7.4	7.7	8.3	8.4	9.1	9.9	10.4
-70 to -60(ref.)	6.3	6.4	6.6	6.8	6.9	7.1	7.2	7.3	7.5	7.8	8.4	8.5	9.2	9.9	10.4

Absolute Δn/ΔT [1E-6/℃]															
Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90	5.6	5.7	6.0	6.2	6.4	6.7	6.8	6.8	7.1	7.5	8.3	8.4	9.3	10.3	10.9
60 to 80	5.4	5.4	5.7	5.9	6.2	6.4	6.5	6.5	6.8	7.2	8.0	8.1	9.0	9.9	10.5
40 to 60	5.0	5.1	5.3	5.6	5.8	6.0	6.1	6.1	6.4	6.8	7.5	7.6	8.5	9.4	10.0
20～40	4.7	4.7	5.0	5.2	5.4	5.6	5.7	5.7	6.0	6.4	7.1	7.2	8.0	8.9	9.4
0 to 20	4.3	4.4	4.6	4.8	5.0	5.2	5.3	5.4	5.6	6.0	6.6	6.7	7.5	8.4	8.9
-20 to 0	4.0	4.0	4.2	4.4	4.6	4.8	4.9	5.0	5.2	5.5	6.2	6.3	7.1	7.9	8.4
-40 to -20	3.6	3.7	3.9	4.1	4.3	4.5	4.5	4.6	4.8	5.1	5.8	5.8	6.6	7.3	7.8
-60 to -40	3.3	3.3	3.5	3.7	3.9	4.1	4.1	4.2	4.4	4.7	5.3	5.4	6.1	6.8	7.3
-70 to -60	3.0	3.1	3.3	3.4	3.6	3.8	3.8	3.9	4.1	4.4	5.0	5.1	5.7	6.4	6.9

Coef. disp. form. (frac. eq.)(ref.)	
P1	1.17189783E-01
Q1	8.45174088E+01
P2	3.58162927E-02
Q2	3.20065079E-02
P3	3.90078549E-01
Q3	5.73410961E-03

Fitting error of disp. form. σ [1E-6]		
	Visible	Infrared
Power ser. eq.	0.6	6.4
Frac. eq. (ref.)	0.9	7.4

Prod. Freq. (A to D)	D

Similar glass type			
OHARA	-	HOYA	-
C.D.G.M	-	SCHOTT	-

2022-7-1	Prod. Freq
2020-4-1	StP,AP,SP
2019-4-1	Transmittance

HIKARI GLASS CO., LTD.

Q-LASFPH2S

n_d = 1.765437 n_e = 1.769334

ν_d = 46.75 ν_e = 46.51

Glass code (d)
765468
Glass code (e)
769465

Spectral l.	Refractive idx
2.058	1.72940
1.970	1.73104
1.530	1.73858
1.129	1.74544
1.064	1.74672
t	1.74780
s	1.75204
A'	1.755003
r	1.757753
C	1.760519
C'	1.761297
He-Ne	1.762025
D	1.765292
d	1.765437
e	1.769334
F	1.776892
F'	1.777840
g	1.786003
h	1.793667
0.389	1.798386
i	1.806941

Partial dispersion	
F-C	0.016373
F'-C'	0.016543
C-t	0.012717
C-A'	0.005516
d-C	0.004918
e-C	0.008815
g-d	0.020566
g-F	0.009111
h-g	0.007664
i-g	0.020938
C'-t	0.013495
e-C'	0.008037
F'-e	0.008506
i-F'	0.029101

Relative partial dispersion	
C-t／F-C	0.7767
C-A'／F-C	0.3369
d-C／F-C	0.3004
e-C／F-C	0.5384
g-d／F-C	1.2561
g-F／F-C	0.5565
h-g／F-C	0.4681
i-g／F-C	1.2788
C'-t／F'-C'	0.8158
e-C'／F'-C'	0.4858
F'-e／F'-C'	0.5142
i-F'／F'-C'	1.7591

Deviation of relative partial disp.	
ΔPdC	0.0021
ΔPgF	-0.0095

Internal CC (80%/5%)
348/282
Color Code (80%/5%)
375/285
CCI

B	0.00
G	0.32
R	0.33

Thermal properties	
CTE(-30,70) [1E-7/℃]	53
CTE(100,300) [1E-7/℃]	69
Tg [℃]	572
At [℃]	608
StP [℃]	528
AP [℃]	558
SP [℃]	668
Ht cndct. [W/m･K]	0.819
Sp. heat [kJ/kg･K]	0.493
Ht diffus. [1E-6 m2/sec]	0.367

Chemical properties [class]	
Acid res. (surface)	6
Alkaline detergent res.	3
Climate resistance	1
Water res. (powder)	1
Acid res. (powder)	3

Mechanical properties	
Knoop hardness	611 (6)
Abrasion hardness	66
Young's mod. [GPa]	113.5
Shear mod. [GPa]	43.6
Poisson's ratio	0.303
Stress optical coef. [1E-5 nm/cm／Pa]	2.43

Internal trans. (10mm)	
λ [nm]	τ
280	0.04
290	0.10
300	0.20
310	0.30
320	0.47
330	0.62
340	0.74
350	0.83
360	0.89
370	0.935
380	0.960
390	0.974
400	0.982
420	0.990
440	0.993
460	0.995
480	0.996
500	0.997
550	0.998
600	0.998
650	0.998
700	0.998
800	0.998
900	0.998
1000	0.998
1200	0.998
1400	0.994
1600	0.990
1800	0.979
2000	0.958
2200	0.89
2400	0.67

Specific gravity
4.52

Coef. disp. form. (pwr ser.)	
A0	3.04304370E+00
A1	-1.30169861E-02
A2	-1.75012562E-04
A3	2.56037330E-02
A4	4.48879136E-04
A5	1.13138900E-05
A6	4.69755261E-07
A7	0.00000000E+00
A8	0.00000000E+00

Relative Δn/ΔT [1E-6/℃]															
Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90(ref.)	7.8	7.9	8.1	8.3	8.5	8.8	8.8	8.9	9.2	9.5	10.2	10.3	11.1	11.9	12.4
60 to 80(ref.)	7.6	7.7	8.0	8.1	8.3	8.5	8.6	8.7	8.9	9.3	9.9	10.0	10.8	11.6	12.1
40 to 60	7.4	7.5	7.7	7.9	8.1	8.3	8.4	8.4	8.7	9.0	9.6	9.7	10.5	11.2	11.7
20 to 40	7.2	7.3	7.5	7.7	7.9	8.1	8.1	8.2	8.4	8.7	9.4	9.4	10.2	10.9	11.3
0 to 20	7.1	7.1	7.4	7.5	7.7	7.9	7.9	8.0	8.2	8.5	9.1	9.2	9.9	10.6	11.0
-20 to 0	7.0	7.0	7.3	7.4	7.6	7.8	7.8	7.9	8.1	8.4	9.0	9.0	9.7	10.3	10.8
-40 to -20	7.0	7.0	7.2	7.4	7.5	7.7	7.8	7.8	8.0	8.3	8.8	8.9	9.5	10.2	10.6
-60 to -40(ref.)	7.0	7.1	7.3	7.4	7.6	7.8	7.8	7.8	8.1	8.3	8.8	8.9	9.5	10.1	10.5
-70 to -60(ref.)	7.2	7.2	7.4	7.6	7.7	7.9	7.9	8.0	8.2	8.4	8.9	9.0	9.6	10.1	10.5

Absolute Δn/ΔT [1E-6/℃]															
Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90	6.7	6.8	7.1	7.2	7.4	7.7	7.7	7.8	8.1	8.4	9.1	9.2	10.0	10.7	11.3
60 to 80	6.5	6.5	6.8	7.0	7.1	7.4	7.4	7.5	7.7	8.1	8.7	8.8	9.6	10.3	10.8
40 to 60	6.1	6.2	6.4	6.6	6.8	6.9	7.0	7.1	7.3	7.6	8.3	8.3	9.1	9.8	10.3
20～40	5.7	5.8	6.0	6.2	6.4	6.5	6.6	6.6	6.9	7.2	7.8	7.9	8.6	9.3	9.7
0 to 20	5.4	5.4	5.6	5.8	6.0	6.1	6.2	6.2	6.5	6.8	7.3	7.4	8.1	8.7	9.2
-20 to 0	5.0	5.0	5.2	5.4	5.6	5.7	5.8	5.8	6.1	6.3	6.9	6.9	7.6	8.2	8.6
-40 to -20	4.6	4.7	4.9	5.0	5.2	5.3	5.4	5.4	5.6	5.9	6.4	6.5	7.1	7.7	8.1
-60 to -40	4.3	4.3	4.5	4.6	4.8	4.9	5.0	5.0	5.2	5.5	6.0	6.0	6.6	7.2	7.5
-70 to -60	4.0	4.0	4.2	4.3	4.5	4.6	4.7	4.7	4.9	5.1	5.6	5.7	6.2	6.8	7.1

Coef. disp. form. (frac. eq.)(ref.)	
P1	1.07605967E-01
Q1	6.96851002E+01
P2	3.65825717E-02
Q2	2.77552514E-02
P3	3.68566643E-01
Q3	5.42179225E-03

Fitting error of disp. form. σ [1E-6]		
	Visible	Infrared
Power ser. eq.	0.6	5.9
Frac. eq. (ref.)	0.7	5.7

Prod. Freq. (A to D)	A

Similar glass type			
OHARA	-	HOYA	-
C.D.G.M	-	SCHOTT	-

2020-4-1	StP,AP,SP
2019-4-1	Transmittance
2015-4-1	1st edition

HIKARI GLASS CO., LTD.

Q-LASFPH3S

n_d = 1.795256 n_e = 1.799438

ν_d = 45.25 ν_e = 45.01

Glass code (d)
795453
Glass code (e)
799450

Spectral l.	Refractive idx
2.058	1.75803
1.970	1.75965
1.530	1.76712
1.129	1.77409
1.064	1.77541
t	1.77653
s	1.78098
A'	1.784115
r	1.787040
C	1.789992
C'	1.790824
He-Ne	1.791602
D	1.795101
d	1.795256
e	1.799438
F	1.807566
F'	1.808587
g	1.817388
h	1.825664
0.389	1.830767
i	1.840027

Partial dispersion	
F-C	0.017574
F'-C'	0.017763
C-t	0.013458
C-A'	0.005877
d-C	0.005264
e-C	0.009446
g-d	0.022132
g-F	0.009822
h-g	0.008276
i-g	0.022639
C'-t	0.014290
e-C'	0.008614
F'-e	0.009149
i-F'	0.031440

Relative partial dispersion	
C-t／F-C	0.7658
C-A'／F-C	0.3344
d-C／F-C	0.2995
e-C／F-C	0.5375
g-d／F-C	1.2594
g-F／F-C	0.5589
h-g／F-C	0.4709
i-g／F-C	1.2882
C'-t／F'-C'	0.8045
e-C'／F'-C'	0.4849
F'-e／F'-C'	0.5151
i-F'／F'-C'	1.7700

Deviation of relative partial disp.	
ΔPdC	0.0019
ΔPgF	-0.0095

Internal CC (80%/5%)
351/283
Color Code (80%/5%)
380/290
CCI

B	0.00
G	0.45
R	0.46

Thermal properties	
CTE(-30,70) [1E-7/℃]	59
CTE(100,300) [1E-7/℃]	75
Tg [℃]	586
At [℃]	628
StP [℃]	545
AP [℃]	575
SP [℃]	688
Ht cndct. [W/m･K]	0.849
Sp. heat [kJ/kg･K]	0.489
Ht diffus. [1E-6 m2/sec]	0.360

Chemical properties [class]	
Acid res. (surface)	4
Alkaline detergent res.	2
Climate resistance	1
Water res. (powder)	1
Acid res. (powder)	3

Mechanical properties	
Knoop hardness	660 (7)
Abrasion hardness	60
Young's mod. [GPa]	118.5
Shear mod. [GPa]	45.5
Poisson's ratio	0.303
Stress optical coef. [1E-5 nm/cm／Pa]	2.20

Internal trans. (10mm)	
λ [nm]	τ
280	-
290	0.06
300	0.13
310	0.22
320	0.39
330	0.56
340	0.69
350	0.79
360	0.87
370	0.920
380	0.949
390	0.966
400	0.977
420	0.986
440	0.990
460	0.993
480	0.995
500	0.997
550	0.998
600	0.998
650	0.998
700	0.998
800	0.995
900	0.992
1000	0.994
1200	0.999
1400	0.994
1600	0.991
1800	0.980
2000	0.964
2200	0.920
2400	0.73

Specific gravity
4.83

Coef. disp. form. (pwr ser.)	
A0	3.14195165E+00
A1	-1.29889243E-02
A2	-1.59736617E-04
A3	2.79148154E-02
A4	5.09887221E-04
A5	1.32658761E-05
A6	5.14839040E-07
A7	0.00000000E+00
A8	0.00000000E+00

Relative Δn/ΔT [1E-6/℃]															
Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90(ref.)	6.9	7.0	7.2	7.5	7.7	7.9	8.0	8.0	8.3	8.6	9.3	9.4	10.2	-	-
60 to 80(ref.)	6.8	6.9	7.1	7.3	7.5	7.7	7.8	7.8	8.1	8.4	9.1	9.2	10.0	-	-
40 to 60	6.6	6.7	6.9	7.1	7.3	7.5	7.6	7.6	7.9	8.2	8.8	8.9	9.7	-	-
20 to 40	6.4	6.5	6.7	6.9	7.1	7.3	7.4	7.4	7.7	8.0	8.6	8.7	9.5	-	-
0 to 20	6.3	6.4	6.6	6.8	7.0	7.2	7.2	7.3	7.5	7.8	8.4	8.5	9.3	-	-
-20 to 0	6.2	6.3	6.5	6.7	6.9	7.1	7.1	7.2	7.4	7.7	8.3	8.4	9.1	-	-
-40 to -20	6.2	6.3	6.5	6.7	6.9	7.1	7.1	7.2	7.4	7.7	8.3	8.4	9.1	-	-
-60 to -40(ref.)	6.3	6.4	6.6	6.8	7.0	7.2	7.2	7.3	7.5	7.8	8.3	8.4	9.1	-	-
-70 to -60(ref.)	6.5	6.6	6.8	7.0	7.1	7.3	7.4	7.4	7.6	7.9	8.5	8.5	9.2	-	-

Absolute Δn/ΔT [1E-6/℃]															
Temp. [℃]	1.083	t	s	A'	r	C	C'	He-Ne	d	e	F	F'	g	h	0.389
80 to 90	5.8	5.9	6.2	6.4	6.6	6.8	6.8	6.9	7.2	7.5	8.1	8.2	9.0	-	-
60 to 80	5.6	5.7	5.9	6.1	6.3	6.5	6.6	6.6	6.9	7.2	7.8	7.9	8.7	-	-
40 to 60	5.2	5.3	5.6	5.8	5.9	6.1	6.2	6.2	6.5	6.8	7.4	7.5	8.3	-	-
20～40	4.9	5.0	5.2	5.4	5.6	5.8	5.8	5.9	6.1	6.4	7.0	7.1	7.8	-	-
0 to 20	4.5	4.6	4.9	5.0	5.2	5.4	5.4	5.5	5.7	6.0	6.6	6.7	7.4	-	-
-20 to 0	4.2	4.3	4.5	4.7	4.8	5.0	5.1	5.1	5.4	5.6	6.2	6.3	7.0	-	-
-40 to -20	3.9	3.9	4.1	4.3	4.5	4.7	4.7	4.7	5.0	5.2	5.8	5.9	6.6	-	-
-60 to -40	3.5	3.6	3.8	4.0	4.1	4.3	4.3	4.4	4.6	4.9	5.4	5.5	6.1	-	-
-70 to -60	3.2	3.3	3.5	3.7	3.8	4.0	4.1	4.1	4.3	4.6	5.1	5.2	5.8	-	-

Coef. disp. form. (frac. eq.)(ref.)	
P1	1.13060928E-01
Q1	7.62209754E+01
P2	4.52648971E-02
Q2	2.65887976E-02
P3	3.71328872E-01
Q3	5.26870734E-03

Fitting error of disp. form. σ [1E-6]		
	Visible	Infrared
Power ser. eq.	0.7	11.1
Frac. eq. (ref.)	0.8	11.0

Prod. Freq. (A to D)	A

Similar glass type			
OHARA	-	HOYA	-
C.D.G.M	-	SCHOTT	-

2020-4-1	StP,AP,SP
2019-4-1	Transmittance
2015-4-1	1st edition

HIKARI GLASS CO., LTD.