NOW, COLOR DIAGRAMS
of Glasses & Optical Liquids
n_D, V_D

Research Quality is our Standard

Cargille

SPECIALTY OPTICAL LIQUIDS

CARGILLE LABORATORIES, 55 COMMERCE RD., CEDAR GROVE, N.J. 07009, U.S.A. 973-239-6633

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Cargille Specialty Optical Liquids Index

SPECIALTY OPTICAL LIQUIDS

CARGILLE SPECIALTY OPTICAL LIQUIDS INDEX

■ **Optical Data Available and Custom Changes**

☐ In addition to the "typical" optical data provided at no charge in the Technical Bulletins for each product, specific data printouts are available on most liquids. Custom physical characterization changes or formula modifications to attain specific mechanical or optical properties can be ordered.

■ **Refractive Index Liquids**

☐ Standard Series consists of 222 liquids divided into seven different series extending in range from 1.300 to 2.11.

☐ Certified Series (AA, A, B) cover the range of most minerals, most chemicals and practically all biological materials.

☐ High Dispersion Series consists of 64 liquids (3 series) with a range of 1.500 to 1.800. Use for dispersion staining, focal masking and double refractometry.

☐ Refractive Index Melts, 2.12 to 2.31: Low melting solids.

■ **Immersion Liquids**

☐ Formulations similar to Refractive Index Liquids but less expensive (characterized at only one wavelength). Intended for detection of striae in optical solids (prisms, etc.) by immersion in specific n_D liquids. Custom blended to desired indices between 1.293-1.700 at desired temperature and wavelength and for special chemical and physical properties.

■ **Laser Liquids™**

☐ High stability, low toxicity, custom blended optical liquids for use with laser and other wavelengths.

■ **Fused Silica Matching Liquids**

☐ Colorless optical couplants designed for exact matching with fused silica for liquid prisms, optical and laser systems. Full optical characterization data available.

■ **Optical Gel**

☐ High temperature/high transmittance stable gel, eliminates or reduces internal reflections in fiber optic systems and can be used for optical fiber mode stripping.

■ **Meltmounts™**

☐ Patented thermoplastic mounting media for temporary or permanent optical interface (rigid, without the containment required with liquids) with specific n . Melts /remelts at 65°C. Cleans off easily with xylene.

■ **Diagrams of Cargille Optical Liquids**

☐ Presented in the same form as optical glass diagrams, Cargille Optical Liquids are plotted for refractive index versus dispersion.

☐ **Note**

☐ Unless otherwise noted, all Refractive index values are stated at 5893 Å (n_D) and 25°C.

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SPECIALTY OPTICAL LIQUIDS

OPTICAL DATA AVAILABLE and CUSTOM CHANGES

CARGILLE LIQUIDS TYPICAL CHARACTERISTICS COMPUTER PRINTOUTS

In addition to the "typical" optical data provided at no charge in the Technical Bulletins for each product, specific data printouts are available for many of the physical and optical characteristics of the laser liquids and most of the Immersion and Refractive Index Liquids. These printouts can be for any refractive index, at any wavelength, and any temperature within the limits of the particular liquid. It is important that the user of these printouts understands what they are and are not.

The computer printouts represent average or TYPICAL values. Specific optical values of any particular batch of Cargille liquid can be obtained when requested at the time of purchase. See prices for applicable charges.

CUSTOM CHANGES

Custom changes are available at additional charge.

Custom changes from the standard values supplied with a Cargille liquid may be one or more of the following:

1. PHYSICAL CHARACTERIZATION

A. WAVELENGTH:	Read at other than 5893 A and/or dispersion coefficients. Range is 4358 to 11000 A
B. TEMPERATURE:	Refractive index or dispersion coefficient read at other than 25°C. Range is 15°C to 40°C
C. TOLERANCE:	Read at other than ±0.0005, or for Laser Liquids ±0.0002. Range is ±.0002 to ±.00005

2. CUSTOM FORMULATIONS

A. SPECIAL PROPERTIES:	Dispersion, Viscosity, Color, Density, Stability and Transmission Combinations.
B. DEVELOPMENT TIME:	Time dedicated to developing special properties or information.

CARGILLE LIQUIDS

TYPICAL CHARACTERISTICS COMPUTER PRINTOUTS

Cargille "Typical Characteristics" are computer generated from the best available measurements, estimates, and calculations. Typical Characteristics are not product specifications but represent average or TYPICAL values for a liquid of a specified formulation and refractive index. If any of the typical values need to be more precisely known, the user is urged to have further testing done.

NOTE: 1) The term "actual liquid" in this bulletin refers to a liquid as purchased with specified refractive index and formulation whose physical and optical values are then compared to those in the Typical Characteristics sheet of the same refractive index and formulation.

2) Each category of information in this bulletin might not be available on the Typical Characteristics sheet for the Code or Series in which you are interested. Such information may be available by phone.

CODES AND SERIES: These and the refractive index of a liquid specify the liquid's formulation.

REFRACTIVE INDEX VALUES: The maximum difference between the refractive index values on a Typical Characteristics sheet (or those calculated from the Cauchy equation on the same sheet) and the refractive index values of an actual liquid can be expected to be as follows:

Wavelength			Maximum variation between Typical Characteristics and Actual Liquid	
Ultraviolet (angstroms)				
2400	to	2900	±0.05	+ tolerance of calibration
2900	to	3370	±0.02	+ tolerance of calibration
3370	to	3650	±0.005	+ tolerance of calibration
3650	to	4047	±0.001	+ tolerance of calibration
Visible (angstroms)				
4047	to	4800	±0.0006	+ tolerance of calibration
4800	to	7065	±0.0003	+ tolerance of calibration
7065	to	8521	±0.0007	+ tolerance of calibration
Infrared (microns)				
0.8521	to	1.1	±0.001	+ tolerance of calibration
1.1	to	1.5	±0.005	+ tolerance of calibration
1.5	to	2	±0.01	+ tolerance of calibration
2	to	5	±0.03	+ tolerance of calibration
5	to	10	±0.07	+ tolerance of calibration

For example: A liquid blended to a refractive index at 5893 angstroms with a tolerance of ± .0002 will have a refractive index value at 8400 angstroms ± .0009 of the value on the Typical Characteristics sheet.

CAUCHY EQUATION: All refractive index values listed are calculations from the Cauchy equation on the same sheet.

DISPERSION VALUES: nF-nC, nF' - nC', and Abbe values for an actual liquid will normally be within 3% of the Typical Characteristics values. Variations as great as 10% have been observed.

TEMPERATURE COEFFICIENT: The change in refractive index with temperature. The Typical Characteristics sheets supply the temperature coefficient at D (5893 angstroms) per °C between 15° and 35°C. The temperature coefficient at D for an actual liquid is normally within 3% of the Typical Characteristics value, although variations as great as 9% have been observed. The temperature coefficient will vary slightly with wavelength; a typical liquid with a refractive index at 5893 angstroms and 25°C of 1.518 has a temperature coefficient at 5893 angstroms of -.000410, -.000420 at 4861 angstroms, and -.000408 at 6563 angstroms.

COMPOSITION: Cargille optical liquids are formulated from one or, more typically, two or more oils, solids, or polymers to give consistent and specified optical and physical properties. For each Code or specific refractive index range of a Series, the formula components will remain the same but the proportions will vary.

COLOR STABILITY: Tests were conducted by putting one or more liquids representing each formulation in individual 1 cm diameter glass test tubes inside a glass window getting direct and indirect sunlight. They were checked for visible changes in color as compared with duplicates kept in the dark.

POUR POINT: The temperature below which the liquid will not pour. It will usually be plastic or glasslike below this temperature, and crystallization may occur. Since the pour point for a formulation may vary, we often pick the highest possible pour point and use a < "less than" symbol.

BOILING POINT: For a formulation there will often be a varying distillation range; in such cases we select the lowest possible boiling temperature and use a > "greater than" symbol.

FLASH POINT: May vary for a formulation so the lowest possible flash point and method is often used with a > "greater than" symbol.

DENSITY: Typical Characteristics values are probably within 5% of an actual liquid.

VISCOSITY: Typical Characteristics values are probably within 10% of an actual liquid.

THERMAL CONDUCTIVITY, COEFFICIENT OF THERMAL EXPANSION, ELECTRIC STRENGTH, VOLUME RESISTIVITY, and DIELECTRIC CONSTANT: These are estimates.

SOLUBILITY: Under "soluble" or "best solvent", solvents are listed alphabetically. Within each Code or formulation, all liquids are miscible.

KNOWN INCOMPATIBILITY and COMPATIBILITY: Information in these categories comes from a variety of sources, including the experiences of customers. When a length of time of immersion (for example: 10 Month Immersion) is specified, this refers to testing done by Cargille in the following manner: a representative liquid of a formulation (usually made of equal parts of the formulation components) was used. One example of each of the solid materials to be tested for compatibility was immersed for the time indicated (at 25°C), then inspected to see if it had been dissolved, softened, swelled, weakened, pitted, or otherwise affected. Customers should do additional compatibility testing on their own material since it might have some important difference from the material of the same name tested by Cargille Laboratories.

TOXICITY: The terms High, Medium, Low, and None, have been used to summarize Cargille Laboratories' knowledge and experience with the liquid characterized. This should not be considered as a substitute for the more detailed information available in the MSDS (Material Safety Data Sheet).

SYMBOLS:

^	indicates an exponent (for example: 5^2=25)
E	is used for powers of 10 (for example: 3.67122E+12 means: 3.67122 times 10^12)
'C	means degree Celcius (°C)
n (W)	means refractive index as a function of wavelength W

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Refractive Index Liquids

SPECIALTY OPTICAL LIQUIDS

REFRACTIVE INDEX LIQUIDS

A COMPLETE SERIES OF SPECIFIC REFRACTIVE INDEX LIQUIDS

Cargille Refractive Index Liquids meet research and quality control needs in many fields including optics, chemical, forensics, and engineering by providing extensive optical data and physical characteristics information. These PCB-FREE liquids are ideal for calibration of refractometers, making temporary microscopic examinations of crystals and fibers for identification, and for optical coupling.

Refractive Index Liquids Include:

■ **STANDARD SERIES** of 222 liquids in seven groups extending from 1.300 to 2.11 n_D.

■ **CERTIFIED LIQUIDS** (3 series: AA, A, B) cover the refractive index range of most minerals, chemicals and biological materials (1.400 to 1.700 n_D) and are adjusted to an accuracy of ±0.0002; available in intervals of 0.002 (full set), 0.004 (half set) or 0.01 (one fifth set).

■ **HIGH DISPERSION LIQUIDS** (series: B, E, M) include 64 liquids for double refractometry, focal masking and dispersion staining of microscopically examined fibers and crystals.

■ **REFRACTIVE INDEX MELTS** Range is 2.12 to 2.31 n_D. Low melting solids.

STANDARD PARAMETERS

n_D RANGE	n_D ACCURACY	WAVELENGTH CHARACTERIZATION	VISCOSITY (cSt @ 25°C)	CALIBRATION TEMPERATURE	MATERIAL SAFETY DATA SHEET
1.300 to 2.31	1.300 to 1.395 ±0.0002 1.400 to 1.700 ±0.0002 1.705 to 1.800 ±0.0005 1.810 to 2.11 ±0.0015 2.12 to 2.31 ±0.003	5893 Å (n_D) 6563 Å (n_C) 4861 Å (n_F) } 1.300 to 2.11 5893 Å for 2.12 to 2.31	1.300 to 1.800 2 to 50 cSt 1.810 to 2.11 4 to 8500 cSt 2.12 to 2.31 9600 to flowable solid	25°C	AVAILABLE

SEE SECTION ON OPTICAL DATA AVAILABLE AND CUSTOM CHANGES.

REFRACTIVE INDEX LIQUIDS

Cargille

RI-0987

CARGILLE REFRACTIVE INDEX LIQUIDS

Cargille Refractive Index (R.I.) Liquids / Optical Liquids have become standard tools in many laboratories as their applications have expanded from mineralogical identification. Broader as well as more specialized uses in many more fields such as chemicals, engineering, biology, forensic, optics and instrumentation are continuously developing. Special requirements for new applications have created a need for more technical data, new formulations, extended ranges, smaller increments and higher degrees of accuracy.

The largest and most comprehensive assemblage of refractive index liquids – over 250 stocked items – is available for Geo Sciences, Industry, Biology, Optics, Forensics and Education. Many more are custom formulated. Materials research is ongoing in anticipation of new requirements. Since 1942, Cargille Laboratories has developed new materials to meet these challenges.

Chlorofluorocarbon (CFCs) components if used in Cargille Refractive Index / Optical Liquids (Series AAA and Laser Liquid Code 3421) have physical properties that are harmless to the ozone layer, unlike those found in refrigerant gases, propellants and solvents, which are destructive. The components used by Cargille Laboratories have vapor densities ten times that of air, are relatively nonvolatile, and have boiling points at least 100 °C higher than the highest boiling CFC listed for removal from commercial use by the Montreal Protocol.

CLASSIFICATIONS

* Complete groups, partial sets, or individual refractive index liquids may be purchased. Request Price List if not included.

APPLICATIONS

PARTICLE IDENTIFICATION and OPTICAL ANALYSIS	Specimen fragments, minerals, ores, chemicals, plastics, gems, identify translucent or transparent solids by microscopic immersion techniques, such as Becke Line, dispersion/optical staining, focal masking and double variation refractometry techniques.
FIBER OPTICS	Liquids and Gels used for fiber optic connections and mode stripping.
MOUNTING MEDIA	Temporarily mount specimens in various index media for Matching or Contrasting index combinations. Mount specimens in stable, non-drying index of refraction liquid to permit sample rotation by shifting cover glass for more comprehensive examination. See Cargille MELTMOUNTS™ pg. 4

Telephone: (973) 239-6633 **8:15AM - 4:45PM ET MON-THURS**
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55 Commerce Road
Cedar Grove, NJ 07009-1289, USA

REFRACTOMETRY	Calibrate refractometers and other optical instruments. See MASTER CALIBRATION LIQUIDS pg.4
EDUCATION	Instruct and demonstrate principles and applications of refraction & optics
STRAIN ANALYSIS	Examine stress and strain effects on transparent or translucent items, molded, formed, curved or intrinsically shaped parts by polariscopic immersion technique. See Cargille IMMERSION LIQUIDS pg.3
OPTICAL COUPLING	Couple optical elements with liquids and gels formulated to reduce or eliminate reflection losses.
OPTICAL LENSES	Fill hollow lens / prisms with index of refraction liquids and obtain unique optical / dispersion properties at lower cost than solid lens / prisms.
ELECTRO-OPTICS	Examine and preserve cathode coatings without stripping or re-immersion by utilizing liquids calibrated to match the index of crystals and glasses.
POLLUTION	Identify particles and particulates from air, water and soil.
FLUID FLOW	Photograph flow patterns by filling test system with refractive index liquids containing suspended "beads".

1. **Standard Refractive Index Liquids Series AAA thru M & High Dispersion Series E are read at 3 wavelengths in order to calculate dispersion, and the liquids are blended so that the dispersion always falls into a consistent range. These liquids are quality-controlled for dispersion and index.**
Refractive indices are stated for Refractive Index liquids at 25 °C, illuminated by 589.3 nms / 5893 angstroms Sodium light.

REFRACTIVE INDEX LIQUID STANDARDS: Range: 1.300 to 2.11

Consists of 222 liquids divided into seven different Series. The three Certified Series cover the range of most minerals, chemicals, glasses and practically all biological materials.

SERIES AAA Range 1.300 to 1.395 Int. 0.005 Adjusted to ±0.0002

Slightly volatile, colorless chlorofluorocarbon formulation. Keep tightly capped.

SERIES AA (Certified) Range 1.400 to 1.458 Int. 0.002 Adjusted to ±0.0002

Very stable, colorless

SERIES A (Certified) Range 1.460 to 1.640 Int. 0.002 Adjusted to ±0.0002

Stable, colorless at the low end, increasing to faint yellow* at the high end.

SERIES B (Certified) Range 1.642 to 1.700 Int. 0.002 Adjusted to ±0.0002

Stability inversely related to increasing index. Color increases with index to yellow or yellow brown*.

SERIES M Range 1.705 to 1.800 Int. 0.005 Adjusted to ±0.0005

Methylene iodide formulation, keep tightly capped. 1.740 to 1.780 liquids contain sulfur imparting yellow color*. 1.785 to 1.800 liquids have tin iodide added, dark red color* As methylene iodide evaporates, 1.705 to 1.735 liquids decrease in index. 1.740 liquids and up increase in index and may form crystals.

* Color refers to appearance in bulk. All optical liquids are virtually colorless in thin layer.

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These Liquids have been discontinued and we have limited stock available. Please call to check availability.

SERIES H Range 1.81 to 2.00 Int. 0.01 Adjusted to ±0.0015

Quite stable. Color varies from yellow to brown*. Toxic and corrosive. A super-saturated solution. May crystallize with time and low temperature. Formulation: arsenic tribromide, arsenic disulfide and sulfur.

SERIES EH Range 2.01 to 2.11 Int. 0.01 Adjusted to ±0.0015

Quite stable. Similar to Series H but contains selenium. Toxic and corrosive. Darker color*, more viscous. Viscosity increases with index.

HIGH DISPERSION GROUP Range: 1.500 to 1.800:

Consists of 64 liquids (three combined Series). Use for dispersion/optical staining, focal masking and double variation refractometry. Series E is specially formulated for high dispersion. Series B-1/2 and M are from the Standard group and have suitable dispersion characteristics.

SERIES E Range 1.500 to 1.640 Int. 0.05 Adjusted to ±0.0005

Slightly volatile, keep tightly capped. Supplied with optical constants for F, D and C lines. Recommended by prominent microscopists who have developed and published these techniques.

SERIES B-1/2 Range 1.644 to 1.700 Int. 0.004 Adjusted to ±0.0002

Represents one-half of the B Series in the Standard group. Has high dispersion characteristics.

SERIES M Range 1.705 to 1.800 Int. 0.005 Adjusted to ±0.0005

The same Series M as in the Standard group. Has high dispersion characteristics.

2. Standard Immersion Liquids, Immersion Liquid Specials & Laser Liquids™ are calibrated according to the customers' requirements, usually reading the index at 1 wavelength. These liquids are quality-controlled only for the customer-specified properties. If requested, typical dispersion data can be provided.

A. STANDARD IMMERSION LIQUIDS

Formulations similar to Standard Refractive Index Liquids, but less expensive; custom blended to a desired index between 1.400 and 1.700 at desired temperature and wavelength.

Consult Technical Department

B. IMMERSION LIQUID SPECIALS

Custom blended formulations with properties that differ from Standard Immersion Liquids, making them preferable for certain specific applications

Consult Technical Department

C. LASER LIQUIDS™

Originally formulated for use with lasers, the use of these liquids has expanded to many optical applications for indices between 1.293 and 1.630 where maximum stability, inertness, transparency, and low toxicity are required. Consult Technical Department

3. FUSED SILICA and BK-7 GLASS MATCHING LIQUID

Liquids match the refractive index of fused silica or BK-7 Glass at 632.8 nms and closely match it at other wavelengths.

Request Fused Silica Matching Liquid Code 50350 Typical Characteristics
Request BK-7 Matching Liquid Code 81520 Typical Characteristics

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4. MASTER CALIBRATION LIQUIDS

Cargille Master Calibration Liquids are very stable, non-toxic liquids with refractive index measured to an accuracy of ±0.00005 (five-in-the-fifth-place) at various temperatures and wavelengths. **NOTE:** To make use of the unusually high accuracy of these refractive index measurements, the user will require knowledge of the working temperature to an accuracy of ± 0.02 °C or better. This is because liquids typically have a temperature co-efficient of -0.0004 refractive index units per 1 °C, so they will be affected by approximately 0.000008 (eight-in-the-sixth-place) refractive index units for each 0.02 °C difference in temperature. All measurements are NIST (formerly the National Bureau of Standards) traceable.

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5. MELTMOUNTS™ MOUNTING MEDIA

Low melting (65 °C) thermo-plastic, indices 1.539, 1.582, 1.605, 1.662 (PCB-FREE replacement for Aroclor 5442), 1.680, and 1.704. Useful as a thermally reversible cement for making microscope slides and in other optical coupling applications. Request Data Sheet for MELTMOUNTS™

6. OPTICAL GELS

Refractive indices of 1.46 and 1.52 for lens and fiber coupling and mode striping.

7. SOLID REFRACTIVE INDEX STANDARDS

supplied in a solid wood case. Sets of 58+ vials of powdered minerals and glasses -100 +200 mesh. Range: 1.34 to 2.40, most intervals near 0.01.

M-1 - REFRACTIVE INDEX STANDARDS: ½ cc each of 60 optical glasses & minerals, refractive indices 1.34 to 2.40, 0.01 increments, R.I. value ± 0.01@ n_D

M-7 – PRECISION SOLID REFRACTIVE INDEX STANDARDS: ½ cc each of 58 Precision Optical Glasses, R.I. 1.34 to 2.40, 0.01 increments: set is accompanied by extensive technical data. R.I. values: ± 0.00005 in most instances @ 7 wavelengths.

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Catalog #	ACCESSORIES
18505	REPRINT: "PRACTICAL REFRACTOMETRY BY MEANS OF THE MICROSCOPE", by Dr. Roy M. Allen. 48-page booklet describes basic methods; with 13 photomicrographs.
18501	RACK Model RF-1. Solid wood with transparent rigid plastic cover. Contains four stepped rows for easily identifying R.I. numbers on labels. Each rack holds 51 x 7.4 cc bottles.

ORDERING INFORMATION FOR STANDARD REFRACTIVE INDEX LIQUIDS

All Refractive Index Liquid Standards Sets are sold in 7.4 cc (¼ fl.oz.) in amber bottles with applicator caps.

Temperature co-efficients and dispersion values are printed on each label.

Liquids are standardized for the sodium (n_D) line 589.3 nms / 5893 angstroms at 25 °C.

If any ½ sets have been ordered, the alternate half can be ordered to obtain a complete set.

Individual Refractive Index Liquid Standards come in 7.4 cc (¼ oz.) and 30 cc (1 oz.) amber bottles with applicator caps.

SEE PRICE LIST AND SALES POLICY FOR COMPLETE ORDERING INFORMATION

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CARGILLE REFRACTIVE INDEX LIQUIDS PRICE LIST

Refractive Index values stated are standardized at 589.3 nm and 25 °C

COMBINED SETS - CERTIFIED SERIES AA, A, & B RANGE 1.400 - 1.700

Cat. No.								
18001	RF-1	Full Set	Intl	0.002	151 liq	$	3,499.50
18002	RF-1/2	Half Set	Intl	0.004	76 liq	$	1,921.25
18002/Alt	RF-1/2	1.402 - 1.698	Intl	0.004	75 liq	$	1,921.25
18005	RF-1/5	Fifth Set	Intl	0.01	31 liq	$	777.00

CARGILLE STANDARD GROUP: 1.300 – 2.11

Cat. No. SERIES AAA Range 1.300 - 1.395 Adjustment ±0.0002

18031	AAA-1	Full Set	Intl	0.005	20 liq	$	619.00
18032 (1.300)	AAA-1/2	Half Set	Intl	0.01	10 liq	$	335.50
1803X	AAA-x	(std) 1/4 fl. oz (7 cc)	Any liq selected			$	49.50
1803Y	AAA-xx	1 fl. oz (30 cc)	Any liq selected			$	146.50

Cat. No. SERIES AA Range 1.400 - 1.458 Adjustment ±0.0002

18061	AA-1	Full Set	Intl	0.002	30 liq	$	590.25
18062 (1.400)	AA-1/2	Half Set	Intl	0.004	15 liq	$	321.75
18065 (1.400)	AA-1/5	Fifth Set	Intl	0.01	6 liq	$	133.75
1806X	AA-x	(std) 1/4 fl. oz (7 cc)	Any liq selected			$	31.75
1806Y	AA-xx	1 fl. oz (30 cc)	Any liq selected			$	93.50

Cat. No. SERIES A Range 1.460 - 1.640 Adjustment ±0.0002

18091	A-1	Full Set	Intl	0.002	91 liq	$	1,777.75
18092 (1.460)	A-1/2	Half Set	Intl	0.004	46 liq	$	971.75
18095 (1.460)	A-1/5	Fifth Set	Intl	0.01	19 liq	$	393.50
1809X	A-x	(std) 1/4 fl. oz (7 cc)	Any liq selected			$	33.50
1809Y	A-xx	1 fl. oz (30 cc)	Any liq selected			$	96.00

Cat. No. SERIES B Range 1.642 - 1.700 Adjustment ±0.0002

18121	B-1	Full Set	Intl	0.002	30 liq	$	1,217.50
18122 (1.644)	B-1/2	Half Set	Intl	0.004	15 liq	$	687.50
18125 (1.650)	B-1/5	Fifth Set	Intl	0.01	6 liq	$	272.75
1812X	B-x	(std) 1/4 fl. oz (7 cc)	Any liq selected			$	69.75
1812Y	B-xx	1 fl. oz (30 cc)	Any liq selected			$	206.50

Cat. No. SERIES M Range 1.705 - 1.800 Adjustment ±0.0005

18151	M-1	Full Set	Intl	0.005	20 liq	$	818.00
18152 (1.710)	M-1/2	Half Set	Intl	0.01	10 liq	$	455.25
1815X	M-x	(std) 1/4 fl. oz (7 cc)	Any liq selected			$	71.25
1815Y	M-xx	1 fl. oz (30 cc)	Any liq selected			$	201.00

FOB & SHIPPING POINT: CEDAR GROVE, NJ 07009 – USA
MINIMUM ORDER – USA, CANADA, MEXICO : $ 50.00 ◆ INTERNATIONAL: $ 70.00
SEE SALES POLICY FOR FULL TERMS / PRICES SUBJECT TO CHANGE WITHOUT NOTICE

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CARGILLE REFRACTIVE INDEX LIQUIDS PRICE LIST

CARGILLE HIGH DISPERSION GROUP

The Cargille High Dispersion Series are used when doing dispersion staining for identification of asbestos. Please note that Series A will not produce the colors needed in dispersion staining work for identifying asbestos. The Series E liquids were developed especially for this work and will produce the right colors.

Cat. No. SERIES E Range 1.500 - 1.640 Adjustment ±0.0005

18431	E-1	Full Set	Intl	0.005	29 liq	$	1,144.25
18432 (1.500)	E-1/2	Half Set	Intl	0.01	15 liq	$	638.00
1843X	E-x	(std) 1/4 fl. oz (7 cc)	Any liq selected			$	66.75
1843Y	E-xx	1 fl. oz (30 cc)	Any liq selected			$	191.25

Cat. No. SERIES B Range 1.642 - 1.700 Adjustment ±0.0002

18122	B-1/2	Half Set	Intl	0.004	15 liq	$	687.50
18125	B-1/5	Fifth Set	Intl	0.01	6 liq	$	272.75

Cat. No. SERIES M Range 1.705 - 1.800 Adjustment ±0.0005

18151	M-1	Full Set	Intl	0.005	20 liq	$	818.00
18152	M-1/2	Half Set	Intl	0.01	10 liq	$	455.25

COMBINED SETS - HIGH DISPERSION SERIES E, B, & M RANGE 1.500 - 1.800

Cat. No. 18461	HD-1	Full Set	Consists of E-1, B-1/2, & M-1	64 liq	$	2,251.50
18462	HD-1/2	Half Set	Consists of E-1/2, B-1/5, & M-1/2	31 liq	$	1,238.50

OB & SHIPPING POINT: CEDAR GROVE, NJ 07009 – USA
MINIMUM ORDER – USA, CANADA, MEXICO : $ 50.00 <> INTERNATIONAL: $ 70.00
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FAX: (973) 239-6096 • WWW.CARGILLE.COM

CARGILLE REFRACTIVE INDEX LIQUIDS PRICE LIST

CARGILLE MASTER CALIBRATION LIQUIDS

See MASTER CALIBRATION LIQUIDS PRICE SHEET: RI-MCL-PL

CARGILLE OPTICAL COUPLING LIQUIDS

Cat. No. 16xxx	See IMMERSION OIL DATA SHEET: IO-DS
Cat. No. 241xx	MELTMOUNT™ Mounting Media - available in 1 oz. (30 cc) jars and convenient QUICK-STICKS™ Refer to DATA SHEET: RI-MOM-MM

CARGILLE REFRACTIVE INDEX SOLIDS

Cat. No. 34100	SET M-1: Solid Refractive Index Standards, ½ cc each of 60 optical glasses & minerals -100 +200 mesh, refractive indices 1.34 to 2.40: 0.01 increments; includes wood case. **(LONG TERM OUT OF STOCK)** See REFERENCE SETS DATA SHEET
Cat. No. 34200	SET M-7: Precision Optical Glasses, with extensive technical data. **(LONG TERM OUT OF STOCK)** See DATA SHEET: RS-M7
Cat. No. 34224 ***NEW - Replacing M-25 Contact us for details!***	SET M-24: NVLAP Recognized Means of Verification of Refractive Index Liquids. (Sub-set of M-7) See DATA SHEET: RI-NVLAP

CARGILLE REFRACTIVE INDEX ACCESSORIES

Cat. No. 18501	Rack: Model RF-1 Holds 52, ¼ oz. Stds. (3 racks hold one RF-1 set)	$ 133.00 /ea
Cat. No. 18505	Booklet " PRACTICAL REFRACTOMETRY BY MEANS OF THE MICROSCOPE " by Dr. Roy M. Allen	$ 6.75 /ea

FOB & SHIPPING POINT: CEDAR GROVE, NJ 07009 – USA
MINIMUM ORDER – USA, CANADA, MEXICO: $ 50.00 <> INTERNATIONAL: $ 70.00
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RI-BXCW–PL-198
Replaces: RI-BXCW-PL-197A
Effective Date: January 15, 2022

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0.000% BRIX STANDARD

REFRACTIVE INDEX CERTIFIED WATER *

0.000% Brix at any temperature (15 - 35 °C)

NIST/ASME uses as the authority for the properties of water, the publication issued by IAPWS, (The International Association for the Properties of Water and Steam). The IAPWS has published the "absolute" refractive index of water,that is relative to a vacuum. We have calculated its refractive index, relative to air, by dividing the absolute refractive index of water by the absolute refractive index of air. (References available).

ACS Reagent Grade Water was measured for refractive index at 589.3 nm on an Abbe type refractometer standardized with NIST traceable standards.

Temperature Degrees Celsius ± 0.01	Absolute Refractive Index of Water ± 0.00005 at 589.3 nm, ASME Steam v2.2:	Refractive Index of Water relative to air at 589.3 nm, calculated values:	Refractive Index of Water (RGW) read by Cargille ± 0.00005 RI Units at 589.3 nm 23°C, relative to air, calculated values:	Brix Equivalent as per ICUMSA 2000:
20	1.33334	1.33297	1.33297	0.000
25	1.33285	1.33249	1.33249	0.000
30	1.33228	1.33193	1.33193	0.000

*Note: Refractive Index of water at 589.3 nm ± 0.00005 is equivalent to ± 0.000% Brix ± 0.035

Catalog # 19400

1 x 1/4 fl. oz.	12 x 1/4 fl. oz	1 x 1 fl. oz.	12 x 1 fl. oz
$ 98.00	$ 88.50	$ 251.00	$ 228.00

LETTER OF CERTIFICATION ACCOMPANIES EACH BOTTLE

FOB & SHIPPING POINT: CEDAR GROVE, NJ 07009 – USA
MINIMUM ORDER – USA, CANADA, MEXICO : $ 50.00 ◄► INTERNATIONAL: $ 70.00
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RI-MCL-BRX-TB-198
Replaces: RI-MCL-BRIX-TB-197A
Effective Date: January 15, 2022

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CARGILLE MASTER CALIBRATION LIQUIDS WITH EQUIVALENT % BRIX (SUCROSE) - ICUMSA 2000

Cargille Master Calibration Liquids are very stable, non-toxic liquids with refractive index measured to an accuracy of ± 0.00005 at various temperatures and wavelengths. The unusually high accuracy of these refractive index measurements will often require that the user knows his or her working temperature with an accuracy of ± 0.02°C or better; this is because liquids typically have a temperature coefficient of -0.0004 refractive index units per 1°C so they will be affected by approximately 0.000008 refractive index units for each 0.02°C difference in temperature

When the Master Calibration Liquid has a refractive index measurement at two temperatures, 20°C or less apart, the user can compute a temperature coefficient and calculate (interpolate) refractive index at any temperature in between with an accuracy of at least ± 0.00006 (the relationship of refractive index to temperature is linear). Typical temperature coefficients (accurate to ± 10%) are available from Cargille Laboratories and can in practice be used to correct for up to a known temperature change of 0.20°C from the temperature of calibration.
All measurements are NIST (NBS) traceable. All measurements available are listed here.
n = refractive index

Cat. No. 19251-BXS	Code 3421	Nominal nD = 1.362
(n = 1.36176 at 20 °C at 589.3 nm)		(18.742 % BRIX ±0.030 at 20 °C)
Cat. No. 19253-BXS	Code S50	Nominal nD = 1.404
(n = 1.40427 at 20 °C at 589.3 nm)		(42.247 % BRIX ±0.025 at 20 °C)
Cat. No. 19257-BXS	Code 06	Nominal nD = 1.459
(n = 1.45932 at 20 °C at 589.3 nm)		(67.461 % BRIX ±0.021 at 20 °C)
Cat. No. 19259-BXS	Code 1160	Nominal nD = 1.490
(n = 1.48989 at 20 °C at 589.3 nm)		(79.687 % BRIX ±0.019 at 20 °C)

Price per Bottle

1 x 1/4 fl. oz.	12 x 1/4 fl. oz	1 x 1 fl. oz.	12 x 1 fl. oz
$ 98.00	$ 88.50 ea.	$ 251.00	$ 228.00 ea.

NOTE: Prices of multiples (12x) must be for the same Cargille Master Calibration Liquid

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CARGILLE MASTER CALIBRATION LIQUIDS

Cargille Master Calibration Liquids are very stable, non-toxic liquids with refractive index measured to an accuracy of + 0.00005 at various temperatures and wavelengths. The unusually high accuracy of these refractive index measurements will often require that the user knows his or her working temperature with an accuracy of + 0.02 °C or better; this is because liquids typically have a temperature coefficient of - 0.0004 refractive index units per 1 °C so they will be affected by approximately 0.000008 refractive index units for each 0.02 °C difference in temperature.

When the Master Calibration Liquid has refractive index measurements at two temperatures, 20 °C or less apart, the user can compute a temperature coefficient and calculate (interpolate) refractive index at any in between temperature with an accuracy of at least ± 0.00006 (the relationship of refractive index to temperature is nearly linear). Typical temperature coefficients (accurate to ± 10%) are available from Cargille Laboratories and can in practice be used to correct for up to a known temperature change of 0.20 °C from temperature of calibration. All measurements are NIST (NBS) traceable. All measurements available are listed here.

Cat. No.	Master Calibration Liquids	Nominal	Temperature
19252	Code S50	nD=1.402	@25°C
19253	Code S50	nD=1.404	@20°C
19255	Code 06	nD=1.457	@25°C
19257	Code 06	nD=1.459	@20°C
19259	Code 1160	nD=1.490	@20°C
19261	Code 1160	nD=1.514	@25°C
19264	Code 1057	nD=1.572	@25°C
19268	Code 63	nD=1.630	@25°C
19300	Code S1050	nD=1.436	@30°C
*19340	Code 1160	nD=1.516	@20°C (Multi-Temp)

* **±0.0001**

1 x ¼ fl. oz.	12 x ¼ fl. oz.	1 x 1 fl. oz.	12 x 1 fl. oz.
$98.00	$88.50 ea.	$ 251.00	$ 228.00 ea.

Note: Prices of multiples (12x) must be for the same Cargille Master Calibration Liquid.

See over for Technical Data

CARGILLE MASTER CALIBRATION LIQUIDS

Cat. No.	Code	Nominal	Actual Reading	Lot#
19252	S50	nD = 1.402	(1.40235 at 25 °C at 589.3 nm)	072681
19253	S50	nD = 1.404	(1.40427 at 20 °C at 589.3 nm)	082581
19255	06	nD = 1.457	(1.45746 at 25 °C at 589.3 nm)	121681
19257	06	nD = 1.459	(1.45932 at 20 °C at 589.3 nm)	120981
19259	1160	nD = 1.490	(1.48989 at 20 °C at 589.3 nm)	072176
19261	1160	nD = 1.514	(1.51432 at 25 °C at 589.3 nm)	100977
19264	1057	nD = 1.572	(1.57230 at 25 °C at 589.3 nm)	030374
19268	63	nD = 1.630	(1.63026 at 25 °C at 589.3 nm)	070395
19300	S1050	nD = 1.436	(1.43604 at 30 °C at 589.3 nm)	022772
19340	1160	nD = 1.516	*(1.5163 at 20 °C at 589.3 nm)	051582

*** ±0.0001**

FOB & SHIPPING POINT: CEDAR GROVE, NJ 07009 – USA

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Precaution Sheet
RI-SS-PS-1186

REFRACTIVE INDEX LIQUIDS STANDARD SERIES

SAFETY AND HANDLING

SERIES AAA, AA, A, B, M – These series have low toxicity; however, good laboratory procedures should be observed. Series AAA and M are slightly volatile and should be kept well stoppered. Series B and M should be protected from light as they darken slowly from exposure to light!

SERIES H, EH FH* GH* Note* FH and GH are not currently for sale.

1. Cargille High Series and Extra High Series Refraction Index Liquids and FH and GH Series Melts contain arsenic tribromide which is **toxic** and **corrosive.**

2. Personnel handling these materials should avoid contact and breathing of vapors. Any material on the body should be immediately removed by thorough scrubbing. Persons with any allergenic history should be extremely careful to avoid contact.

   NOTE: Arsenic can be absorbed through intact skin.

3. The greatest danger of arsenic poisoning is from ingestion. The possibility of accidental ingestion is greatly reduced by preventing eating and smoking in areas where these liquids are used.

4. Since these materials are corrosive, it is recommended that slides be prepared away from the microscope and mounted specimens left on the microscope no longer than necessary. Direct contact with instruments will attack metal parts and leaded optical glasses.

5. These materials also react with moisture in the air. Therefore, mountings should be made quickly so the liquid is protected from the atmosphere by the cover glass, and caps should be tightened on bottles to prevent escape of vapors and avoid moisture-vapor reactions.

FOR ADDITIONAL SAFETY DATA, PLEASE REQUEST MATERIAL SAFETY DATA SHEET BY SERIES NAME

Cargille

Immersion Liquids

SPECIALTY OPTICAL LIQUIDS

IMMERSION LIQUIDS

FOR SUBMERSION EXAMINATION OF SOLIDS

Immersion Liquids permit detection of imperfection in transparent and translucent materials and examination for stress and strain effects in molded, formed, curved or intrinsically shaped parts by polariscopic immersion technique.

Immersion Liquids are:

- CUSTOM BLENDED to specific refractive index.
- REUSABLE.
- INEXPENSIVE.
- LOW IN TOXICITY.
- AVAILABLE with n_D between 1.293 and 1.700.

STANDARD PARAMETERS

n_D RANGE	n_D ACCURACY	WAVELENGTH CHARACTERIZATION	VISCOSITY (cSt @ 25°C)	CALIBRATION TEMPERATURE	MATERIAL SAFETY DATA SHEET
1.293 to 1.700	±.0005	5893 Å	3 to 47	25°C	AVAILABLE

SEE SECTION ON OPTICAL DATA AVAILABLE AND CUSTOM CHANGES

CARGILLE IMMERSION LIQUIDS
TYPICAL VALUES FOR
A FEW REPRESENTATIVE LIQUIDS

Representative Liquid / Catalog Number		19501	19503	19505	19507		
Formula Code		S1050			5040		
Refractive Index Range possible for Code (n_D 25 °C)		1.400 – 1.458			1.459 – 1.570		
REFRACTIVE INDEX @ 25 °C and PERCENT TRANSMITTANCE 1 cm at a Few Wavelengths (nm)	2900	1.433 78%	1.461 80%	1.499 84%	– 0%	– 0%	– 0%
	365 i	1.418 100%	1.444 99%	1.478 99%	1.500 51%	1.531 20%	1.576 5%
	404.7 h	1.4127 99%	1.4382 99%	1.4719 99%	1.4920 85%	1.5214 69%	1.5625 51%
Calibrated at n_D^{25} ± 0.0005	486.1 F	1.4054 100%	1.4306 100%	1.4637 99%	1.4819 98%	1.5086 95%	1.5460 92%
	589.3 D	1.4000 100%	1.4250 100%	1.4580 100%	1.4750 99%	1.5000 99%	1.5350 98%
	656.3 C	1.3977 100%	1.4227 100%	1.4557 100%	1.4722 100%	1.4966 100%	1.5307 100%
	1064.8	1.392 98%	1.417 97%	1.450 95%	1.465 95%	1.488 96%	1.520 97%
	1300	1.390 96%	1.415 92%	1.449 88%	1.464 88%	1.487 89%	1.518 90%
	1550	1.390 63%	1.415 70%	1.448 81%	1.463 82%	1.486 82%	1.517 84%
Abbe v: (n_D – 1) / (n_F-n_C)		52	54	57	49	42	35
Temp. Coef. dn_D/dt (°C) 15-35 °C		-.000412	-.000402	-.000388	-.000393	-.000401	-.000411
Viscosity cSt @ 25 °C		10	13	17	22	31	50
Density g / cc @ 25 °C		0.930	0.887	0.831	0.855	0.894	0.948
Flash Point °C		> 138			> 138		
Pour Point °C		< - 7			< - 7		
Boiling Point °C		> 200			> 262		
Toxicity (request MSDS)		low			low		
Compatible (c) Incompatible (i)							
Acrylic		c			c		
Polycarbonate		c			c		
Polyethylene		c			c		
Polypropylene		c			c		
Polystyrene		c			i		
Latex Rubber		i			i		
Neoprene Rubber		c			i		
Silicone Rubber		i			i some		
Aluminum		c			c		
Copper		c			c		
Steel		c			c		
Best Solvents		Ethyl Ether, Naphtha, Xylene, Toluene, Heptane, Methylene Chloride, Turpentine					
Color Stability in sun		v. high			Moderate		
PRICE: 2021 (Subject: to Change)	4 fl. oz.	$133.75	$132.00	$124.25	$139.00		
	16 fl. oz.	$277.00	$270.00	$247.00	$256.75		
	32 fl. oz.	$448.00	$438.50	$366.00	$385.00		
Note:		Like Series AA but at lower cost. Colorless			Like Series A but at lower cost. Light Yellow. Low dispersion. Often used to inspect optical glass.		

na = not available v. = very

Representative Liquid / Catalog Number		19507 (continued)	19531	19533	19535	19519	19525
Formula Code		5040	40BN			BNDN	
Refractive Index Range possible for Code (n_D 25 °C)		1.459-1.570	1.571-1.656			1.657-1.698	
REFRACTIVE INDEX @ 25 °C and PERCENTTRANSMITTANCE 1 cm at a Few Wavelengths (nm)	290	– 0%	– 0%	– 0%	– 0%	– 0%	– 0%
	365 i	1.620 1%	1.666 4%	1.711 10%	1.750 25%	1.774 3%	1.807 0%
	404.7 h	1.6036 38%	1.6437 43%	1.6832 50%	1.7175 57%	1.7401 9%	1.7689 1%
	486.1 F	1.5833 89%	1.6170 88%	1.6504 88%	1.6794 87%	1.7000 55%	1.7249 33%
Calibrated at n_D^{25} ± 0.0005	589.3 D	1.5700 98%	1.6000 98%	1.6300 98%	1.6560 98%	1.6750 96%	1.6980 94%
	656.3 C	1.5648 100%	1.5936 99%	1.6224 98%	1.6473 98%	1.6657 98%	1.6880 97%
	1064.8	1.552 97%	1.578 98%	1.605 99%	1.628 99%	1.644 99%	1.665 99%
	1300	1.550 90%	1.576 92%	1.602 94%	1.624 95%	1.640 96%	1.661 98%
	1550	1.549 85%	1.574 88%	1.600 90%	1.622 93%	1.638 93%	1.659 93%
Abbe v: (n_D – 1) / (n_F-n_C)		31	26	22	20	20	19
Temp. Coef. dn_D/dt (°C) 15-35 °C		-.000421	-.000438	-.000454	-.000468	-.000474	-.000479
Viscosity cSt @ 25 °C		82	29	10	4	4	4
Density g / cc @ 25 °C		1.003	1.172	1.334	1.475	1.595	1.718
Flash Point °C		>138	> 113			> 93	
Pour Point °C		< - 7	< 6			< 6	
Boiling Point °C		> 262	> 279			> 279	
Toxicity (request MSDS)		low	moderate			moderate	
Compatible (c) Incompatible (i)							
Acrylic		c	c			c	
Polycarbonate		c	i			i	
Polyethylene		c	c			c	
Polypropylene		c	c			c	
Polystyrene		i	i			i	
Latex Rubber		i	i			i	
Neoprene Rubber		i	i			i	
Silicone Rubber		i some	c			c	
Aluminum		c	c			c	
Copper		c	i			i	
Steel		c	c			i	
Best Solvents		See page 1: 5040	Acetone, Ethyl Ether, Naphtha, Xylene, Methylene Chloride Toluene, Heptane, , Turpentine				
Color Stability in sun		moderate	low to moderate			low	
	4 fl. oz.	$139.00	$143.75	$168.75	$201.50	$477.25	$623.75
	16 fl. oz.	$256.75	$302.50	$377.75	$488.00	$1,482.25	$2,225.25
	32 fl. oz.	$385.00	$492.00	$629.50	$803.00	$2,779.50	$4,238.00
Note:		See Page 1: 5040	Like Series A & B of the same indices but at lower cost. Light Yellow			Like Series B but lower cost. Yellow brown color. Light sensitive.	

na = not available v. = very

CARGILLE IMMERSION LIQUID SPECIALS
TYPICAL VALUES FOR
A FEW REPRESENTATIVE LIQUIDS

Representative Liquid / Catalog #		19568	19573	19570	19561		
Formula Code		4550 *	4501	50350 *	1160		
Refractive Index Range possible for Code (n_D 25 °C)		1.452-1.457	1.452-1.470	1.458-1.475	1.482-1.538		
REFRACTIVE INDEX @ 25 °C and PERCENT TRANSMITTANCE 1 cm at a Few Wavelengths (nm)	290	1.489 86%	– 0%	1.518 72%	– 0%	– 0%	– 0%
	365 i	1.471 99%	1.500 53%	1.496 99%	1.512 89%	1.535 89%	1.584 87%
	404.7 h	1.4655 99%	1.4902 96%	1.4894 100%	1.5025 97%	1.5237 96%	1.5686 95%
	486.1 F	1.4576 100%	1.4779 100%	1.4809 100%	1.4902 99%	1.5094 99%	1.5501 99%
Calibrated at n_D^{25} ± 0.0005	589.3 D	1.4520 100%	1.4700 100%	1.4750 100%	1.4820 100%	1.5000 100%	1.5380 100%
	656.3 C	1.4497 100%	1.4670 100%	1.4726 100%	1.4788 100%	1.4963 100%	1.5333 100%
	1064.8	1.444 95%	1.460 95%	1.467 95%	1.471 96%	1.487 96%	1.522 97%
	1300	1.442 89%	1.459 85%	1.466 96%	1.469 91%	1.486 92%	1.520 94%
	1550	1.442 84%	1.458 84%	1.465 81%	1.468 83%	1.485 85%	1.519 89%
Abbe v: (n_D – 1) / (n_F-n_C)		57	43	58	42	38	32
Temp. Coef. dn_D/dt (°C) 15-35 °C		-.000394	-.000488	-.000360	-.000385	-.000389	-.000396
Viscosity cSt @ 25 °C		11	0.4	112	41	41	41
Density g / cc @ 25 °C		0.816	0.840	0.867	0.969	1.016	1.115
Flash Point °C		> 135	> 47	> 138	> 199		
Pour Point °C		< 2	< 2	< -7	< - 45		
Boiling Point °C		> 244	> 178	> 262	> 370		
Toxicity (request MSDS)		none	moderate	none	low		
Compatible (c) Incompatible (i)							
Acrylic		c	na	c	c		
Polycarbonate		c	na	c	c		
Polyethylene		c	na	c	c		
Polypropylene		c	na	c	c		
Polystyrene		c	na	c	i		
Latex Rubber		i	na	i	i		
Neoprene Rubber		c	na	c	i		
Silicone Rubber		i some	na	i some	c		
Aluminum		c	na	c	c		
Copper		c	na	c	c		
Steel		c	na	c	c		
Best Solvents		Ethyl Ether, Naphtha, Xylene, Methylene Chloride,Toluene, Heptane, Turpentine			Ethanol, Acetone, Ethyl Ether, Naphtha, Xylene, Methylene Chloride Toluene		
Color Stability in sun		v. high	moderate	v. high	high		
	4 fl. oz.	$137.25	$121.50	$134.25	$135.00		
	16 fl. oz.	$254.25	$229.00	$248.00	$262.50		
	32 fl. oz.	$386.50	$371.50	$398.50	$421.50		
Note:		Colorless and v. stable	v. low viscosity; a bit volatile	Colorless and v. stable	Low fluorescence; very stable; colorless (less yellow than 5040).		

* = VERY LOW FLUORESCENCE 356 nm excitation na = not available v. = very

CARGILLE IMMERSION LIQUID SPECIALS
TYPICAL VALUES FOR
A FEW REPRESENTATIVE LIQUIDS

Representative Liquid / Catalog #		19582		19563		19580	19581
Formula Code		50BN *		5095		OHGL *	OHZB *
Refractive Index Range possible for Code (n_D 25 °C)		1.459-1.656		1.458-1.580		1.333-1.470	1.333-1.556
REFRACTIVE INDEX @ 25 °C and PERCENT TRANSMITTANCE 1 cm at a few Wavelengths (nm)	290	– 0%	– 0%	– 0%	– 0%	1.503 59%	– 0%
	365 i	1.673 39%	1.715 32%	1.536 94%	1.647 87%	1.4885 99%	1.598 78%
	404.7 h	1.6481 68%	1.6853 62%	1.5245 98%	1.6243 97%	1.4832 99%	1.5847 91%
	486.1 F	1.6185 90%	1.6511 89%	1.5097 100%	1.5972 100%	1.4757 100%	1.5679 97%
Calibrated at n_D^{25} ± 0.0005	589.3 D	1.6000 98%	1.6300 98%	1.5000 100%	1.5800 100%	1.4700 100%	1.5560 99%
	656.3 C	1.5931 98%	1.6221 98%	1.4962 100%	1.5735 100%	1.4676 100%	1.5512 100%
	1064.8	1.577 98%	1.604 98%	1.487 96%	1.558 98%	1.461 81%	1.539 93%
	1300	1.574 93%	1.601 94%	1.485 91%	1.555 95%	1.460 57%	1.537 60%
	1550	1.573 89%	1.599 91%	1.484 84%	1.554 90%	– 0%	– 0%
Abbe v: (n_D – 1) / (n_F-n_C)		24	22	37	25	58	33
Temp. Coef. dn_D/dt (°C) 15-35 °C		-.000446	-.000458	-.000398	-.000416	-.000377	-.000330
Viscosity cSt @ 25 °C		6	5	14	10	679	9
Density g / cc @ 25 °C		1.295	1.394	0.881	0.981	1.254	2.498
Flash Point °C		> 113		> 138		> 165	none
Pour Point °C		< 6		< -7		< 18	**
Boiling Point °C		> 262		> 262		> 100	> 100
Toxicity (request MSDS)		moderate		low		none	moderate
Compatible (c) Incompatible (i)							
Acrylic		c		c		c	c
Polycarbonate		i		c		c	c
Polyethylene		c		c		c	c
Polypropylene		c		c		c	c
Polystyrene		i		i		c	c
Latex Rubber		i		i		c	c
Neoprene Rubber		i		i		c	c
Silicone Rubber		c		i some		c	c
Aluminum		c		c		c	i
Copper		c		c		i	i
Steel		c		c		i	c
Best Solvents		Ethyl Ether, Naphtha, Xylene, Methylene Chloride, Toluene, Heptane, Turpentine				Water, Ethanol	Water,Ethanol, Acetone
Color Stability in sun		low to moderate		moderate		high	moderate
	4 fl. oz.	$209.00		$132.00		$129.50	$161.50
	16 fl. oz.	$368.25		$248.00		$243.00	$307.75
	32 fl. oz.	$590.00		$382.00		$390.50	$489.50
Note:		Lowest fluorescence with high index; light yellow		Low cost; almost colorless (less yellow than 5040)		OHGL & OHZB water based: index goes up fast by water evaporation; acid pH	

* = VERY LOW FLUORESCENCE 356 nm excitation na = not available v. = very ** crystallization Point < 7 °C

Cargille

SPECIALTY OPTICAL LIQUIDS

LASER LIQUIDS™

HIGH TRANSMISSION LIQUIDS FOR LASER WAVELENGTHS

Custom blended optical liquids formulated to your desired specifications of refractive index, wavelength, and temperature for use with lasers and in other specialty optical applications.

Laser Liquids are:

- OPTICALLY Characterized at laser and other wavelengths.
- EXTREMELY STABLE
- HIGHLY TRANSPARENT.
- EXTREMELY LOW IN TOXICITY.
- ECONOMICALLY PRICED.

Two liquids, codes 433 and 3421, have unusually high transmittance in the UV above 2400 angstroms and in the IR below 25000 angstroms.

STANDARD PARAMETERS

n_D RANGE	n_D ACCURACY	WAVELENGTH CHARACTERIZATION	VISCOSITY (cSt @ 25°C)	CALIBRATION TEMPERATURE	MATERIAL SAFETY DATA SHEET
1.293 to 1.630	±0.0002	5893 A	3 to 795	25°C	AVAILABLE

SEE SECTION ON OPTICAL DATA AVAILABLE AND CUSTOM CHANGES.

CARGILLE LASER LIQUIDS
TYPICAL VALUES FOR
A FEW REPRESENTIVE LIQUIDS

Representative Liquid / Cat. #		20108	20109		20110		20130
Formula Code		433	3421		S1056		5610
Refractive Index Range for Code (n_D 25 °C)		1.295–1.300	1.301 - 1.400		1.398 - 1.459		1.460 – 1.535
REFRACTIVE INDEX @ 25 °C and PERCENT TRANSMITTANCE 1 cm at a Few Wavelengths (nm)	290	1.31 68%	1.31 51%	1.44 26%	1.43 78%	1.51 67%	1.54 53%
	365 I	1.301 100%	1.311 99%	1.414 96%	1.418 100%	1.483 98%	1.507 97%
	486.1 F	1.2970 100%	1.3072 100%	1.4041 99%	1.4055 100%	1.4630 99%	1.4840 99%
Calibrated at $n_D^{25} \pm .0002$	589.3 D	1.2950 100%	1.3050 100%	1.4000 99%	1.4000 100%	1.4550 100%	1.4750 100%
	656.3 C	1.2941 100%	1.3040 100%	1.3983 100%	1.3977 100%	1.4517 100%	1.4713 100%
	1064.8	1.292 99%	1.301 100%	1.394 100%	1.392 98%	1.443 99%	1.462 99%
	1300	1.291 99%	1.301 98%	1.393 100%	1.390 96%	1.442 96%	1.460 96%
	1550	1.291 99%	1.300 98%	1.392 100%	1.390 63%	1.441 71%	1.459 74%
	2500	1.29 88%	1.30 87%	1.39 95%	– 0%	– 0%	– 0%
Abbe ν: (n_D-1) / (n_F-n_C)		101	97	69	51	40	38
Temp. Coef. dn_D / dt (°C) 15-35 °C		-.000346	-.000334	-.000346	-.000412	-.000414	-.000407
Viscosity cSt 25 °C		5	14	17	10	21	46
Density g / cc @ 25 °C		1.905	1.938	1.902	0.933	0.981	1.011
Flash Point °C		none	none		>121		>121
Pour Point °C		<-20	<-20		<-70		<-22
Boiling Point °C		>174	>215		>149		>149
Toxicity (request) MSDS)		none	none		low		none
Compatible (c) and incompatible (i):							
Acrylic		c	c		c		c
Polycarbonate		c	c		c		c
Polyethylene		c	c		c		c
Polypropylene		c	c		c		c
Polystyrene		c	c		c		c
Latex Rubber		c	c		c		c
Neoprene Rubber		c	c		c		c
Silicone Rubber		c	i some		i some		i some
Aluminum		c	i		c		c
Copper		c	c		c		c
Steel		c	c		c		c
Best Solvents		Freon TF and other Chlorofluorocarbons; also remove with soap & water			Ethyl Ether, Naphtha, Xylene, Methylene Chloride		See: Page 2, 5610
Color Stability in sun		v. high	v. high		v. high		v. high
	4 fl. oz.	$262.25	$262.25		$182.00		$202.75
	16 fl. oz.	$644.25	$644.25		$341.75		$390.50
	32 fl. oz.	$1,095.50	$1,095.50		$480.50		$581.50
Notes:		433 & 3421 have extraordinarily high % trans.; are poor solvents, but are high in gas solubility			S1056 and 5610 are colorless liquids		

na = not available v. = very

CARGILLE LASER LIQUIDS
TYPICAL VALUES FOR
A FEW REPRESENTIVE LIQUIDS

Representative Liquid / Cat.#		20130		20190	20250	20290	20310
Formula Code		5610		1074	1057B	57B63	
Refractive Index Range possible for Code (n_D 25 °C)		1.460 – 1.535		1.535 - 1.557	1.558 - 1.578	1.579 – 1.630	
REFRACTIVE INDEX @ 25 °C and PERCENT TRANSMITTANCE 1 cm at a Few Wavelengths (nm)	290	1.579 40%	1.633 26%	– 0%	– 0%	– 0%	– 0%
	365 i	1.537 95%	1.579 93%	1.608 85%	1.631 89%	1.663 18%	1.705 2%
	404.7 h	1.5252 97%	1.5638 96%	1.5910 96%	1.6139 96%	1.6416 84%	1.6795 70%
	486.1 F	1.5102 99%	1.5457 99%	1.5704 99%	1.5923 98%	1.6163 96%	1.6490 95%
Calibrated at $n_D^{25} \pm .0002$	589.3 D	1.5000 100%	1.5340 100%	1.5570 100%	1.5780 99%	1.6000 99%	1.6300 99%
	656.3 C	1.4960 100%	1.5295 100%	1.5518 100%	1.5724 99%	1.5937 99%	1.6229 99%
	1064.8	1.486 99%	1.519 99%	1.539 98%	1.559 98%	1.579 98%	1.606 99%
	1300	1.484 96%	1.517 95%	1.537 95%	1.556 95%	1.576 96%	1.603 98%
	1550	1.483 75%	1.516 78%	1.535 78%	1.555 81%	1.574 85%	1.602 92%
Abbe v: (n_D-1) / (n_F-n_C)		35	33	30	29	27	24
Temp. Coef. dn_D / dt (°C) 15- 35 °C		-.00039 7	-.000383	-.000414	-.000426	-.000425	-.000423
Viscosity cSt 25 °C		124	479	40	177	454	1734
Density g / cc @ 25 °C		1.049	1.101	1.062	1.092	1.135	1.196
Flash Point °C		>121		>221	>243	>243	
Pour Point °C		<-22		<-20	<-6	<5	
Boiling Point °C		>149		>288	>288	>476	
Toxicity (request) MSDS)		none		none	none	low	
Compatible (c) incompatible (i)							
Acrylic		c		c	c	c	
Polycarbonate		c		c	c	c	
Polyethylene		c		c	c	c	
Polypropylene		c		c	c	c	
Polystyrene		c		c	c	c	
Latex Rubber		c		c	c	c	
Neoprene Rubber		c		c	c	c	
Silicone Rubber		i some		c	c	c	
Aluminum		c		c	c	c	
Copper		c		c	c	c	
Steel		c		c	c	c	
Best Solvents		Acetone, E. Ether, Naphtha, Xylene, Methylene Chloride		Acetone, Ethyl Ether, Xylene, Methylene Chloride, Toluene, Turpentine			
Color Stability in sun		v. high		v. high	v. high	low	
	4 fl. oz.	$202.75		$219.75	$283.25	$507.75	$658.25
	16 fl. oz.	$390.50		$460.25	$694.00	$1,573.00	$2,138.25
	32 fl. oz.	$581.50		$685.50	$1,183.00	$2,916.50	$4,057.50
Notes:		See: Page 1 5610		1074 and 1057 are very stable and almost colorless		Highest index for low toxicity; non-reactive; stable; light sensitive.	

na = not available v. = very

Cargille

Fused Silica Matching Liquids PATENTED

SPECIALTY OPTICAL LIQUIDS

FUSED SILICA MATCHING LIQUIDS

FOR LIQUID FILLED PRISMS, OPTICAL AND LASER SYSTEMS

Colorless Optical Couplants

Closely Match the Dispersion
and
Refractive Index of Fused Silica

Fused Silica Matching Liquids are:

- USED TO FILL HOLLOW PRISMS for substantial savings over solid glass prisms.
- REUSABLE.
- USED TO CHECK FIBER OPTIC INTERFACES for fiber-end aberrations.
- EXTREMELY LOW IN TOXICITY.
- COMPATIBLE with most optical laboratory materials (except latex rubber).

STANDARD PARAMETERS

n_D RANGE	n_D ACCURACY	WAVELENGTH CHARACTERIZATION	VISCOSITY (cSt @ 25°C)	CALIBRATION TEMPERATURE	MATERIAL SAFETY DATA SHEET
1.4587	±0.0005	5893 Å	15 or 54	25°C	AVAILABLE

RI-FS-PL-198
Replaces: RI-FS-PL-197A
Effective: January 15, 2022

Services to the Science Since 1924

Cargille Laboratories

55 Commerce Road • Cedar Grove • New Jersey • 07009-1289 USA
Phone: 973-239-6633 • Fax: 973-239-6096 • WWW.CARGILLE.COM

FUSED SILICA MATCHING LIQUIDS

The Fused Silica Matching Liquids Code 50350 and 06350 precisely match the refractive index and very closely match the dispersion of fused silica.

Both Codes are formulated to match the refractive index of fused silica at the HeNe wavelength (632.8 nm): other custom formulations will match the refractive index of fused silica at other wavelengths.

Colorless, odorless, and non-toxic (request (M)SDS). Soluble in naphtha, ethyl ether, xylene, and methylene chloride, the Fused Silica Matching Liquids are partly soluble in acetone and insoluble in water and ethanol. The liquids have a known incompatibility with Latex rubber.

The two codes differ in the following respects:

Code	25 °C cSt Viscosity	Cloud Point
50350	19	≤ 1 °C
60350	80	No Cloud Pt.

For additional properties and optical values, see Typical Characteristics Sheets.

In development as well as field applications, Fused Silica Matching Immersion Liquids will be very useful to those working with fused silica optical fibers, windows, and other optical components in coupling and refractive near-field scanning applications.

Cat. No.	Code No.	1 fl. oz.	4 fl. Oz.	16 fl. Oz.	2 x 16 fl. Oz.	1 gal.	5 gal.
19569	50350	$ 72.50	$136.00	$ 240.50	$193.75 / 16 oz.	$656.25	$ 1,923.75
19571	06350	$ 71.50	$139.50	$ 255.25	$ 204.75 / 16 oz.	$719.25	$ 2,726.25

FOB & SHIPPING POINT: CEDAR GROVE, NJ 07009 – USA
MINIMUM ORDER – USA, CANADA, MEXICO : $ 50.00 ◆ INTERNATIONAL: $ 70.00
SEE SALES POLICY FOR FULL TERMS / PRICES SUBJECT TO CHANGE WITHOUT NOTICE

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FUSED SILICA MATCHING LIQUID CODE 06350 30-NOV-17

n (589.3nm) 25°C = 1.4587

TYPICAL CHARACTERISTICS

COMPOSITION ..... Aliphatic and Alicyclic Hydrocarbons
APPEARANCE ..... Colorless Liquid
COLOR STABILITY IN DIRECT SUN ..... No visible change after 10 years
INDEX CHANGE RATE BY EVAPORATION ..... Very Low: 0.00002 expected
exposed surface area to volume ratio of 0.2 cm^2/cc @ 25°C for 32 days
ODOR ..... None
FREEZING POINT °C ..... < -18
BOILING POINT °C @ 760mm Hg ..... > 343
FLASH POINT °C C.O.C. ..... > 216
DENSITY g/cc @ 25°C 0.824
DENSITY TEMP. COEFFICIENT g/cc/°C ..... -0.0006
COEF. OF THERM. EXP. cc/cc/°C 0.0008
VISCOSITY @ 25°C ..... 80 cSt
SURFACE TENSION dynes/cm @ 25°C..... 29
SOLUBLE: Carbon Tetrachloride, Diethyl Ether, Freon TF, Heptane, Methylene Chloride, Naphtha, Toluene, Turpentine, Xylene
PARTLY SOLUBLE: Acetone
INSOLUBLE: Ethanol, Water
COMPATIBLE 6-month immersion at 25°C: Acrylic, Cellulose Acetate, Epoxy, Mylar, Nylon, Polycarbonate, Polyester, Polyethylene, Polypropylene, Polystyrene, Polyurethane, Polyvinyl Chloride, Phenolic, Teflon, Neoprene, Fluorosilicone (Silastic 730 RTV), Silicone (Sylgard 184, 3140 RTV) Rubbers, Tygon F-4040-A, Tygothane, Aluminum, Copper, Brass, Steel; (tests done on one example of each).
INCOMPATIBLE: Latex Rubber, Tygon except F-4040-A

CAUCHY EQUATION: Refractive index as a function of wavelength at 25.0°C

W = wavelength (nm)

$$n(W) = 1.44719 + (3.83343E+03) / W^2 + (5.66134E+07) / W^4$$

SOURCE OR SPECTRAL LINE	WAVELENGTH (nm)	REFRACTIVE INDEX 25°C	% TRANSMITTANCE 25°C 1 mm	1 cm	10 cm
near UV cut off	225	1.55	1	0	0
excimer	248	1.52	1	0	0
local dip	270	1.51	84	18	0
Excimer	308	1.494	99	92	42
N Laser	337	1.485	99	95	60
i (Hg)	365	1.4792	100	98	78
F (H)	486.1	1.4644	100	100	95
e (Hg)	546.1	1.4607	100	100	99
D (Na:D1,D2 mean)	589.3	1.4587	100	100	99
HeNe Laser	632.8	1.4571	100	100	99
C (H)	656.3	1.4564	100	100	100
GaAs laser	840	1.4527	100	99	91
Nd: YAG laser	1064.8	1.451	99	95	60
Diode	1300	1.449	99	88	27
Diode	1550	1.449	98	79	9

$n_F - n_C$	=	0.0080
Abbe v_D: $(n_D - 1)/(n_F - n_C)$	=	57.1
Temp. coef: dn_D/dt 15 - 35°C	=	-0.000365

CARGILLE LABORATORIES

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FUSED SILICA MATCHING LIQUID CODE 50350 30-NOV-17

n (589.3nm) 25°C = 1.4587

TYPICAL CHARACTERISTICS

COMPOSITION ..... Aliphatic and Alicyclic Hydrocarbons
APPEARANCE ..... Colorless Liquid
COLOR STABILITY IN DIRECT SUN ..... No visible change after 10 years
INDEX CHANGE RATE BY EVAPORATION ..... Very Low: 0.00001 expected
exposed surface area to volume ratio of 0.2 cm^2/cc @ 25°C for 32 days
ODOR ..... None
FREEZING POINT °C ..... < -7
BOILING POINT °C @ 760mm Hg ..... > 262
FLASH POINT °C C.O.C. ..... > 138
DENSITY g/cc @ 25°C 0.831
DENSITY TEMP. COEFFICIENT g/cc/°C ..... -0.0007
COEF. OF THERM. EXP. cc/cc/°C 0.0008
VISCOSITY @ 25°C ..... 19 cSt
SURFACE TENSION dynes/cm @ 25°C..... 29
SOLUBLE: Carbon Tetrachloride, Diethyl Ether, Freon, Heptane, Naphtha, Toluene, Turpentine, Xylene
PARTLY SOLUBLE: Most Organic Solvents
INSOLUBLE: Ethanol, Water
COMPATIBLE 10-month immersion at 25°C: Acrylic, Cellulose Acetate, Epoxy, Mylar, Nylon, Polycarbonate, Polyester, Polyethylene, Polypropylene, Polystyrene, Polyurethane, Polyvinyl Chloride, Phenolic, Teflon, Neoprene, Fluorosilicone (Silastic 730 RTV), Silicone (Sylgard 184), Rubbers, Tygon F-4040-A, Tygothane, Aluminum, Copper, Brass, Steel; (tests done on one example of each).
INCOMPATIBLE: Latex Rubber, Silicone (Sylgard 3140 RTV) Rubbers, Tygon except F-4040-A

CAUCHY EQUATION: Refractive index as a function of wavelength at 25.0°C

W = wavelength (nm)

$$n(W) = 1.44690 + (3.98963E+03) / W^2 + (3.75775E+07) / W^4$$

SOURCE OR SPECTRAL LINE	WAVELENGTH (nm)	REFRACTIVE INDEX 25°C	% TRANSMITTANCE 25°C 1 mm	1 cm	10 cm
near UV cut off	225	1.54	48	0	0
excimer	248	1.52	93	50	0
local dip	270	1.51	89	31	0
Excimer	308	1.493	98	84	18
N Laser	337	1.485	100	98	86
i (Hg)	365	1.4790	100	99	93
F (H)	486.1	1.4645	100	100	95
e (Hg)	546.1	1.4607	100	100	95
D (Na:D1,D2 mean)	589.3	1.4587	100	100	95
HeNe Laser	632.8	1.4571	100	100	95
C (H)	656.3	1.4564	100	100	99
GaAs laser	840	1.4526	100	100	96
Nd: YAG laser	1064.8	1.450	99	95	57
Diode	1300	1.449	99	88	29
Diode	1550	1.449	98	81	12

$n_F - n_C$	=	0.0081
Abbe v_D: $(n_D - 1)/(n_F - n_C)$	=	56.7
Temp. coef: dn_D/dt 15 - 35°C	=	-0.000386

Cargille

Optical Gel

PATENT PENDING

SPECIALTY OPTICAL LIQUIDS

OPTICAL GELS AND SUB-LUX GELS

OPTICAL COUPLANT GEL FOR OPTICAL COMPONENTS

Optical Gels are:

- ABLE TO REDUCE OR ELIMINATE INTERNAL REFLECTIONS in fiber optic systems while providing exceptionally high transmittance over a broad range of wavelengths from the near UV to the near infrared.

- USED AS A MODE STRIPPING GEL for removal of extraneous signals otherwise carried on optical fiber cladding allows detectors to record only the signal propagated by the fiber core.

- STABLE over a wide range of temperatures (freezing point below -67 °C, boiling point above 400 °C) and have less tendency to cloud than other popular optical couplants.

NEW SUB-LUX GELS ARE:

- PROFOUNDLY BLACK GELS with refractive indices close to many common glasses. The purpose of each gel is to minimize ghost images caused by secondary reflections off a lens surface. When the gel is near the refractive index of a glass element, light going through the glass goes into the gel and is trapped by absorption in sub-micron particles.

- STABLE, will not harden, dry out or evaporate.

STANDARD PARAMETERS

n_D RANGE	n_D ACCURACY	WAVELENGTH CHARACTERIZATION	VISCOSITY (cSt @ 25°C)	CALIBRATION TEMPERATURE	MATERIAL SAFETY DATA SHEET
1.457 1.517 Sub-Lux 1.46 1.52 1.54	APPROX.	5893 Å	GEL	25°C	AVAILABLE

SEE SECTION ON OPTICAL DATA AVAILABLE AND CUSTOM CHANGES.

RI-OG-DS-198
Replaces: RI-OG-DS-197A
Effective Date: January 15, 2022

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CARGILLE OPTICAL GELS: nD 1.46

Cargille Optical Gels Codes 0607 and 0608 have two primary uses:

First, as an optical coupling for optical fibers and optical components, they reduce or eliminate internal reflectance thus increasing transmittance of light. They do this by having a refractive index and dispersion similar to many glasses and optical plastics, and closely match the refractive index and dispersion of fused silica.

A second primary use is as a mode stripping gel. When one of the gels is coated on a silica fiber that has cladding, it will remove the signal from the cladding. This is useful when evaluating fiber systems using only short fiber lengths, in that the signal that is carried for a short distance in the cladding can be eliminated from the system and detectors will record only the signal propagated by the fiber core. This is quicker and easier than mechanically stripping away the cladding and is non-destructive.

These gels have several very desirable properties. They are transparent to radiation in the near UV, the visible, and the near infrared. We know of no other liquids, gels, or greases with significantly better transmittance. Each has wide temperature stability. Freezing points are below –67 °C and boiling point exceeds 400 °C. This means a more stable refractive index than some other liquid, gel or grease couplants.

WHAT'S THE DIFFERENCE ?

Optical Gels Codes 0607 and 0608 are optically and chemically nearly identical, and both are used for coupling optical fibers and other optical components, and for mode stripping. Optical Gel Code 0607 is a thinner gel than 0608 and, upon standing, the surface of 0607 will normally appear to be fluid. Code 0608 appears to be much less fluid.

Optical Gel Code 0607	although not water soluble, made to "disperse" when immersed in water to facilitate cleaning.
Optical Gel Code 0608	specially made for applications where water immersion *without* dispersing or changing is required.

PACKAGED IN 1 OZ BOTTLES	Cat. # 24230	Optical Gel Code 0607	1 x 1 fl oz	2 x 1 fl oz
	Cat. # 24231	Optical Gel Code 0608	$ 98.00	$ 92.25 / ea.

For Technical Data, Request Typical Characteristics

See Sales Policy For Full Terms / Prices Subject To Change Without Notice
FOB & Shipping Point: 55 Commerce Rd., Cedar Grove, NJ 07009 USA Minimum Order – USA, Canada, Mexico : $ 50.00 • International: $ 70.00

RI-OG-152-DS-198
Replaces: RI-OG-152-DS-197A
Effective Date: January 15, 2022

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CARGILLE OPTICAL GEL : nD = 1.52

BK – 7 Matching Liquid

Optical Gel Code 081160 nD = 1.52 has the refractive index of BK – 7 glass and is close to the refractive indices of other frequently used glasses. As an optical couplant, it is used to reduce or eliminate reflection losses. It is not recommended for Acrylic with which it is slightly incompatible at elevated temperatures. It is normally opalescent / translucent but is clear in thin layers as it is normally used. It is usable over a wide range of temperatures: its freezing point is < -45 °C and its boiling point is >370 °C.

PACKAGED IN 1 OZ. CONTAINERS	Cat. # 24317	Optical Gel 1.52	1 fl. oz. $ 136.50	2 x 1 fl. oz. $ 126.50 /ea.

For Technical Data, Request Typical Characteristics

See Sales Policy For Full Terms / Prices Subject To Change Without Notice
FOB & Shipping Point: 55 Commerce Rd., Cedar Grove, NJ 07009 USA
Minimum Order – USA, Canada, Mexico: $ 50.00 • International: $ 70.00

RI-OGSL-DS-198
Replaces: RI-OGSL-DS-197A
Effective Date: January 15, 2022

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Phone: 973-239-6633 • Fax: 973-239-6096 • WWW.CARGILLE.COM

CARGILLE SUB-LUX GELS

Cargille Sub-Lux Gels are profoundly black gels with refractive indices close to many common glasses. The purpose of each gel is to minimize ghost images caused by secondary reflections off of a lens surface. When the gel is near the refractive index of a glass element, light going through the glass, goes into the gel and is trapped by absorption in sub-micron particles of black pigment.

The gels are very stable and will not harden, dry out, or evaporate. They are available in three refractive indices: nD=1.46, 1.52, and 1.54 at 25 °C.

				1 x 1 fl.oz.	1 x 4 fl.oz.	4 x 4 fl.oz.	
Cat # 24310	Sub-Lux	1.46	Code 0608C				
Cat # 24320	Sub-Lux	1.52	Code 081160C	$118.50	$ 275.00	$ 232.00	/ea.
Cat # 24330	Sub-Lux	1.54	Code 081160C				

See Sales Policy For Full Terms / Prices Subject To Change Without Notice
FOB & Shipping Point: 55 Commerce Rd., Cedar Grove, NJ 07009 USA Minimum Order – USA, Canada, Mexico: $ 50.00 • International: $ 70.00

CARGILLE LABORATORIES

55 Commerce Road • Cedar Grove • New Jersey • 07009 – 1289 USA

Ph: 973-239-6633 • Fax: 973-239-6096 • CargilleLabs@cargille.com • www.cargille.com

OPTICAL GEL CODE 0607 30-NOV-17

n (589.3nm) 25°C = 1.457

TYPICAL CHARACTERISTICS

COMPOSITION ..... Aliphatic Hydrocarbons and Gelling Agents
APPEARANCE ..... Colorless to slightly yellow gel
COLOR STABILITY IN DIRECT SUN ..... No visible change after 9 years
INDEX CHANGE RATE BY EVAPORATION ..... Very Low: 0.0000 expected
exposed surface area to volume ratio of 0.2 cm²/cc @ 25°C for 32 days
ODOR ..... None
FREEZING POINT °C ..... < -67
BOILING POINT °C @ 760mm Hg ..... >416
FLASH POINT °C C.O.C. ..... >245
DENSITY g/cc @ 25°C 0.878
DENSITY TEMP. COEFFICIENT g/cc/°C ..... -0.0006
COEF. OF THERM. EXP. cc/cc/°C 0.0007
VISCOSITY @ 25°C ..... Soft Gel
OIL SEPERATION 100°C for 24 hours, % by weight..... <0.05
WEIGHT LOSS 100°C for 24 Hours, %.....<0.05
WATER IMMERSION.....Gel disperses
PARTLY SOLUBLE: Most Organic Solvents (to remove from glass use Kimwipe & Glass Cleaner)
INSOLUBLE: Acetone, Ethanol, Water
COMPATIBLE 10-month immersion at 25°C: Acrylic, Cellulose Acetate, Epoxy, Mylar, Nylon, Polycarbonate, Polyester, Polyethylene, Polypropylene, Polystyrene, Polyurethane, Polyvinyl Chloride, Phenolic, Teflon,Neoprene, Fluorosilicone (Silastic 730 RTV), Silicone (Sylgard 184, 3140 RTV) Rubbers, Aluminum, Copper, Brass, Steel; (tests done on one example of each).
INCOMPATIBLE: Latex Rubber, Tygon types: S-50-HL, R-3603, B-44-3

CAUCHY EQUATION: Refractive index as a function of wavelength at 25.0°C

W = wavelength (nm)

$$n(W) = 1.44503E + (4.40960E+03) / W^2 + (-2.85878E+07) / W^4$$

SOURCE OR SPECTRAL LINE	WAVELENGTH (nm)	REFRACTIVE INDEX 25°C	% TRANSMITTANCE 25°C 1 mm	1 cm	10 cm
near UV cut off	320	1.486	83	15	0
i (Hg)	365	1.477	98	81	12
h (Hg)	404.7	1.471	99	92	42
F' (Cd)	480	1.464	100	98	78
F (H)	486.1	1.463	100	98	79
e (Hg)	546.1	1.459	100	98	86
D (Na D1, D2 mean)	589.3	1.457	100	99	90
HeNe laser	632.8	1.456	100	99	92
C' (Cd)	643.9	1.455	100	99	90
C (H)	656.3	1.455	100	99	92
Ruby Laser	694.3	1.454	100	100	98
GaAs laser	840	1.451	100	100	99
Nd: YAG laser	1064.8	1.449	100	95	61
Diode	1300	1.448	99	91	39
Diode	1550	1.447	98	80	11

$n_F - n_C$	=	0.008
Abbe v_D: $(n_D - 1)/(n_F - n_C)$	=	57
Temp. coef: dn_D/dt 15 - 35°C	=	-0.00035

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OPTICAL GEL CODE 0608 30-NOV-17

n (589.3nm) 25°C = 1.457

TYPICAL CHARACTERISTICS

COMPOSITION ..... Aliphatic Hydrocarbons and Gelling Agents
APPEARANCE ..... Colorless Gel
COLOR STABILITY IN DIRECT SUN ..... No visible change after 9 years
INDEX CHANGE RATE BY EVAPORATION ..... Very Low: 0.0000 expected
exposed surface area to volume ratio of 0.2 cm^2/cc @ 25°C for 32 days
ODOR ..... None
FREEZING POINT °C ..... < -67
BOILING POINT °C @ 760mm Hg ..... >416
FLASH POINT °C C.O.C. ..... >245
DENSITY g/cc @ 25°C 0.878
DENSITY TEMP. COEFFICIENT g/cc/°C ..... -0.0007
COEF. OF THERM. EXP. cc/cc/°C 0.0008
VISCOSITY @ 25°C ..... Soft Gel
OIL SEPERATION 100°C for 24 hours, % by weight..... <0.05
WEIGHT LOSS 100°C for 24 Hours, %.....<0.05
WATER IMMERSION.....No effect
PARTLY SOLUBLE: Most Organic Solvents (to remove from glass use Kimwipe & Xylene)
INSOLUBLE: Acetone, Ethanol, Water
COMPATIBLE 10-month immersion at 25°C: Acrylic, Cellulose Acetate, Epoxy, Mylar, Nylon, Polycarbonate, Polyester, Polyethylene, Polypropylene, Polystyrene, Polyurethane, Polyvinyl Chloride, Phenolic, Teflon, Neoprene, Fluorosilicone (Silastic 730 RTV), Silicone (Sylgard 184, 3140 RTV) Rubbers, Aluminum, Copper, Brass, Steel; (tests done on one example of each).
INCOMPATIBLE: Latex Rubber, Tygon types: S-50-HL, R-3603, B-44-3

CAUCHY EQUATION: Refractive index as a function of wavelength at 25.0°C

W = wavelength (nm)

$n(W) = 1.4451400 + (4.3176E+03) / W^2 + (-1.80659E+07) / W^4$

SOURCE OR SPECTRAL LINE	WAVELENGTH (nm)	REFRACTIVE INDEX 25°C	% TRANSMITTANCE 25°C 1 mm	1 cm	10 cm
near UV cut off	320	1.486	70	3	0
i (Hg)	365	1.477	98	84	16
h (Hg)	404.7	1.471	99	91	40
F' (Cd)	480	1.464	100	97	71
F (H)	486.1	1.463	100	97	72
e (Hg)	546.1	1.459	100	98	80
D (Na D1, D2 mean)	589.3	1.457	100	99	90
HeNe laser	632.8	1.456	100	99	92
C' (Cd)	643.9	1.455	100	100	95
C (H)	656.3	1.455	100	100	96
Ruby Laser	694.3	1.454	100	100	99
GaAs laser	840	1.451	100	100	99
Nd: YAG laser	1064.8	1.449	100	97	74
Diode	1300	1.448	99	91	39
Diode	1550	1.447	98	83	16

$n_F - n_C$	=	0.008
Abbe v_D: $(n_D - 1)/(n_F - n_C)$	=	57
Temp. coef: dn_D/dt 15 - 35°C	=	-0.00035

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OPTICAL GEL CODE 081160 30-NOV-17

n (589.3nm) 25°C = 1.517

TYPICAL CHARACTERISTICS

COMPOSITION ..... Phthalate Esters and Gelling Agents
APPEARANCE ..... Colorless Translucent
COLOR STABILITY IN DIRECT SUN ..... May slightly discolor in 1 to 8 years
INDEX CHANGE RATE BY EVAPORATION ..... Very Low: -0.00001 expected
exposed surface area to volume ratio of 0.2 cm^2/cc @ 25°C for 32 days
ODOR ..... Slightly Characteristic
FREEZING POINT °C ..... < -45
BOILING POINT °C @ 760mm Hg ..... >370
FLASH POINT °C C.O.C. ..... >199
DENSITY g/cc @ 25°C 1.110
DENSITY TEMP. COEFFICIENT g/cc/°C ..... -0.0008
COEF. OF THERM. EXP. cc/cc/°C 0.0007
VISCOSITY @ 25°C ..... Soft Gel
PARTLY SOLUBLE: Most Organic Solvents (to remove from glass use Kimwipe & Glass Cleaner)
INSOLUBLE: Acetone, Ethanol, Water
COMPATIBLE 10-month immersion at 25°C: Acrylic, Cellulose Acetate, Epoxy, Mylar, Nylon, Polycarbonate, Polyethylene, Polypropylene, Phenolic, Teflon, Fluorosilicone (Silastic 730 RTV), Silicone (Sylgard 184, 3140 RTV) Rubber, Aluminum, Copper, Brass, Steel; (tests done on one example of each).
INCOMPATIBLE: Polystyrene, Polyurethane, Polyvinyl Chloride, Latex Rubber, Neoprene Rubber, Tygon, (Acrylic and Polycarbonate at 55°C)

CAUCHY EQUATION: Refractive index as a function of wavelength at 25.0°C

W = wavelength (nm)

$$n(W) = 1.49614 + (6.92199E+03) / W^2 + (8.07052E+07) / W^4$$

SOURCE OR SPECTRAL LINE	WAVELENGTH (nm)	REFRACTIVE INDEX 25°C	% TRANSMITTANCE 25°C 0.01 mm	0.1mm	1 mm
near UV cut off	320	1.571	97	72	04
i (Hg)	365	1.553	98	82	13
h (Hg)	404.7	1.541	99	87	26
F' (Cd)	480	1.528	99	93	48
F (H)	486.1	1.527	99	93	49
e (Hg)	546.1	1.520	99	95	60
D (Na D1, D2 mean)	589.3	1.517	100	96	68
HeNe laser	632.8	1.514	100	97	71
C' (Cd)	643.9	1.513	100	97	73
C (H)	656.3	1.513	100	97	74
Ruby Laser	694.3	1.511	100	98	76
GaAs laser	840	1.506	100	98	83
Nd: YAG laser	1064.8	1.502	100	99	86
Diode	1300	1.500	100	99	89
Diode	1550	1.499	100	99	90

$n_F - n_C$	=	0.014
Abbe v_D: $(n_D - 1)/(n_F - n_C)$	=	36
Temp. Coef: dn_D/dt 15 - 35°C	=	-0.00038

Cargille

Meltmounts™ for Microscopy

PATENTED

SPECIALTY OPTICAL LIQUIDS

MELTMOUNTS™ FOR MICROSCOPY

INCLUDING MELTMOUNTS™ for ASBESTOS

THERMOPLASTIC SLIDE MOUNTING AND OTHER OPTICAL COUPLING

Meltmounts™ are:

- INSTANT, they are thermal mountants and require " no oven-time "
- 100% USABLE, contain no solvents.
- LESS EXPENSIVE per slide.
- REVERSIBLE, thermally, for particle retrieval or re-orientation.
- SOLUBLE in toluene if needed for special techniques or clean-up.
- FLUID at 65°C, a temperature chosen because it makes a permanent mount and is harmless to the majority of specimens.
- PCB-FREE DIRECT REPLACEMENTS for "older style" media.

OLD MEDIA	MELTMOUNT™ EQUIVALENTS
Canada Balsam and other alternatives	Meltmount™ 1.539
Aroclor	Meltmount™ 1.662
Naphrax	Meltmount™ 1.704

STANDARD PARAMETERS

n_D RANGE	n_D ACCURACY	WAVELENGTH CHARACTERIZATION	VISCOSITY (cSt @ 25°C)	CALIBRATION TEMPERATURE	MATERIAL SAFETY DATA SHEET
1.539 1.55 1.582 1.605 1.662 1.680 1.704	±.001	5893 Å	> 500,000 (flowable solid)	25°C	AVAILABLE

SEE SECTION ON OPTICAL DATA AVAILABLE AND CUSTOM CHANGES.

MOM-MM-DS-198
Replaces: MOM-MM-DS-197A
Effective Date: January 15, 2022

Cargille
Services to the Science Since 1924

Cargille Laboratories

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Phone: 973-239-6633 • Fax: 973-239-6096 • WWW.CARGILLE.COM

CARGILLE MELTMOUNTS™ for MICROSCOPY
Including MELTMOUNTS™ for Asbestos

The Cargille Meltmount™ series of mounting media are specially formulated optical-quality thermoplastics for use in microscope slide mounting and in other optical coupling applications.

Meltmounts™ are:

1. **Instant** - they are thermal mountants and require "no oven time"
2. **100 % useable** - contain no solvents
3. **Less Expensive** per slide
4. **Reversible** - thermally, for particle retrieval or re-orientation
5. **Soluble** - in toluene if needed for special techniques or clean-up
6. **Fluid** at 65 °C - a temperature chosen because it makes a permanent mount and protects the majority of specimens from thermal changes
7. **PCB-FREE**
8. **Direct replacements** for 'older style' media

Old Media	Meltmounts™ Equivalent
Canada Balsam	Meltmount™ 1.539
Aroclor 5442	Meltmount™ 1.662
Naphrax	Meltmount™ 1.704

MELTMOUNT™ 1.539 Code 53 Cat.#24140 Patent Pending $ 77.25 /fl.oz

Meltmount™ 1.539 has a refractive index (nD @ 25 °C) of 1.539 and an Abbe V dispersion of 45 making it optically similar to Canada Balsam and, therefore, ideal for mounting many biological specimens but without the long drying time of Canada Balsam.

MELTMOUNT™ FOR CHRYSOTILE ASBESTOS Code 25761
Cat.#24145 Patent Pending $ 85.00 /fl.oz

Meltmount™ Code 25761 has dispersion characteristics making it appropriate for mounting chrysotile asbestos - **CALL TO CHECK AVAILABILITY**

MELTMOUNT™ 1.582 Code 5870 Cat.#24150 Patented $ 77.25 /fl.oz

Meltmount™ 1.582 has a refractive index (nD @ 25 °C) of 1.582 and an Abbe V dispersion of 33. Its optical clarity makes it the preferred choice for minimum visible absorption.

MELTMOUNT™ 1.605 Code 5870 Cat.#24152 Patented $ 77.25 /fl.oz

Meltmount™ 1.605 has a refractive index (nD @ 25 °C) of 1.605 and an Abbe V dispersion of 30, making it appropriate for mounting asbestiform Tremolite, Anthophyllite and Actinolite.

MELTMOUNT™ 1.662 Code 5870 Cat.#24160 Patented $ 77.25 /fl.oz

Meltmount™ 1.662 has a refractive index (nD @ 25 °C) of 1.662 and an Abbe V dispersion of 26, optically similar to Aroclor 5442 , but is PCB-free.

MELTMOUNT™ 1.680 Code 5870 Cat.#24165 Patented $ 77.25 /fl.oz

Meltmount™ 1.680 has a refractive index (n_D @ 25 °C) of 1.680 and an Abbe V dispersion of 25, making it appropriate for mounting Amosite and Crocidolite asbestos.

MELTMOUNT™ 1.704 Code 5870 Cat.#24170 Patented $ 77.25 /fl.oz

Meltmount™ 1.704 has a refractive index (n_D @ 25 °C) of 1.704, similar to naphrax, and an Abbe V dispersion of 24.

QUICK-STICK™

Cargille Meltmount™ is now available in a convenient stick form called Quick-Stick™. It can be used to make permanent microscope slide mounts quickly.

Quick-Stick™ can be applied to a slide on a hotplate. As soon as the specimen and cover glass are positioned and the slide is cooled, you have a permanent prepared slide that can be reversed by reheating, if you should wish to retrieve a particular particle.

DESCRIPTION	nD		CAT. NO.		2/3 oz.
Quick-Stick™	1.539	Code 53	#24040	$	72.75 /ea
Quick-Stick™	1.582	Code 5870	#24050	$	72.75 /ea
Quick-Stick™	1.605	Code 5870	#24052	$	72.75 /ea
Quick-Stick™	1.662	Code 5870	#24060	$	72.75 /ea
Quick-Stick™	1.680	Code 5870	#24065	$	72.75 /ea
Quick-Stick™	1.704	Code 5870	#24070	$	72.75 /ea

Meltmount™ / Quick Stick™ and the proper care of your slides

Meltmount™ is a THERMAL PLASTIC MATERIAL. This means its viscosity is dependent on temperature, (inversely dependent). As the temperature increases the viscosity decreases. There is no sharp melting point. Being thermal plastic, it is capable of "cold flow". This means the Meltmount™, the specimen, the slide, and the cover slip can all move independently of each other given a mix of time, temperature, and lateral pressure or gravity.

Storage of prepared slides: treat them as the ***valuable*** items they are. Store:

A. Flat, cover slip on top
B. In the dark
C. Away from dust and fumes
D. Meltmount™ is meant to be thermally reversible. Don't allow this to happen inadvertently by storing or transporting prepared slides above 88 °F, (31.1 °C).

For complete technical information on Meltmounts™
contact the Cargille Technical Staff at 973-239-6633

™ *Meltmount and Quick-Stick are Trade Names of Cargille Laboratories*

FOB & SHIPPING POINT: CEDAR GROVE, NJ 07009 – USA
MINIMUM ORDER – USA, CANADA, MEXICO : $ 50.00 ◄► INTERNATIONAL: $ 70.00
SEE SALES POLICY FOR FULL TERMS / PRICES SUBJECT TO CHANGE WITHOUT NOTICE

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Ph: (973) 239-6633 8:15 AM - 4:45PM M-Th 8:00 AM - 12:00 PM Fri. ET
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Cargille

Diagrams of Cargille Optical Liquids

SPECIALTY OPTICAL LIQUIDS

DIAGRAMS OF CARGILLE OPTICAL LIQUIDS

Diagrams of Cargille Optical Liquids plotted for refractive index versus dispersion reveal some interesting information:

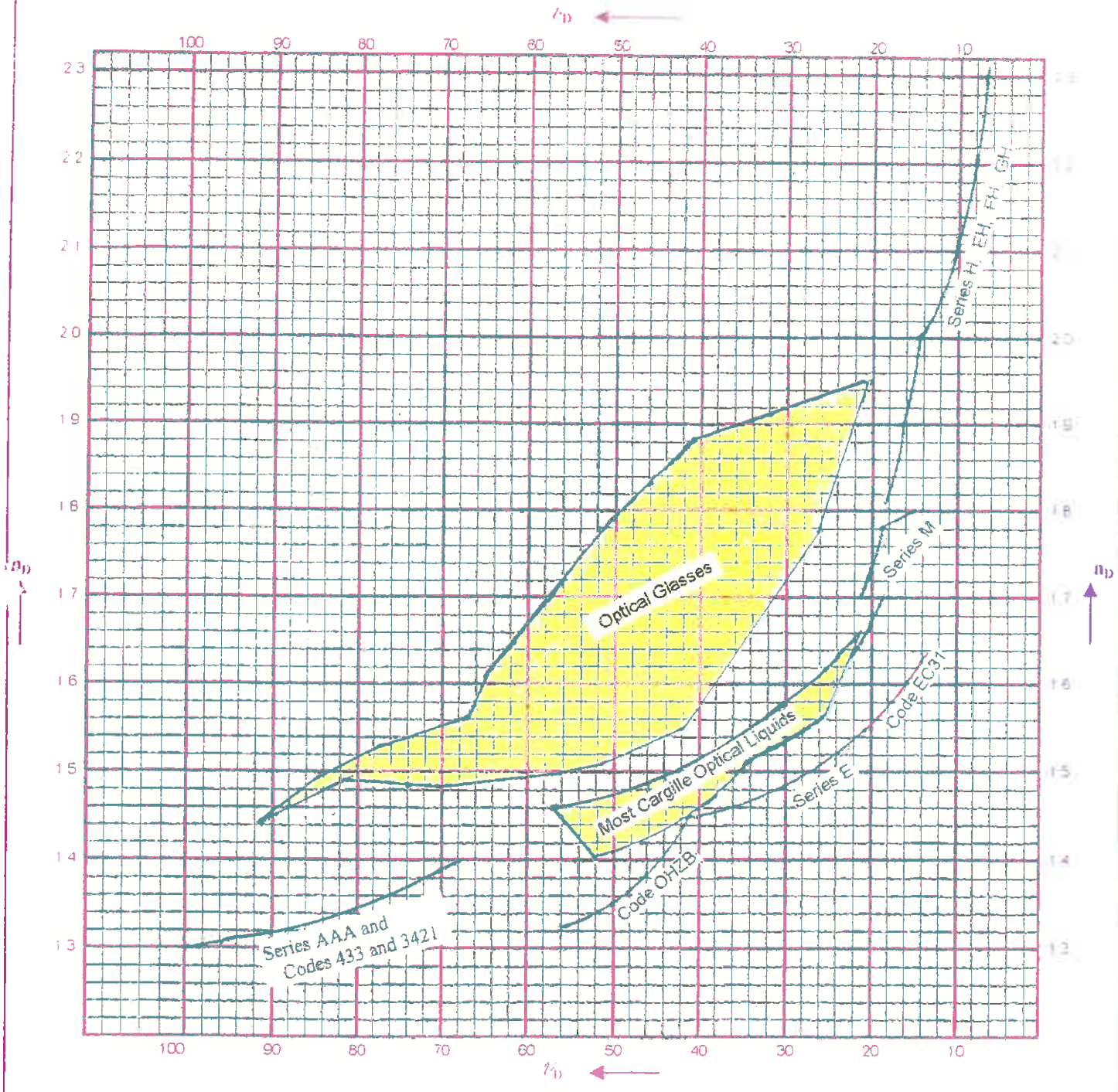
1. **CARGILLE OPTICAL LIQUIDS** fall into a somewhat different n_D/v_D range than optical glasses as seen in similar Optical Glass diagrams published by optical glass manufacturers. This different range makes possible some innovative optical configurations.

2. **CARGILLE OPTICAL LIQUIDS** cover a wider range of refractive indices than do optical glasses.

3. **CARGILLE OPTICAL LIQUIDS** are generally higher in dispersion than optical glasses.

Diagram of Optical Glasses and Cargille Optical Liquids

Technical Bulletin RI-DOLG-T-0476



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