Variable Pathlength Liquid Cell

User Manual

2I-07500-4

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P/N GS07500 Series

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1. Introduction

Thank you for buying a Specac product. We trust it will provide you with invaluable and excellent service in use.

The Variable Pathlength Liquid Cell P/N G07500 Series allows for liquids to be studied spectroscopically over a range of different pathlengths that can be set easily and quickly from one liquid cell assembly without the need to fully disassemble and rebuild the cell. The Variable Pathlength Cell is designed to be used with liquids at ambient temperatures and static (non-flow) applications.

There is a pair of one plane and one stepped circular window fitted into the Variable Pathlength Cell. The pathlength range is adjustable from a (theoretical) minimum of 0.00mm to 6.000mm maximum in increments of 0.005mm from a Vernier scale indicator by rotation of the outer body sleeve cap assembly containing the stepped window against the main body of the liquid cell containing the plane window. (The Micrometer Vernier scales enable accurate pathlength setting and readability.)

Although the windows are fitted and sealed into their respective main body and outer rotating body assemblies, the window surfaces themselves **do not rotate** against each other in relation to the movement for separation of the outer body sleeve cap assembly to the main body for change of a pathlength setting. Hence the windows, when properly fitted into the Variable Pathlength Cell remain parallel to each other throughout the entire pathlength range that can be set on the liquid cell.

There is a choice of standard windows from NaCl, KBr, CaF_2, BaF_2 and ZnSe material options that are supplied as fitted in the Variable Pathlength Cell. The variety of window material options allows for the study of many liquid sample types and there is a standard 3” x 2” slide mount fixing, such that the Variable Pathlength Cell can be used and easily installed within a very wide range of commercially available IR spectrometer systems.

2. Safety Considerations

With use of any spectroscopic accessory that involves the study of a wide range of chemical samples, the associated risk in handling may mostly be attributed to the specific sample type to be handled itself. As far as it possible you should follow a procedure for safe handling and containment of the type of sample to be used.

With respect to safety of use specifically for the Variable Pathlength Liquid Cell P/N GS07500 Series, this uses different window materials for containment of a specific liquid sample type within a stainless steel body for the cell itself. As standard, NaCl, KBr, CaF_2, BaF_2 and ZnSe windows are the five window materials of choice that can be used.

Caution: *Out of these five different window types, ZnSe is the most potentially hazardous material with respect to toxicity risk in use and handling.*

NaCl, KBr, CaF_2 and BaF_2 window materials can be considered relatively safe to use, although all of them may be harmful to the body if ingested in significant quantity. The general rule when working with **any** window/crystal material (and sample) **is to always wear gloves and safety gear** (e.g. safety spectacles) when handling to obviate the risk of contact with the skin.

Provided with each fitted window version of a Variable Pathlength Liquid Cell is a window material safety data sheet for the specific material itself that can be consulted for safe handling. A copy of each of these datasheets can also be found in this User Instruction Manual in the **Notes On Cleaning** Section found on pages 18 to 24.

3. Unpacking and Checklist

The Variable Pathlength Liquid Cell P/N GS07500 Series is despatched from Specac completely assembled ready for use. It is sealed in a container with silica gel as a desiccant.

Note: *When handling the Cell it is advisable to wear gloves at all times to prevent accidental touching of the windows, particularly if the window material is hazardous or moisture sensitive.*
Before opening the sealed container, ensure that it and its contents have reached the same temperature as the surroundings. The reason for this precaution is that during transit, the package may have become cold and if opened in a warm, moist atmosphere, the moisture will condense onto the Cell windows causing fogging. (NaCl and KBr windows are particularly susceptible to fogging from excess moisture in the atmosphere.)

On receipt of your Variable Pathlength Liquid Cell please check that the following have been supplied.

1 Variable Pathlength Liquid Cell complete with choice of windows fitted into position and marked with a Serial Number. (See Section 13), page 27 of this User Instruction Manual).
1 PTFE Luer plug.
1 PTFE reservoir cap stopper.
1 Window key.
1 Allen key 2.0mm short arm.
1 Allen key 1.5mm short arm.
1 Allen key 0.05 inches short arm.

After removing the Variable Pathlength Cell from its packaging, check that it is complete and that the black coloured outer body sleeve cap assembly (**1**) with silver coloured, graduated division markings in microns (0, 5, 10, etc), is free to rotate about the stainless steel body (**2**) with the black coloured Vernier graduations. **(See Fig 1.)**

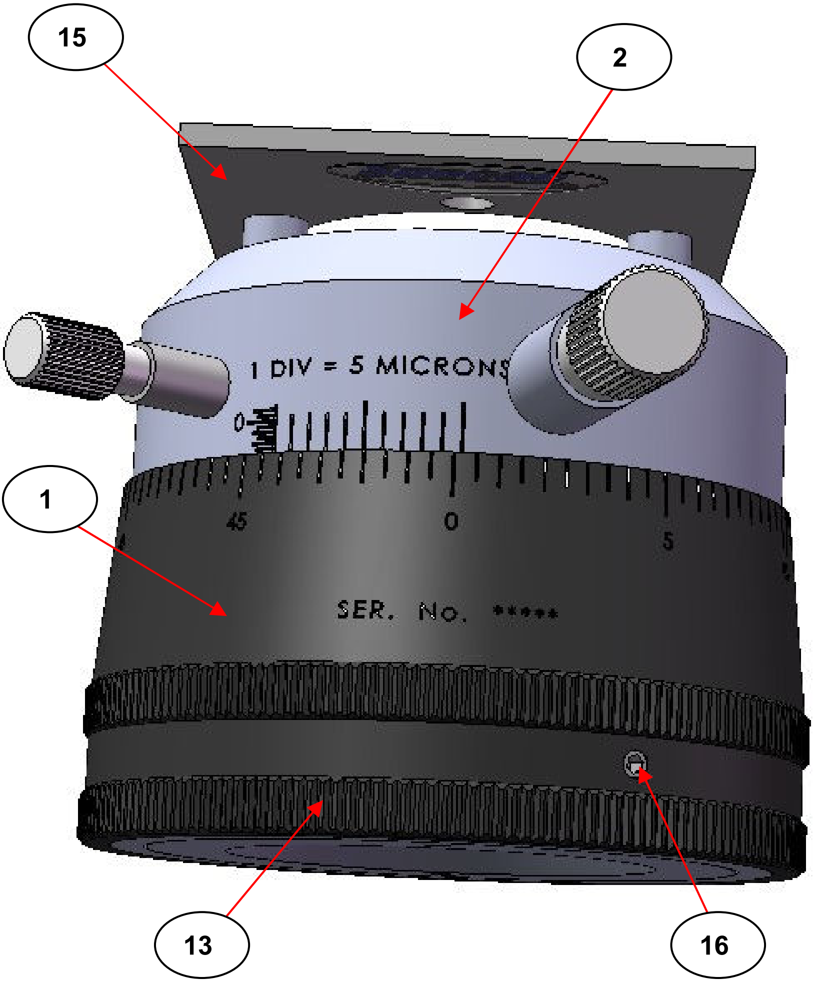

Fig 1. View of Vernier Scales for Pathlength Setting of the Variable Pathlength Liquid Cell GS07500 Series

4. Construction of the Variable Pathlength Cell

A schematic cross section (cutaway view) of the Variable Pathlength Cell is seen as **Fig 2.** There is one plane window (**3**) and one stepped window (**4**) used in the cell. The stepped window (**4**) moves laterally (in and out) within the cell body (**2**) in relation to the fixed plane window (**3**) by rotation of the black coloured outer body sleeve cap assembly (**1**), thus allowing for variation in the pathlength of the cell.

The plane window (**3**) is held in position in the cell body (**2**) by a clamping ring (**5**) and cushioned by a neoprene gasket (**6**) between the window (**3**) and clamping ring (**5**). A PTFE gasket (**7**) (0.1mm thick) is used to seal the plane window (**3**) against the cell body (**2**).

The stepped window (**4**) is held in the black coloured outer body sleeve cap assembly (**1**) by means of a clamp ring (**8**) and a further stainless steel ring (**9**). The clamp ring (**8**) has three small adjustable grub screws (**10**) in an equilateral triangular configuration, which are used to align the stepped window (**4**) for window surface parallelism with the fixed plane window (**3**). The grub screws (**10**) make contact with the stainless steel ring (**9**) which in turn affects the positioning of the stepped window (**4**). A PTFE gasket (**11**) (0.5mm thick) is used to cushion the stepped window (**4**) against the stainless steel ring (**9**) and a thinner PTFE gasket (**12**) (0.1mm thick) is used to seal the stepped window (**4**) against the internal housing flange face of the rotatable black coloured outer body sleeve cap assembly (**1**).

When the outer body sleeve cap assembly (**1**) is rotated anticlockwise via the knurled edge outer cap (**13**) in relation to a fixed position for the cell body (**2**), the pathlength of the Cell is increased as the window faces move further away from each other. Clockwise rotation of the outer body sleeve assembly (**1**) decreases the pathlength as the window faces move closer together. The window faces themselves do not rotate in relation to each other, so that when the windows are set parallel to each other, this parallelism remains constant throughout the pathlength range that can be set for the Cell.

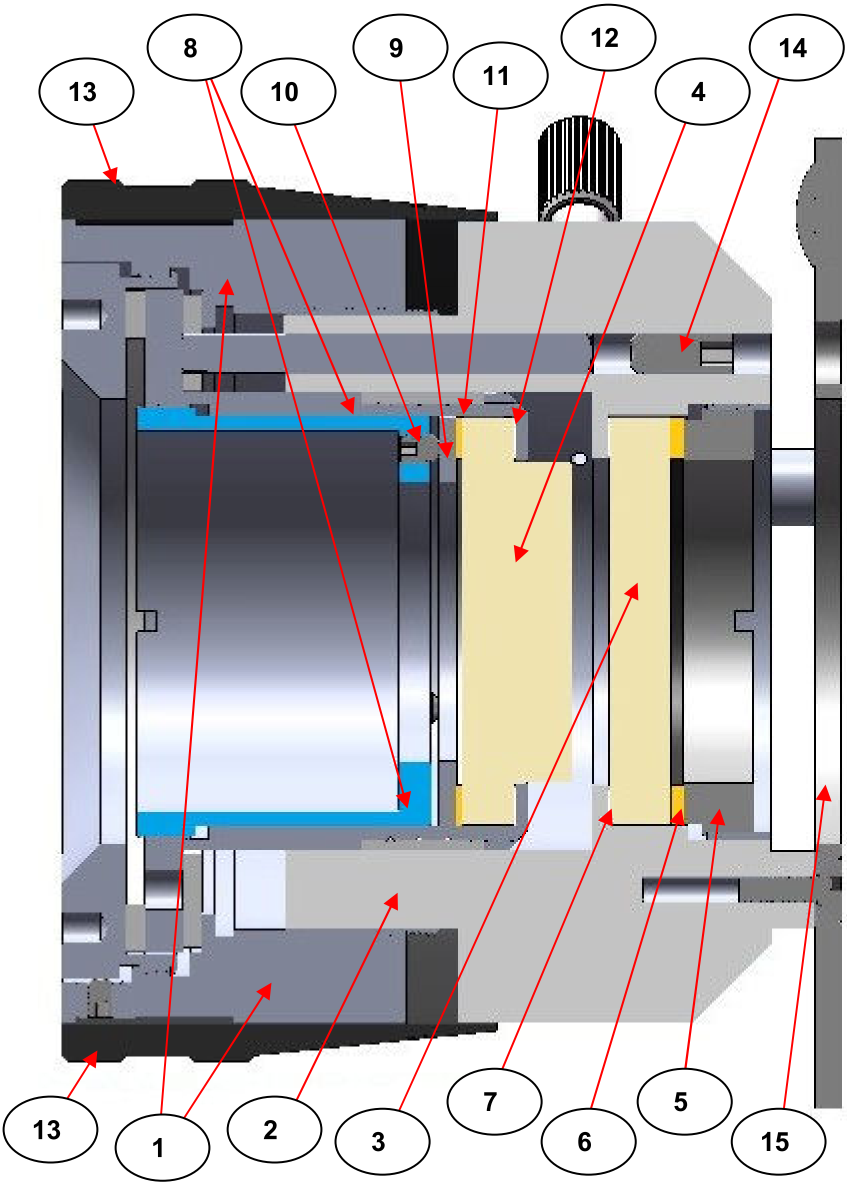

Fig 2. Cutaway Side View of Variable Pathlength Liquid Cell GS07500 Series

Theoretically, the windows (**3**) and (**4**) can be brought together such that their surfaces are in contact with each other, but they could be damaged by this action. To minimise the possibility of damage to the windows, the variable pathlength cell is fitted with an adjustable stop grub screw (**14**). This grub screw is accessible through the 3" x 2" mount plate (**15**) at the rear of the cell body (**2**). (See **Fig 5**., page 17.) When supplied from Specac, this grub screw (**14**) has been set to stop clockwise rotational movement of the outer body sleeve cap assembly (**1**) with a setting of a pathlength at approximately 0.080mm (80 microns) between the windows (**3**) and (**4**) inner surfaces. Therefore, when rotating the outer body sleeve cap assembly (**1**) clockwise, it will come to a stop at this minimum pathlength setting, beyond which it should not be forced. For shorter pathlengths, down to a practical measurable minimum of circa 0.025mm (25 microns), the stop grub screw (**14**) will require readjustment and should be unscrewed by the 1.5mm Allen key provided.

Important Note! *The three grub screws (**10**) on the clamp ring (**8**) should not be disturbed as these have been factory set to obtain a parallel window surface setting for the stepped window (**4**) to the fixed plane window (**3**).*

The Variable Pathlength Liquid Cell may be disassembled for cleaning for easier access to the internal window surfaces if required, by unscrewing completely the outer body sleeve assembly (**1**) away from the cell body (**2**) whereby the complete cell assembly separates into two parts. The outer body sleeve cap assembly (**1**) is turned anticlockwise further beyond the maximum 6mm pathlength setting as indicated by the Vernier scale gauges and when it has reached the limit of the screw threading attachment to the main body (**2**), can be pulled away to separate the parts. (There is a good suction fit due to the internal PTFE construction of parts to maintain a leak tight seal for the separation movement of the windows in change of a pathlength.) The fixed plane window (**3**) is retained in the body (**2**) and the stepped window (**4**) is retained in the outer body sleeve cap assembly (**1**).

This process for separation of these parts and their subsequent re-fitting does not alter the minimum pathlength setting as set by the adjustable stop grub screw (**14**) if the parts are handled carefully.

5. Installation of the Variable Pathlength Cell

The Variable Pathlength Cell is supplied fitted with a 3" x 2" mount plate (**15**) that allows the cell to fit directly into an IR spectrometer system via the spectrometers own 3" x 2" mount slide plate holder.

The Variable Pathlength Cell should be fitted in the spectrometer such that the focus point of the IR spectral beam passes through at the centre of the liquid cell cavity for the pathlength conditions that have been created.

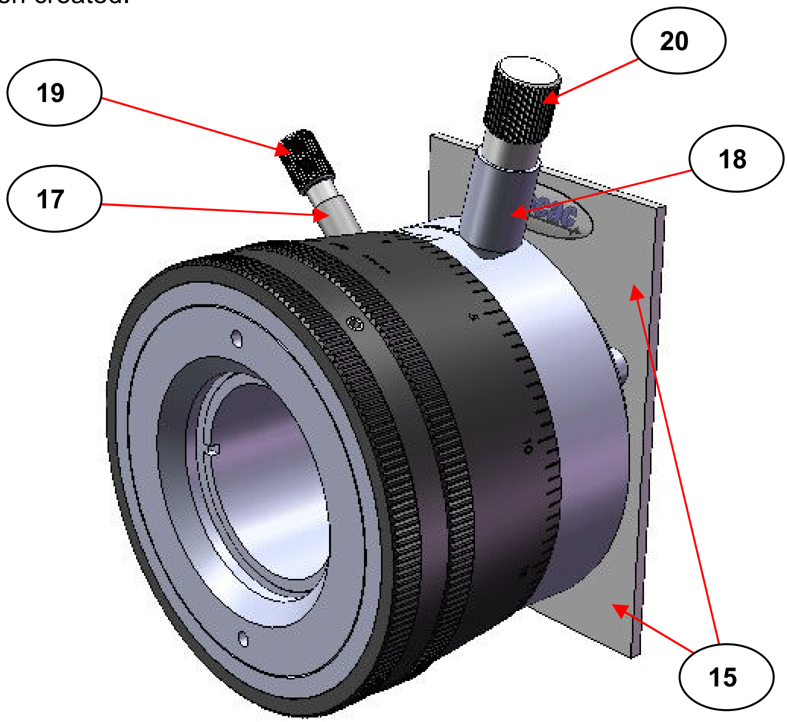

Fig 3. 3" x 2" Slide Mount Plate as Fitted to the Variable Pathlength Liquid Cell GS07500 Series

6. Adjusting the Pathlength of the Variable Pathlength Liquid Cell

As mentioned in section 3), adjustment of the pathlength for the Variable Pathlength Cell is achieved by rotation of the outer body sleeve cap assembly (**1**) about the cell body (**2**). (The whole outer body sleeve cap assembly (**1**) is turned by gripping of the knurling (**13**) on the outer black coloured sleeve cap.). One complete revolution of the outer body sleeve cap assembly (**1**), which contains the stepped window (**4**), changes the pathlength of the Cell by 0.5mm. The pathlength is set and read by means of the micrometer and Vernier scales.

The outer body sleeve cap assembly (**1**) has 100 graduated divisions (marked in silver). A rotational movement in either a clockwise (decrease pathlength) or anticlockwise (increase pathlength) direction equal to one of these divisions changes the pathlength by 0.005mm (5 microns). This scale is marked every 10 divisions i.e. every 0.05mm (50 microns). (See **Fig 1**. , page 6.)

The cell body (**2**) has a millimeter scale marked in black that runs parallel to the pathlength change axis of the Cell and is graduated in 0.5mm divisions from 0 to 6mm. Adjacent to this millimeter scale is a Vernier scale which permits the pathlength to be set within 0.005mm. (See **Fig 1**. , page 6.)

When setting the Variable Pathlength Cell for a desired pathlength it is recommended to always approach the pathlength setting from the same direction and it is best to adopt the practice of ***reducing*** the Cell pathlength to make the required setting. (Turn the outer body sleeve cap assembly (**1**) in a clockwise direction.) This will eject and push any excess liquid sample (if in the Cell) into the sample reservoir port (**18**) as the overall volume of the Cell decreases from a reduction in a pathlength setting, rather than potentially drawing air into the Cell and increase the risk of any bubbles being trapped in the liquid sample when measuring from an increased, anticlockwise turn of pathlength setting approach.

As mentioned, on receipt of the Variable Pathlength Liquid Cell when supplied as new, the minimum pathlength setting achievable has been set to approximately 0.080mm (80 microns), limited by the setting of the stop grub screw (**14**). A realistic, measurable pathlength of 0.025mm (25 microns) from a fringing pattern of an empty Cell, can be achieved by loosening of this grub screw (**14**) (turn the grub screw anticlockwise for 1 to 2 complete rotations) and then by turning the outer body sleeve cap assembly (**1**) clockwise by 11 divisions to reach a 0.025mm, (25microns) setting. The grub screw (**14**) can then be retightened, thus stopping further reduction in the pathlength of the Cell and preventing the window faces from accidently touching.

Note: *It should be possible to achieve a shorter pathlength than 0.025mm (25 microns) with the Variable Pathlength Cell by further clockwise rotation of the outer body sleeve cap assembly (**1**) when the grub screw (**14**) is loosened. However, it is not always possible to achieve a reliable fringing pattern of an empty Cell for precise calibration when adjusted for this shorter pathlength. (See Calibration of the Cell – Section 7).*

Specac would also advise not to try and adjust the Variable Pathlength Cell for pathlengths shorter than 0.025mm as you risk the window surfaces making contact with each other and possibly becoming damaged.

Warning! ***If very short pathlengths less than 0.025mm are needed and are attempted to be set, proceed with extreme care.***

7. Calibrating the Variable Pathlength Cell

For the most precise working with the Variable Pathlength Cell and to ensure that the micrometer and Vernier readings are the same as the ***actual*** pathlength of the cell (from the fringing pattern established when measuring an empty cell), it is recommended that the Cell is calibrated using the following procedure.

First, collect a reference background spectrum for the IR spectrometer system being used, **without** the Variable Pathlength Cell being positioned in the spectrometer.

Make sure that the Variable Pathlength Cell is empty (there is no liquid sample within) and set the micrometer scale to read 0.100mm (100 microns) from rotational adjustment of the outer body sleeve cap assembly (**1**). Slide the Variable Pathlength Cell into the 3" x 2" mount sample holder of the spectrometer using the Cells own 3" x 2" slide mount (**15**).

Collect an infrared spectrum of ***an interference fringing pattern*** for this pathlength setting of the empty Cell. A fringing pattern is a series of very regular repeating fine peaks and troughs of a sinusoidal wave pattern superimposed onto a general background throughput spectral trace for the window material being used in the Variable Pathlength Cell. The phenomenon of fringing occurs when the window surfaces for a Cell assembly are parallel to each other and the Cell is empty (no liquid sample within).

Note: *If **no fringing pattern** is observed then the window parallelism should be checked. However, in the first instance adjust the Cell to a different pathlength setting e.g. to 0.120mm (120 microns) to see if fringes are obtained for this pathlength setting. If it is believed that the windows are not parallel to each other (no fringes are seen) then the Cell should ideally be returned to Specac for window realignment. (**Please contact Specac for advice if in doubt**.)*

From the fringing pattern obtained, the thickness (pathlength) of the Cell can be calculated from the following formula.

$$t = \frac{10\ n}{2(f_1 - f_2)}$$

Where t = thickness in millimeters (cell pathlength).
n = number of fringes (peak to peak measurement).
f_1 = frequency at first peak (wavenumber position).
f_2 = frequency at second peak (wavenumber position).

If the calculated value for the pathlength found from the fringing pattern obtained **does not agree** with the micrometer and Vernier scale setting set for the Cell, then the knurled edge outer cap (**13**) of the outer body sleeve cap assembly (**1**) can be repositioned so that the silver graduated markings match correctly with the black micrometer and Vernier scales to coincide with the pathlength as calculated from the fringing pattern measurement.

Loosen the three grub screws (**16**) (See **Fig 1.**, page 6), that secure the knurled edge outer cap (**13**) to the outer body sleeve assembly (**1**). Rotate and position the outer cap (**13**) **ONLY** (be very careful that the whole outer body sleeve cap assembly (**1**) does not rotate, otherwise the pathlength setting will be lost), until the correct pathlength reading (found from the fringing calculation) is indicated by the micrometer and Vernier scales. Carefully retighten the three grub screws (**16**) to secure the outer cap (**13**) into its new correct position in relation to the rest of the outer body sleeve cap assembly (**1**).

Recheck the pathlength accuracy by repeating a spectral scan of the empty cell for a fringing pattern and recalculate.

After the pathlength has been established and the micrometer and Vernier scales match the pathlength obtained, the Variable Pathlength Cell can be adjusted to its recommended minimum pathlength setting of 0.025mm (25 microns). (Set the stop grub screw (**14**) for this minimum distance such that it prevents any accidental damage that may occur to the surface of the windows if they touch.)

Unscrew the stop grub screw (**14**) and rotate the sleeve cap assembly (**1**) clockwise to bring the pathlength from 0.100mm (100microns) to 0.025mm (25 microns) as measured by the 0.005mm graduated divisions on the sleeve cap assembly (**1**) against the micrometer and Vernier scales.

Now retighten the stop grub screw (**14**) until it makes contact with the inner part of the outer body sleeve cap assembly (**1**).

You can check this pathlength by scanning the empty Cell again (if desired) for the fringing pattern and recalculating from the formula.

$$t = \frac{10\ n}{2(f_1 - f_2)}$$

8. Window Parallelism

The Variable Pathlength Liquid Cell P/N GS07500 Series is supplied as new with the windows (**3**) and (**4**) fitted into position. They will have been aligned at Specac to ensure that the window faces are parallel to each other. When the window faces are parallel to each other, the fringing pattern can be observed for an empty Cell and consequently the pathlength of the Cell can be calculated (See Section 6).

The parallelism of the window faces is achieved by adjustment of the 3 grub screws (**10**) on the stepped window clamp ring (**8**). These grub screws should **NOT** be adjusted without risking the parallelism setting for the windows, which means that a fringing pattern could not be obtained for any subsequent calibration of the Cell and a correct pathlength setting from use of the micrometer and Vernier scales cannot be made.

If it is suspected that the windows (**3**) and (**4**) as fitted are not parallel and need adjustment or if replacement window materials are to be fitted into the Cell, then Specac would advise that the Variable Pathlength Cell should ideally be returned to Specac to carry out these operations. (***Please contact Specac for advice if in doubt.***)

9. Filling the Variable Pathlength Cell

The liquid sample volume for a given pathlength of the Variable Pathlength Cell can be calculated from the formula V = 1 + t, where t is the set pathlength of the cell (in millimetres) and V is the volume of the cell (in millilitres). This means that for every change in pathlength of 1mm, the volume of sample changes by 1ml.

Before filling the Cell, set the pathlength slightly longer than you require. Take a syringe with a Luer fitting and fill it with the liquid sample to be placed into the Variable Pathlength Cell. If possible the syringe should be filled with slightly more sample than would be required for the pathlength to be used.

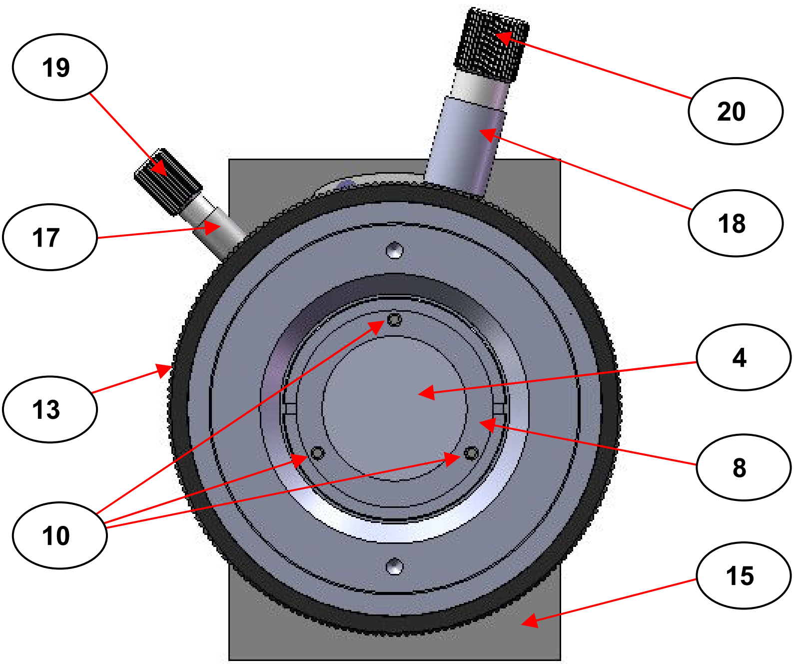

Fig 4. Front View of the Variable Pathlength Cell GS07500 Series

Fit the Luer of the syringe into the smaller Luer filling port (**17**) of the variable pathlength cell and inject the sample into the cell until it is seen starting to fill the larger reservoir port (**18**). Stop injecting and tilt the Cell backwards and forwards slightly to dislodge any air bubbles that may be trapped in the Cell. If bubbles emerge at the reservoir port (**18**), inject a little more sample. Remove the syringe from the Luer port (**17**) and fit the PTFE Luer plug (**19**).

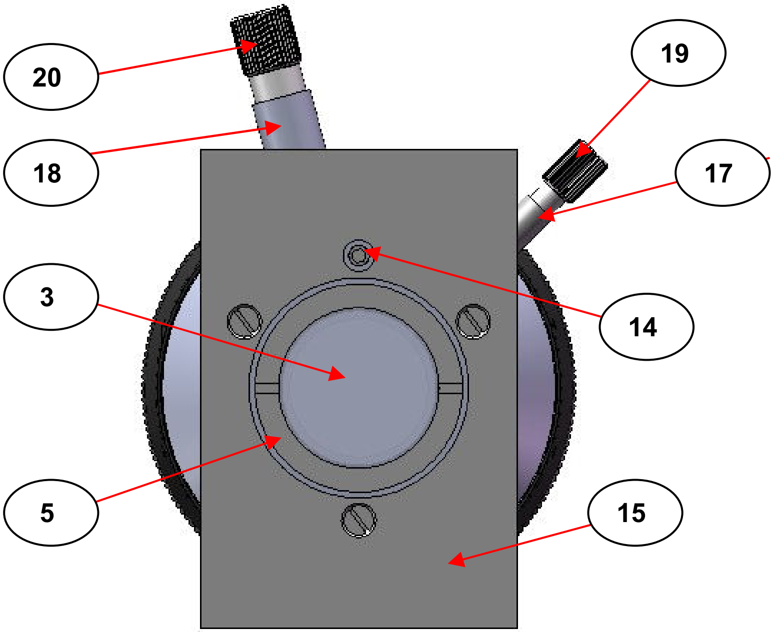

Fig 5. Back View (Through 3" x 2" Mount Plate) of the Variable Pathlength Cell GS07500 Series.

Now, reduce the pathlength of the Cell to the required pathlength by clockwise rotation of the outer body sleeve cap assembly (**1**). As the pathlength reduces, the liquid sample will be pushed out of the Cell area and into the reservoir port (**18**). If there is a large reduction in pathlength e.g. 1mm, then 1ml of sample will be displaced. A piece of tissue by the reservoir port (**18**) can be used to "mop up" any displaced sample out of the top of the port (**18**). When the required pathlength has been set, fit the PTFE reservoir cap stopper (**20**).

10. Care of the Variable Pathlength Cell

Always clean the Variable Pathlength Cell after use, taking special care if sticky or viscous samples have been used. It is usually sufficient to flush the Cell through with an organic solvent which does not contain water (e.g. methanol, acetone etc.), particularly if water sensitive window materials such as NaCl and KBr are fitted in the Cell. Introduce any solvent for cleaning via the small Luer port fitting (**17**) and allow any excess fluid to drain out of the Cell as washed flushings via the reservoir port (**18**).

After flushing, any residual solvent trapped within the Cell cavity may be evaporated from the Cell by pumping a gentle flow of air through from an empty Luer syringe or from an air-line attached to the small Luer port fitting (**17**) to exit via the reservoir port (**18**). Keep the Cell at room temperature or above when carrying out this cleaning procedure.

For materials which adhere stubbornly to the inside of the Cell, it may be necessary to separate the Cell parts to clean properly. This involves complete removal of the outer body sleeve cap assembly (**1**) from the main body (**2**) - see end paragraph Section 4, page 9). Take great care when cleaning the surface of the windows if they have been accessed from separation of the parts. Use suitable solvents and soft lens cleaning tissues.

Always store the Cell in a desiccator or dry cupboard when not in use.

Notes On Cleaning

When cleaning any window material being used in the Variable Pathlength Liquid Cell it is **very important to take care** to avoid damage to the window materials**.** As also mentioned in the Safety Considerations (Section 2, page 4), of the five standard window materials supplied that can be fitted in the Cell, ZnSe is potentially the most hazardous in terms of risk of toxicity if it comes into contact with the skin.

Note: ***Always wear gloves to protect yourself and the window material.***

Solvents such as water, methanol, acetone, hexane, chloroform etc are suitable to use for cleaning purposes, but avoid use of any solvents that are "wet" or contain trace amounts of water, as NaCl and KBr window materials will be damaged. CaF_2, BaF_2 and ZnSe window materials are generally chemically tolerant of a wide range of aqueous based **solutions**, but only sample solutions that fall within the pH range of pH4 to pH11 are tolerated by the ZnSe window material. Stronger acids and bases if introduced into the Variable Pathlength Cell will irreparably damage any ZnSe windows that are fitted.

Caution! *If in doubt that your liquid sample may be damaging to the window material being used within the Variable Pathlength Liquid Cell, always try to test a fragment of the window material type, if possible, with the chemical first.*

When wiping away any solid residues (if present) or a viscous liquid sample, use very soft lens tissues to avoid scratches being caused on the surface of the window material. Scratches and blemishes to the window surface will result in poor light throughput for the transmission technique (more risk of light scatter) and an overall degradation in the Variable Pathlength Liquid Cell performance.

Datasheet for Sodium Chloride (NaCl) Material

General

Synonyms: salt, sea salt, table salt, common salt, rock salt.
When fused together as a solid can be polished and used as a transmission window material. Slightly hygroscopic material similar to Potassium Bromide (KBr).
Soluble in water and glycerine. Slightly soluble in lower order alcohols.
Fairly good resistance to mechanical and thermal shock and can be easily polished.
Molecular formula: NaCl.
Chemical Abstracts Service (CAS) No: 7647-14-5.

Physical Data

Appearance: Odourless, white or colourless crystalline solid.
Melting point: 804°C.
Boiling point: 1413°C.
Vapour pressure: 1mm Hg at 865°C.
Specific gravity: 2.16 g cm^{-3}
Solubility in water: 35.7g/100g at 0°C.
Hardness: 6 Kg/mm^2.
Refractive Index: 1.52 (at 2000cm-1 - wavenumbers).
Spectroscopic transmission range: 40,000 to 600 cm-1 (wavenumbers).

Stability

Stable. Incompatible with strong oxidising agents.

Toxicology

Not believed to present a significant hazard to health. May cause eye irritation.

Personal Protection

Always wear safety spectacles and gloves when handling the powder or window material.
Allow for adequate ventilation.

Storage

Keep powder or windows stored in a cool, dry container.

Datasheet for Potassium Bromide (KBr) Material

General

Medium for making Potassium Bromide pellets for IR spectroscopy.
When fused together as a solid can be polished and used as a transmission window material. Hygroscopic material similar to Sodium Chloride (NaCl).
Soluble in water, glycerine and alcohols. Slightly soluble in ether.
Fairly good resistance to mechanical and thermal shock.
Molecular formula: KBr.
Chemical Abstracts Service (CAS) No: 7758-02-3.

Physical Data

Appearance: Odourless, white or colourless crystalline solid.
Melting point: 730°C.
Boiling point: 1380°C.
Vapour pressure: 1mm Hg at 795°C.
Specific gravity: 2.75 g cm^{-3}.
Solubility in water: 53.48g/100g at 0°C.
Hardness: 6 Kg/mm^2.
Refractive Index: 1.54 (at 2000cm-1 - wavenumbers).
Spectroscopic transmission range: 43,500 to 400 cm-1 (wavenumbers).

Stability

Stable. Incompatible with strong oxidising agents, strong acids, bromine trifluoride and bromine trichloride.

Toxicology

Harmful if ingested in large amounts, if inhaled, or if in repeated contact with the skin.

Personal Protection

Always wear safety spectacles and gloves when handling the powder or window material.
Allow for adequate ventilation.

Storage

Keep powder or windows stored in a cool, dry container.

Datasheet for Calcium Fluoride (CaF_2) Material

General

Known as Calcium Fluoride, Calcium Difluoride, Fluorspar or Irtran 3.
When powder is fused together, is used as a transmission window material.
Insoluble in water, resists most acids and alkalis. Is soluble in ammonium salts.
Its high mechanical strength makes it particularly useful for high pressure work.
Brittle material sensitive to mechanical and thermal shock. Does not fog.
Molecular formula: CaF_2.
Chemical Abstracts Service (CAS) No: 7789-75-5.

Physical Data

Appearance: Odourless, white or colourless crystalline solid.
Melting point: 1360°C.
Boiling point: 2500°C.
Solubility in water: 0.0017g/100g at 0°C.
Hardness: 158 Kg/mm^2.
Refractive Index: 1.40 (at 2000cm-1 - wavenumbers).
Spectroscopic transmission range: 77,000 * to 900 cm-1 (wavenumbers).

Stability

Stable.Incompatible with acids.

Toxicology

Harmful if ingested in large amounts, if inhaled, or if in repeated contact with the skin.

Personal Protection

Always wear safety spectacles and gloves when handling the powder or window material.
Allow for adequate ventilation.

Storage

Keep powder or windows stored in a cool, dry container.
(* UV Grade material required for this range limit.)

Datasheet for Barium Fluoride (BaF_2) Material

General

Synonyms: Barium Difluoride.
When powder is fused together, is used as a transmission window material.
Very slightly soluble in water, soluble in acids and ammonium chloride. Good resistance to fluorine and fluorides. Does not fog.
Its high mechanical strength makes it particularly useful for high pressure work.
Brittle material - very sensitive to mechanical and thermal shock.
Molecular formula: BaF_2.
Chemical Abstracts Service (CAS) No: 7787-32-8.

Physical Data

Appearance: Odourless, white or colourless crystalline solid.
Melting point: 1280°C.
Boiling point: 2137°C.
Solubility in water: 0.17g/100g at 0°C.
Hardness: 82 Kg/mm^2.
Refractive Index: 1.45 (at 2000cm-1 - wavenumbers).
Spectroscopic transmission range: 66,666 * to 800 cm-1 (wavenumbers).

Stability

Stable. Incompatible with acids.

Toxicology

Harmful if ingested in large amounts, if inhaled, or if in repeated contact with the skin.

Personal Protection

Always wear safety spectacles and gloves when handling the powder or window material. Allow for adequate ventilation.

Storage

Keep powder or windows stored in a cool, dry container.
(* UV Grade material required for this range limit.)

Datasheet for Zinc Selenide (ZnSe) Material

General

Toxic and hard yellow coloured crystalline powder when fused together as a solid can be used as a transmission window material or as a crystal material for attenuated total reflectance (ATR) FTIR spectroscopy.
Insoluble in water, but attacked by strong acids and bases. (pH range 4 to 11 tolerant).
Organic solvents have no effect.
Fairly brittle as a window material and sensitive to thermal and mechanical shock.
Molecular formula: ZnSe
Chemical Abstracts Service (CAS) No: 1315-09-9.

Physical Data

Appearance: Yellow crystals, granular powder or amber coloured window material
Melting point: 1515°C at 1.8 atmospheres. (26.5psi)
Solubility in water: 0g/100g at 0°C.
Hardness: 120 Kg/mm^2.
Refractive Index: 2.43 (at 2000cm-1 - wavenumbers).
Spectroscopic transmission range: 20,000 to 500 cm-1 (wavenumbers).

Stability

Stable. Reacts with acids to give highly toxic hydrogen selenide. May be air and moisture sensitive. Incompatible with strong acids, strong bases and strong oxidising agents.

Toxicology


Toxic if small amounts are inhaled or swallowed. In stomach toxic hydrogen selenide (H2Se) is liberated. Skin and eye irritant. Danger of cumulative effects from frequent handling without protection.

Personal Protection

Always wear safety spectacles and gloves when handling the powder or window material. Allow for good ventilation.

Storage

Keep powder or windows stored in a cool, dry container, with appropriate safety labelling.

11. Parts Identification List

(**1**) Sleeve cap assembly.
(**2**) Stainless steel body.
(**3**) Plane window.
(**4**) Stepped window.
(**5**) Clamp ring for plain window.
(**6**) Neoprene gasket.
(**7**) PTFE gasket (0.1mm thick).
(**8**) Clamp ring for stepped window.
(**9**) Stainless steel ring.
(**10**) Grub screw for parallelism adjustment.
(**11**) PTFE gasket (0.5mm thick).
(**12**) PTFE gasket (0.1mm thick).
(**13**) Knurled edge outer cap.
(**14**) Adjustable stop grub screw.
(**15**) 3” x 2” slide mount plate.
(**16**) Grub screw to secure knurled edge outer cap.
(**17**) Small Luer filling port.
(**18**) Reservoir port.
(**19**) PTFE Luer plug.
(**20**) PTFE reservoir cap stopper.

12. Spares for the Variable Pathlength Cell

Complete Variable Pathlength Liquid Cells GS07500 Series with Windows Fitted

P/N GS07500 Variable Pathlength Liquid Cell with NaCl windows.
P/N GS07501 Variable Pathlength Liquid Cell with KBr windows.
P/N GS07502 Variable Pathlength Liquid Cell with CaF2 windows.
P/N GS07503 Variable Pathlength Liquid Cell with BaF2 windows.
P/N GS07509 Variable Pathlength Liquid Cell with ZnSe windows.

Spare Parts

P/N GS07020 Pair of NaCl windows.
P/N GS07021 Pair of KBr windows.
P/N GS07022 Pair of CaF2 windows.
P/N GS07023 Pair of BaF2 windows.
P/N GS07096 Pair of ZnSe windows.
P/N GS01110 Luer syringe (2ml).
P/N GS07130 Neoprene gaskets (pkt 10).
P/N GS07135 Luer plug and reservoir cap.
P/N GS07140 Teflon gaskets 0.1mm thick (pkt 10).
P/N GS07150 Window Key for Variable Pathlength Cell.

13. Variable Pathlength Cell Serial Numbers

Your Variable Pathlength Liquid Cell P/N GS07500 Series will be provided with a serial number for identification of the original window materials supplied as fitted to the Cell. The serial number takes the form of a five figure number preceded by a letter e.g. **P12345**.

To help you, please use the grid below to fill in the serial number information of the Variable Pathlength Liquid Cell assembly you have received.

If you need to contact Specac for any issues regarding your Variable Pathlength Liquid Cell it may be necessary to provide the serial number of the item to identify for replacement parts.

Variable Pathlength Liquid Cell Assembly With Fitted Windows	Serial Number
GS07500 Variable Pathlength Cell with NaCl Windows	
GS07501 Variable Pathlength Cell with KBr Windows	
GS07502 Variable Pathlength Cell with CaF_2 Windows	
GS07503 Variable Pathlength Cell with BaF_2 Windows	
GS07509 Variable Pathlength Cell with ZnSe Windows	

Notes for Use of Variable Pathlength Cell

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