

Storm™ 10 Pyrex™ Glass Gas Cell

User Manual



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Gas Cell

User Manual

2I-05000-11

Storm™ 10 Pyrex™ Glass Gas Cell

P/N GS05000

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1. Introduction

Thank you for buying a product from Specac.

The Storm™ 10 Pyrex™ Glass 10 cm Pathlength Gas Cell P/N GS05000 can be used with a variety of different window materials for the study of high concentrations of gases from analysis by FTIR spectroscopy.

The Gas Cell allows for introduction of the gas by glass inlet tubes (cone size 10/19) with open and closeable PTFE taps. The Gas Cell is rated for operation to hold a gas at pressures up to +1bar (14.7psi) over atmospheric pressure and at vacuum conditions to circa 0.1Torr, irrespective of the window material type used in the Gas Cell. Specific gas containment will depend on the durability of the window material type and seals for their chemical resistance to the vapour conditions.

For use of the PTFE taps on the Pyrex™ Gas Cell there is a “fine balance” in having the taps tight enough in their glass cone recess fittings to seal adequately by tightening of the rear locking nut, so that the taps will turn to allow for flow of a gas in and out of the Cell, but are not so loose that any gas pressure can leak out past these tap points.

The overall dimensions of the Storm™ 10 Pyrex™ Gas Cell P/N GS05000 are:

Overall **length** with both window end cap screw assemblies in place and fitting of 5mm thick windows is 122mm.

Overall **width** at window end cap screw assembly is 58mm.

Overall **height** to top of inlet gas tap/valve assemblies is 117mm.

The internal **volume** of the gas cell (not including gas tap connections) is 132cm³ (132mls).

There is a choice of standard windows from NaCl, KBr, CaF₂, BaF₂ and ZnSe material options that are supplied separately for fitting into the

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Storm™ 10 Pyrex™ Glass Gas Cells. The variety of window material options allows for the study of many gas/vapour sample types, although the choice of a specific window material will be dependent upon the specific vapour/gas conditions to be studied with respect to an allowable transmission range and chemical compatibility resistance offered by the window material itself.

The window materials to use are as follows:

P/N GS05020 Pair of Sodium Chloride (NaCl) windows.

P/N GS05021 Pair of Potassium Bromide (KBr) windows.

P/N GS05022 Pair of Calcium Fluoride (CaF₂) windows.

P/N GS05023 Pair of Barium Fluoride (BaF₂) windows.

P/N GS05096 Pair of Zinc Selenide (ZnSe) windows.

The standard window seals for the Storm™ 10 Pyrex™ Glass Gas Cell are in Neoprene and PTFE material. In respect of fitting specific window materials for certain spectroscopic studies, similarly, there may be a need to change the Neoprene window seal material if the gaseous sample to be measured will chemically attack Neoprene. If in doubt, please consult Specac for advice.

The Storm™ 10 Pyrex™ Glass Gas Cell can be installed into the sample compartment of many commercially available IR spectrometer systems via use of the Gas Cell Mount Holder P/N GS05030. This part consists of a 3" x 2" size metal plate fitted with two elongated support rods. The metal plate slides into a standard 3" x 2" mount offered from the IR spectrometer system and the Storm™ 10 Pyrex™ Glass Gas Cell sits horizontally on the support rods in the correct position for spectral transmission gas/vapour analysis.

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 Storm™ 10 Pyrex™ Glass Gas Cells, these use different window materials for containment of a specific gaseous/vapour type within a Pyrex™ glass body for the Gas Cell itself. As standard, NaCl, KBr, CaF₂, BaF₂ 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, CaF₂ and BaF₂ 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 choice of window material that can be fitted for use in the Storm™ 10 Pyrex™ Glass Gas 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 13 to 18.

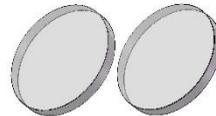
3. Unpacking and Checklist

On receipt of your Storm™ 10 Pyrex™ Glass Gas Cell (P/N GS05000) please check that the following have been supplied.

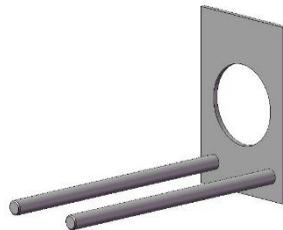
- P/N GS05000 Storm™ 10 Pyrex™ Glass Gas Cell with 1 pair of end caps, 6 Neoprene gaskets and 2 PTFE gaskets.



- Pair of windows of choice for Storm™ Pyrex™ Glass Gas Cell. (If ordered).



- P/N GS05030 3" x 2" Gas Cell Mount Holder for Storm™ 10cm Pathlength Gas Cells. (If ordered).



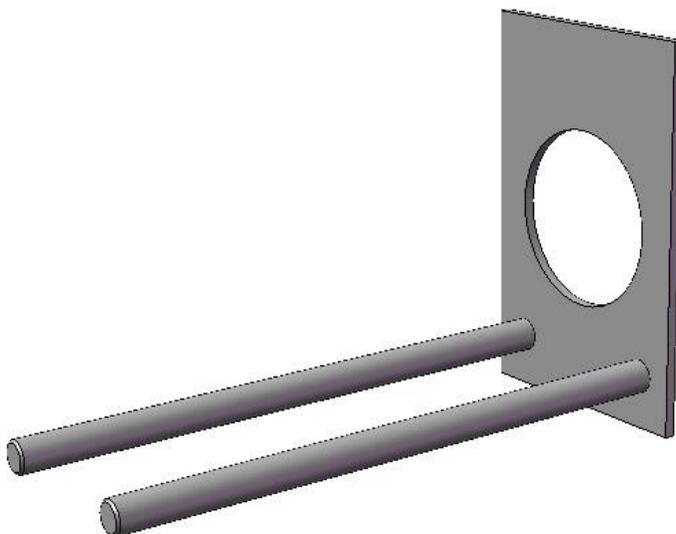
Unpack the Storm™ 10 Pyrex™ Glass Gas Cell and parts carefully. If the windows supplied are hygroscopic in nature (NaCl or KBr material) do not remove them from their sealed container until required.

4. Installation

The Storm™ 10 Pyrex™ Glass Gas Cell must be positioned correctly within the sample compartment of an IR spectrometer before a spectral analysis of gaseous sample can be made.

The Gas Cell can be installed into the sample compartment of many commercially available IR spectrometer systems via use of the Gas Cell Mount Holder P/N GS05030. (See **Fig 1.**)

This part consists of a 3" x 2" size metal plate fitted with two elongated support rods. The metal plate slides into a standard 3" x 2" mount offered from the IR spectrometer system and the Storm™ 10 Pyrex™ Glass Gas Cell sits horizontally on the support rods in the correct position for spectral transmission gas/vapour analysis.



**Fig 1. 3" x 2" Gas Cell Mount Holder for Storm™
10cm Pathlength Gas Cells**

5. Operation of the Storm™ 10 Pyrex™ Glass Gas Cell

The Storm™ 10 Pyrex™ Glass body 10cm pathlength Gas Cell can be used with a variety of different window materials for the study of high concentrations of gases. Introduction of a gas is made through glass inlet tubes (1) (cone size 10/19), with closeable, tapered PTFE taps (7) on these glass inlet tubes. (See Fig 2.) A knurled nut (8) can be tightened if necessary, to pull in the tapered PTFE taps (7) against the Pyrex glass inlet tubes (1) to improve the sealing.

Fitting of Windows into the Storm™ 10 Pyrex™ Gas Cell

A pair of Storm™ 10 Gas Cell windows are fitted into the Storm™ 10 Pyrex™ Gas Cell as seen from Fig 2.

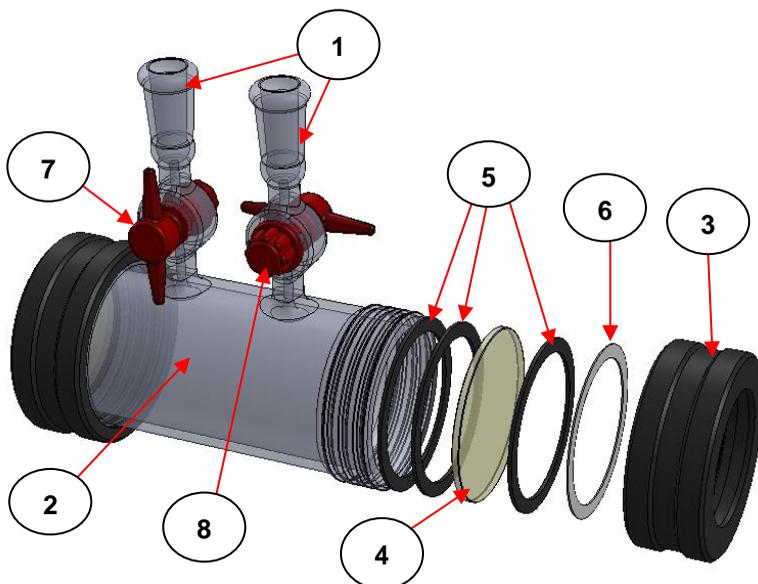


Fig 2. Sequence of Neoprene and PTFE Circular Gasket Seals and Window Fitting in Storm™ 10 Pyrex Gas Cell

The Pyrex™ glass body (2) carries two end caps (3) which are screw threaded to the body (2). Any window (4) to be fitted is held between two of the Neoprene circular gaskets (5). A further Neoprene gasket (5) seals against the Gas Cell body (2) end face, such that there are two Neoprene gaskets (5) between the gas cell body (2) and window (4). A PTFE gasket seal (6) that fits inside the end cap (3) such that there is a Neoprene gasket (5) and the PTFE gasket seal between the end cap (3) and the window (4). Use the following procedure to fit a window into the Storm™ 10 Pyrex™ Gas Cell.

- 1) Take the Storm™ 10 Pyrex™ Gas Cell and unscrew an end cap (3) from the body (2). (Turn end cap (3) anticlockwise.) From new there will be three Neoprene gaskets (5) and one PTFE gasket (6) supplied inside each of the two end caps (3).
- 2) Ensure that the face of the Pyrex™ body (2) and the screw threads (body (2) and end cap (3)) are clean and free from foreign matter.
- 3) Open the container containing the two windows (4) and carefully remove the windows from their internal protective wrappings. **(Always use gloves when handling the window materials.)**
- 4) Insert the PTFE gasket (6) onto the inner flange face of the end cap (3). Now place a Neoprene gasket (5) over the PTFE gasket (6) and then carefully insert a window (4).
- 5) Place two Neoprene gaskets (5) onto the window (4) and Neoprene/PTFE gasket (5 and 6) assembly now located in the end cap (2).
- 6) Hold the end cap assembly of parts (3, 4, 5 and 6) vertically (to centralize the window) and offer up the end face of the cell body (2) to the window end cap (3) and screw the parts together. (Turn end cap (3) clockwise.)
- 7) Ensure that the end cap (3) and internal window assembly of parts are firmly clamped to the cell body (2) to seal the window, but it is not too tight whereby damage could occur to the windows.

Repeat the procedure from steps 1) to 7) for the other end cap and window assembly.

Filling the Storm™ 10 Pyrex™ Gas Cell with a Gas

Either of the gas inlet ports (1) can be used to fill the Storm™ 10 Pyrex™ Gas Cell with gas. The cone size for any connecting glassware (tubing or stoppers) is 10/19. Ensure that both PTFE taps (7) are open (tap handle is in parallel line to the inlet stem) when filling to maintain a flow. Close both taps as quickly as possible after filling to contain the gas in the Gas Cell if a static mode of gas sampling is required.

The Storm™ 10 Pyrex™ Gas Cell filled with a gas sample is now ready to be used in the spectrometer.

Note: *For a sampling regime, a background reference IR spectrum may be taken first with an “empty” (nitrogen gas filled only) Gas Cell and then a sample spectrum is taken with a filled Gas Cell.*

Cleaning the Storm™ 10 Pyrex™ Gas Cell

Depending on the specific type of gas that has been analysed within the Storm™ 10 Pyrex™ Gas Cell, before storage Specac would recommend purging the Gas Cell with a supply of nitrogen gas after use. A purge with nitrogen gas helps to remove any residual vapours that may be trapped within the Gas Cell and to minimise any potential “memory effects” of the previous sample from next use of the Gas Cell. Nitrogen gas can be flowed through (with both PTFE taps (7) open) and then the PTFE taps (7) are closed to contain the nitrogen gas within.

The Storm™ 10 Pyrex™ Gas Cell can be stored fully constructed with windows in position and containing nitrogen gas. Specac recommends use of a dry cabinet for storage. However, if the windows and maybe the inside of the Gas Cell body (2) need to be cleaned, then it is easier to do so by removal of the windows (4) and gaskets (5 and 6) from their end cap (3) assemblies. Removal of the windows is reversal of steps 4) to 6) from the window fitting procedure on pages 10 and 11.

Notes On Cleaning

When cleaning any removed window material being used in the Storm™ 10 Pyrex™ Gas 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 7), of the five standard window materials supplied that can be fitted in the Gas Cell, ZnSe is potentially the most hazardous in terms of risk of toxicity if it contacts 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. CaF₂, BaF₂ and ZnSe window materials are generally chemically tolerant of a wide range of aqueous based solvents or solutions for cleaning purposes, but only aqueous solutions that fall within the pH range of pH5 to pH9 are tolerated by the ZnSe window material. Stronger acidic or basic solutions if introduced will irreparably damage any ZnSe windows that are fitted.

Caution! *If in doubt that your solvent for cleaning may be damaging to the window material being used with the Storm™ 10 Pyrex™ Gas Cell, always try to test a fragment of the window material type, if possible, with the chemical first.*

When wiping away any solid (condensed) residues (if present) on the window surfaces, use a very soft lens tissue moistened with the appropriate solvent 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 Storm™ 10 Pyrex™ Gas Cell performance.

Water and/or alcohol solvents can be used on all other parts of the Storm™ 10 Pyrex™ Gas Cell for cleaning as and when necessary.

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/mm².

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/mm².
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 (CaF₂) 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: CaF₂. 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/mm².
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 (BaF₂) 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: BaF₂.

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/mm².

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 5 to 9 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/mm².

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.

6. Legend (Bubble Part Number Identification)

- (1) Gas inlet/outlet Pyrex™ glass connection ports on gas cell body.
- (2) Pyrex™ glass gas cell body.
- (3) End cap for window fitting to Pyrex™ glass cell body (2).
- (4) Window for Pyrex™ glass gas cell body (2).
- (5) Neoprene gasket for sealing between window (4) and Pyrex™ glass gas cell body (2).
- (6) PTFE gasket for sealing between Neoprene gasket (5) and end cap (3).
- (7) PTFE open/shut tap valve on gas inlet/outlet connection port (1).
- (8) Tightening nut for PTFE open/shut tap valve (7).

7. Spare Parts for Storm™ 10 Pyrex™ Gas Cell

- P/N G05020** Pair of NaCl windows.
P/N G05021 Pair of KBr windows.
P/N G05022 Pair of CaF₂ windows.
P/N G05023 Pair of BaF₂ windows.
P/N G05024 Pair of CsI windows.
P/N G05025 Pair of CsBr windows.
P/N G05026 Pair of KRS-5 windows.
P/N G05027 Pair of fused silica windows (IR).
P/N G05028 Pair of AgCl windows.
P/N G05096 Pair of ZnSe windows.
P/N G05097 Pair of Si windows.
P/N G05098 Pair of fused silica windows (UV).
P/N G05030 3" x 2" Gas cell mount holder for Storm™ 10 gas cells.
P/N G05040 Seal kit for Storm™ 10 Pyrex™ gas cells.

8. Serial Number Identification of the Storm™ 10 Pyrex™ Gas Cell

Your Storm™ 10 Pyrex™ Gas Cell P/N GS05000 will be provided with a serial number for identification. The serial number takes the form of a five-figure number preceded by a letter e.g. **P12345**.

To help you, please use the space below to fill in the serial number information of the Storm™ 10 Pyrex™ Gas Cell you have received.

If you need to contact Specac for any issues regarding your Storm™ 10 Pyrex™ Gas Cell, it may be necessary to provide the serial number of the item to identify for replacement parts.

Storm™ 10 Pyrex™ Gas Cell	Serial Number
P/N GS05000 Storm™ 10 Pyrex™ Gas Cell	

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