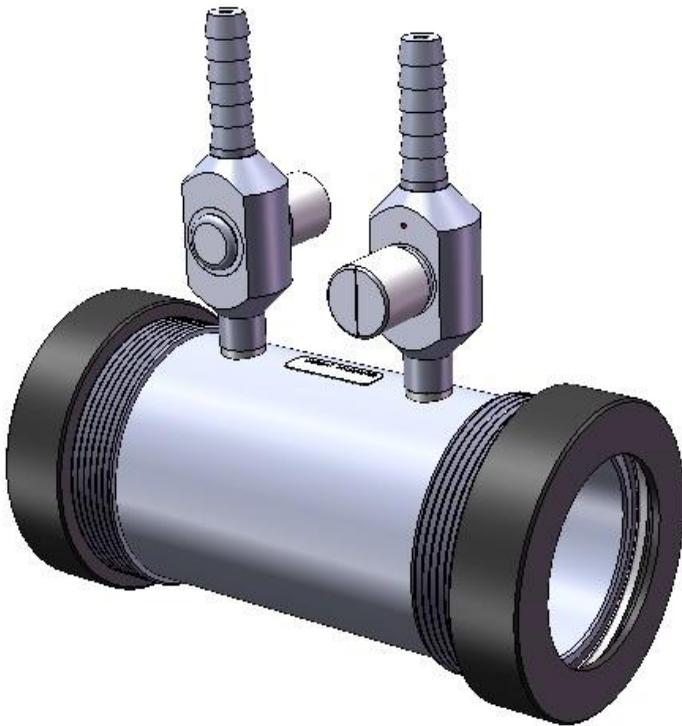


Storm™ 10 Stainless Steel Gas Cell

User Manual



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2I-05800-Issue 9

Storm™ 10 Stainless Steel Gas Cell

P/N GS05800

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1. Introduction

Thank you for buying a product from Specac.

The Storm™ 10 Stainless Steel 10 cm Pathlength Gas Cell P/N GS05800 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 from stainless steel push on hose type (barbed) connectors with stainless steel valve taps that are screw threaded with a PTFE sealing washer into the stainless steel Gas Cell body. The valve taps are simply operated to be open or closed for gas flow or containment of a gas in the Gas Cell.

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.

The overall dimensions of the Storm™ 10 Stainless Steel Gas Cell P/N GS05800 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 valve tap connections) is 120cm³ (120mls).

There is a choice of standard windows from NaCl, KBr, CaF₂, BaF₂ and ZnSe material options that are supplied separately for fitting into the Storm™ 10 Stainless Steel Glass Gas Cell. The variety of window

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material options allows for the study of many gas/vapour sample types, although the choice of a particular window material will be dependent upon the particular vapour and 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™ Stainless Steel Gas Cell are in Nitrile and PTFE materials. (The Nitrile seal is used between the Gas Cell body and the window material being used.) Similar to fitting of particular window materials for certain spectroscopic studies, there may be a need to change this window seal material if the gaseous sample to be measured will chemically attack Nitrile. If in doubt, please consult Specac for advice.

The Storm™ 10 Stainless Steel 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 Stainless Steel 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 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 Stainless Steel Gas Cells, these use different window materials for containment of a specific gaseous/vapour type within a stainless steel 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 Stainless Steel 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.

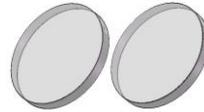
3. Unpacking and Checklist

On receipt of your Storm™ 10 Stainless Steel Gas Cell (P/N GS05800) please check that the following have been supplied.

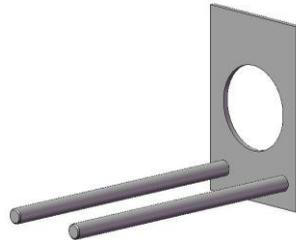
- P/N GS05800 Storm™ 10 Stainless Steel Gas Cell with 1 pair of end caps, 2 Nitrile O-rings and 2 PTFE gaskets.



- Pair of windows of choice for Storm™ 10cm Gas Cell. (If ordered).



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



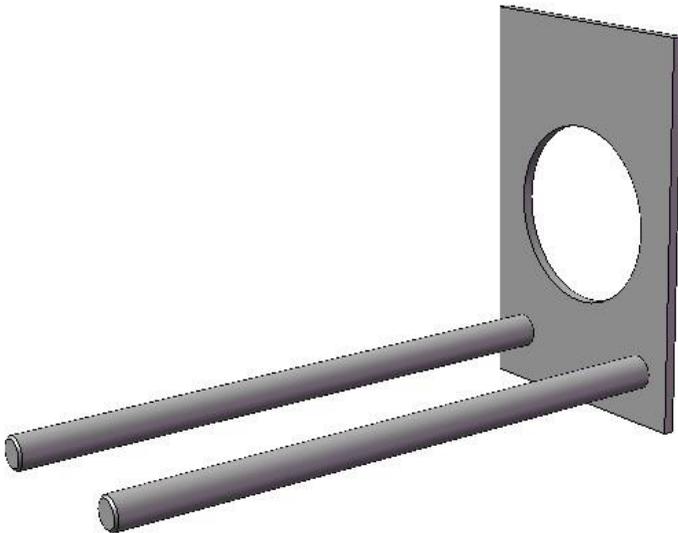
Unpack the Storm™ 10 Stainless Steel Gas Cell and parts carefully. If the windows supplied are hygroscopic in nature (NaCl or KBr material) do not remove them from their sealed container until required.

4. Installation

The Storm™ 10 Stainless Steel 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 Stainless Steel 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 Stainless Steel Gas Cell

The Storm™ 10 Stainless Steel Gas Cell can be used with a variety of different window materials for the study of high concentrations of gases.

The Storm™ 10 Stainless Steel Gas Cell allows for introduction of a gas through stainless steel open/close valve fittings (1) screw thread fitted into the stainless steel body (2). (See Fig 2.)

Fitting of Windows into the Storm™ 10 Stainless Steel Gas Cell

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

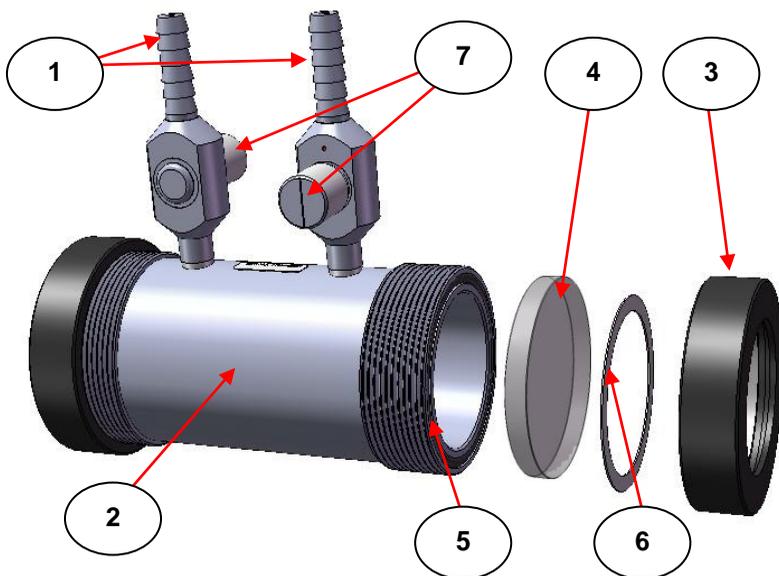


Fig 2. Sequence of Nitrile O-Ring, PTFE Gasket and Window Fitting in Storm™ 10 Stainless Steel Gas Cell

The stainless steel body (2) carries two end caps (3) which are screw threaded to the body (2). Any window (4) to be fitted is held between the Nitrile O-ring (5) that is fitted into a circular grooved recess at the end of the body (2) and the PTFE gasket (6) that seal fits inside the end cap (3). Use the following procedure to fit a window into the Storm™ 10 Stainless Steel Gas Cell.

- 1) Ensure that the face of the body (2), the Nitrile O-ring (5) and the screw threads (body (2) and end cap (3)) are clean and free from foreign matter.
- 2) Fit the Nitrile O-ring (5) into the groove on the face of the body (2).
- 3) Place the PTFE gasket (6) inside and onto the flange of the end cap (3).
- 4) Insert the window (4) into the end cap and PTFE gasket assembly (3 and 6).
- 5) Holding the cell body (2) with nitrile O-ring (5) and the window/gasket/end cap assembly (4, 6 and 3) vertically, screw the parts together. Tighten until firmly clamped, but not too tight to prevent possible damage to the window.

Repeat the procedure from steps 1) to 5) for the other end cap and window assembly.

Filling the Storm™ 10 Stainless Steel Gas Cell with a Gas

Either of the gas connection ports (1) can be used to fill the Storm™ 10 Stainless Steel Gas Cell with gas. There is a valve tap (7) on each gas port (1) that can be turned to open or close the gas connection port.

To fill the Gas Cell and to maintain a flow of gas (if analysing in a flow mode of operation), ensure that both valve taps (7) are open. This is indicated when the line marked on the knurled screw is parallel to the inlet stem of the gas port connection (1) and aligned with the reference dot. Close both valve taps (7) as quickly as possible after filling to contain the gas in the Cell if a static mode of gas sampling is required.

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

Note: *Ordinarily for any 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 Stainless Steel Gas Cell

Depending on the particular type of gas that has been analysed within the Storm™ 10 Stainless Steel 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 valve taps (7) open) and then the valve taps (7) are closed to contain the nitrogen gas within.

The Storm™ 10 Stainless Steel 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 removing the windows (4) from their end cap (3) assemblies. Removal of the windows is reversal of steps 3) to 5) from the fitting of a window procedure on page 11.

Notes On Cleaning

When cleaning any removed window material being used in the Storm™ 10 Stainless Steel 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 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. 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 sample 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 Stainless Steel 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 Stainless Steel Gas Cell performance.

Water and/or alcohol solvents can be used on all other parts of the Storm™ 10 Stainless Steel 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 stainless steel connection ports on gas cell body.
- (2) Stainless steel gas cell body.
- (3) End cap for window fitting to stainless steel cell body.
- (4) Window for stainless steel gas cell body.
- (5) Nitrile O-ring for sealing between window and stainless steel gas cell body.
- (6) PTFE gasket for sealing between window and end cap.
- (7) Stainless steel open/shut tap valve on gas inlet/outlet connection port.

7. Spare Parts for Storm™ 10 Stainless Steel Gas Cell

- P/N G05803** Vacuum valve for Storm™ 10 stainless steel gas cell.
- P/N G05804** Seal kit for Storm™ 10 stainless steel 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.

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

Your Storm™ 10 Stainless Steel Gas Cell P/N GS05800 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 Stainless Steel Gas Cell you have received.

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

| Storm™ 10 Stainless Steel Gas Cell | Serial Number |
|--|----------------------|
| P/N GS05800 Storm™ 10 Stainless Steel Gas Cell | |

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