

## ProCell - Process Flow Cells

Enabling continuous online spectroscopic analysis in the UV/Vis and NIR

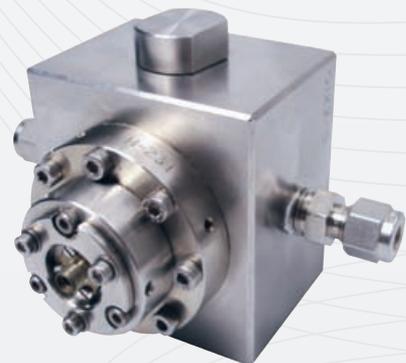


## Process flow cells for online spectroscopic analysis

Reliable sampling. Process optimization. Safety.

Modern process control benefits from access to real-time information. Fiber-optic coupled process flow cells are a key enabling technology to facilitate the acquisition of continuous online UV/Vis and NIR spectroscopic absorbance process measurements. In many instances, this allows the user to achieve significant cost savings through process optimization. Process flow cells contribute to plant safety by eliminating the need for the extraction and transportation of potentially hazardous process sample to a site laboratory for analysis. Further advantages include a

possible reduction in the cost of process sampling, and elimination of sample wastage. With state of the art design and material modeling tools, and over 15 years of process application experience to draw from, Specac's range of process flow cells have a proven track record of reliability and robustness to ensure long-term operation in the most demanding industrial environments. Computer-aided optical design ensures that our process flow cells have the highest levels of optical throughput to ensure the best quality of spectroscopic data.



## Tailored to meet your needs

Materials, pathlength, interfacing: Your choice.

Specac process cells are customized to ensure exact matching with the client's process requirements. Material metallurgies, seal types, and window materials are chosen to be compatible with the chemical and environmental needs of the application. Optical designs are configured for the UV/Vis or NIR spectral regions as appropriate, and optical pathlengths are set to ensure optimum spectral absorbance of the

target chemical species. A range of pipe fittings and flange connections are available to interface the process flow cell with the process pipe work. Cleaning ports and seal leak warning ports can also be integrated into the cell design.

Specac's application engineers work closely with the customer to ensure the optimum process flow cell solution for the application.

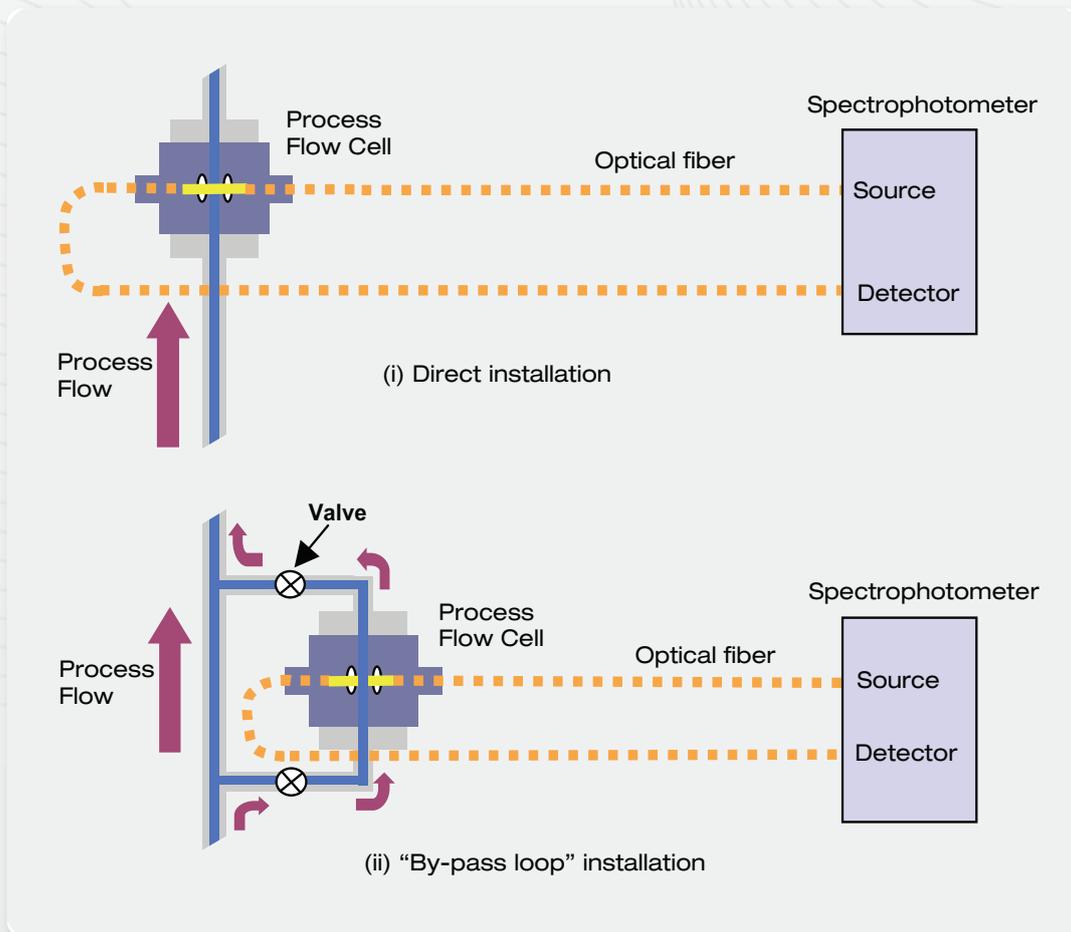
**Specac** brilliant spectroscopy™

## Integration of process flow cells

### Getting light through the process sample.

Light is transmitted via an optical fiber cable from the spectrophotometer source to one port of the process flow cell. Collimation optics then direct this light beam through a set pathlength of process stream to a second set of optics which re-focus the beam to a return optical fiber cable attached to the second process flow cell port. The return optical fiber cable serves to transmit

the light beam back to the spectrophotometer detector. Process flow cells are typically installed as part of the process circuit either directly in the process stream or as a “by-pass loop”. By adopting the process flow cell in a “by-pass loop” configuration, the user has the opportunity to isolate the process flow cell from the process cell for routine cleaning, servicing, or calibration.



## Optimized construction materials

Rugged. Robust. Reliable.

Process flow cells are designed to withstand the rigors of process and environmental conditions while maintaining continuous measurement stability. The choice of construction materials is an important consideration to ensure material compatibility with a range of substances in the process stream, and durability to the temperature and pressures of operation - this often goes beyond standard operating conditions, and includes aggressive cleaning regimes and extreme weather conditions.

### Cell body material:

Specac ProCell process flow cells are manufactured from a range of materials, chosen to ensure optimum chemical compatibility and environmental durability. Typical materials include Stainless Steel 316L, Duplex Stainless Steel, Hastalloy® C276, Zirconium, or Titanium, but others are available upon request.

### Window material:

Sapphire windows are used as standard to ensure the highest level of process cell durability. With outstanding thermal characteristics, coupled with exceptional abrasion resistance - second only to diamond - and strongly resistant against

corrosive process fluids, sapphire is a clear material of choice for process flow cell windows. Standard sapphire substrates offer excellent transmission characteristics from the UV to 5 microns; for specific UV applications, UV grade sapphire is available. As sapphire is able to be polished to a high degree, it is less prone to fouling than other lesser materials.

### Seal material:

Process flow cells contain a seal between the optical and mechanical components, and the integrity of this seal is often critical to the reliability of the cell. Specac offers a wide variety of seal options to meet a broad scope of customer needs. These include chemically inert perfluoroelastomers (such as Kalrez® or Chemraz®), or gold diffusion bonding for the most demanding applications.

For added peace of mind, perfluoroelastomer seals may be incorporated in a unique dual seal arrangement to guard against the unlikely event of window seal failure. With the aid of complex modeling software, Specac application engineers can predict the behaviour of the seal under a wide variety of conditions that may be experienced during its lifetime.

## Optical fiber cables

Delivering light to the point of measurement.

Specac ProCell process flow cells are compatible with a range of optical fiber cables, with core sizes of up to 600 microns diameter. These should be selected by the user to be appropriate for the application. For instance, water-free optical fiber is typically used for NIR applications, while special UV-grade optical fiber should be used if enhanced UV transmission is needed. Optical fibers should also be appropriately coated for the temperature experienced at the point of

connection to the process flow cell: polyimide-coated or metal-coated fibers are recommended for higher temperature applications. Specac follows the industry standard by using the widely available and popular SMA 905 style of fiber connector to interface optical fibers with the process flow cell.



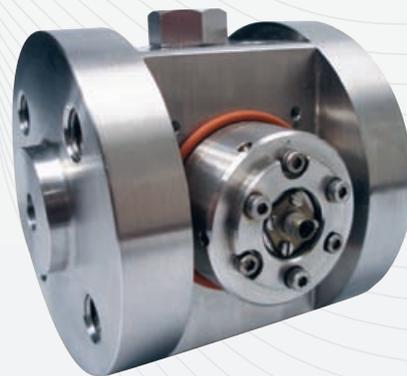
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## Added features

Tell tale leak ports, fiber termination hoods, cleaning ports.

A wide range of added features are offered by Specac to further enhance the performance of our ProCell process flow cell product range. For instance, seal leak warning ports can be incorporated for additional process security, and cells can be specified with a cleaning port to allow easy in-situ cleaning of the windows without the

need to remove the cell from the process environment. Furthermore, protective metal hoods (to I.P. 65 rating) can be fitted over the fiber connections to relieve strain from the fiber connector, to guard against accidental damage at the process cell port, and prevent ingress of moisture and dust/dirt.



## Range of Process Cells

Liquids. Vapours.

### ProCell Vortex Liquid Phase Process Flow Cell:

Specac's ProCell Vortex liquid phase process cell is designed to sample industrial liquid streams by means of UV/Vis or NIR. These applications usually involve optical pathlengths of 1.0 - 10mm. Typical specifications are 0 to 400°C and vacuum to 1500 psi.



### ProCell Typhoon Gas/Vapour Phase Process Flow Cell:

Specac's ProCell Typhoon process cell is designed to sample industrial gas / vapour phase streams by means of UV/Vis or NIR. The gas or vapour stream is sampled through a preset, fixed pathlength (20, 30, and 50 cm available as standard), and typical specifications are 0 to 280°C and vacuum to 1500 psi.



## ProCell Vortex - Liquid Phase Process Flow Cell

Rugged flange-mounted spectroscopic transmission cell for industrial liquid process monitoring in the UV/Vis or NIR.



### ProCell Vortex

The Specac ProCell Vortex liquid phase process cell is an extremely robust cell that delivers optimum sensitivity to process characteristics. Through partnerships with leading multinational companies, Specac have developed unrivalled engineering design expertise and manufacturing techniques for process cells. With a wide choice of cell metallurgies and sapphire windows as standard, ProCell Vortex process cells have an established reputation for ruggedness and reliability. Product solutions customized to individual requirements are available in addition to the range of standard products.

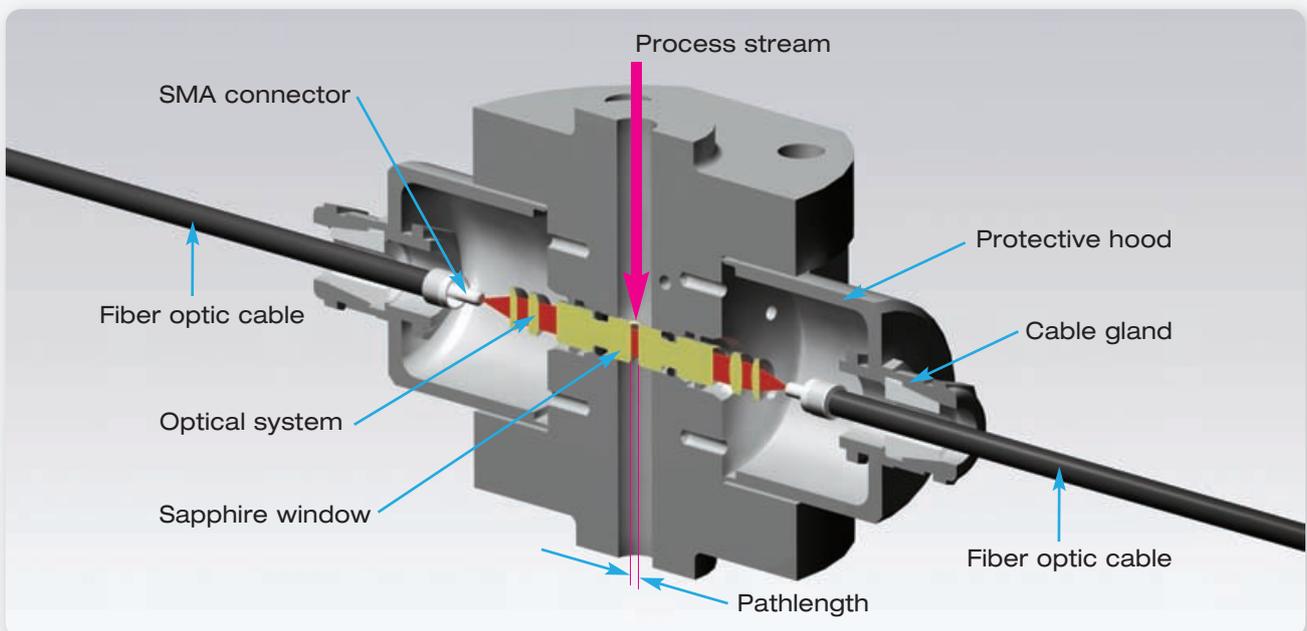
### Key Features

- Proven reliability in aggressive environments.
- Range of cell body and seal materials
- Selection of sizes for ease of process integration
- Cleaning port option for in-situ servicing
- Capability for high temperature applications (up to 400°C)
- Factory-aligned optics to ensure optimum stability and cell sensitivity

**ProCell Vortex:****Tailored for the application**

The ProCell Vortex series process cell is designed to be flange mounted directly into the process stream or in a by-pass. To ensure ease of process integration, the cell can be configured from a wide range of ANSI and DIN flange sizes. A choice of cell body materials, typically starting with Stainless Steel, Duplex Stainless Steel, or Hastelloy®, and a selection of high performance perfluoroelastomer window seals or diffusion

bonded windows ensures appropriate chemical compatibility for the application. Furthermore, to ensure optimum UV/Vis or NIR spectroscopic absorption features for analysis, optical transmission pathlengths are available from 1.0 to 10 mm. Optical components within the cell are selected to be compatible with the wavelength range of interest and the diameter of optical fiber specified by the user. Optical fiber connectivity is ensured by industry standard SMA 905 connectors.

**ProCell Vortex:****Reliability, for peace of mind**

All aspects of the ProCell Vortex were developed to give long-term reliability under the tough conditions of thermal shock, high operating temperatures, and aggressive chemistries that are often encountered in the process environment. The use of sapphire windows gives outstanding abrasion and chemical resistance, in addition to the ability to withstand severe thermal shock (e.g. plant cleaning with high pressure steam).

The Specac ProCell Vortex can be designed with a proprietary dual seal arrangement to give proven long term reliability (with examples of the cell in continuous use for 15 years). Special “hoods” are included that fit over the optical fiber connectors and give environmental protection (keeping out water, dust and dirt) as well as physically supporting the cable outer sheath or armouring. The latter ensures that stresses from the weight of the cable (or from it being moved, pulled, etc.) are not transmitted to the optical fiber connection interface.

**ProCell Vortex:**

**Enhanced Optional Features**

**Cleaning Ports**

An attractive feature of the Specac ProCell Vortex process cell is the optional “cleaning port”, where a novel plug arrangement gives access to the window surfaces. This allows the internal cell windows to be cleaned without removing the cell from the pipe work, in the event that fouling occurs (either from long term use or following a process upset that caused material to be deposited within the plant). To assist this functionality, the cell would typically be installed in a ‘by-pass’ loop where valves can isolate it from the main process when servicing occurs.

**‘Tell-tale’ Ports**

A further propriety optional feature is the ‘Tell-Tale’ ports. These are small passages within the cell body that link the space between the primary and back-up window seals to an outside port. They can be used in critical or hazardous applications in several ways: either as a visual indication of leakage from the primary seal, or with the use of a secondary detection system in the event of a particularly hazardous material. If leakage is observed the user has the option of dealing with it immediately or fitting a blanking

plug into the port. The latter has the effect of stopping the leak and allowing the process to pressurise the secondary seal. The user is then aware that the cell is operating on the back-up seal and needs attention at the first convenient opportunity.

**Diffusion Bonding**

Versions of the Specac ProCell Vortex process cell are available with diffusion bonded windows. These versions avoid the use of any polymer materials and are capable of operation at temperatures up to 400°C or in chemical environments that are incompatible with even the high performance perfluoroelastomer seals.



**ProCell Vortex: Application Support**

Specac endeavor to provide the most reliable and appropriate process cell solution for the customer’s application. We ensure that an application engineer is always close at hand throughout the product purchase and implementation stages, so customers can have complete confidence in our quality of service. Specac has an active program of ongoing innovation to ensure that our process cell solutions are at the forefront of the market.

**Large bore ProCell Vortex**



**Standard Specification**

**Optical range**

Specify UV/Vis or NIR operation

**Pathlength**

1 - 10mm

**Window material**

Sapphire

**Body material**

Stainless Steel 316, Hastelloy C276, and Duplex Stainless Steel (others available on request)

**Temperature range**

0 - 280°C (up to 400°C with Gold diffusion bonding)

**Pressure range**

Vacuum to 1500 psi.

**Seals**

Kalrez 4079, Aluminium Diffusion Bonding, or Gold Diffusion Bonding (others available on request)

**Standard fiber diameter**

300 to 600µm (others available on request)

**Fiber fitting**

SMA 905

**Pipe fitting**

Range of ANSI (150 or 300lb) and DIN flanges (16 bar)

**Thermocouple well**

1/8" BSP

**Optional Features**

Primary seal leak ports

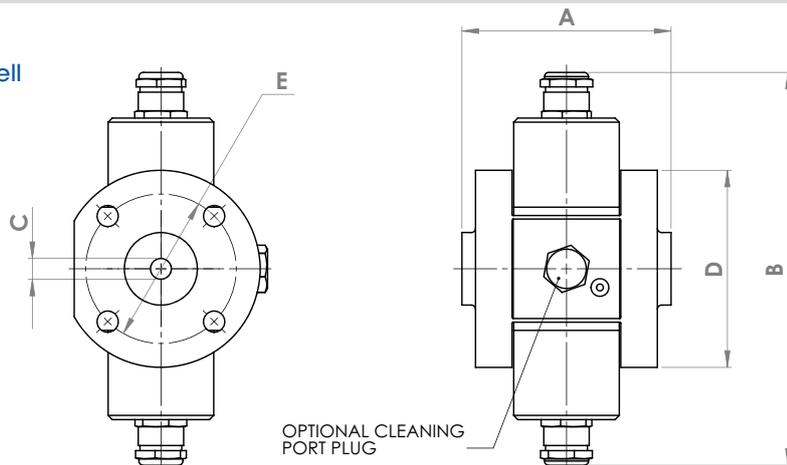
Window cleaning ports

**Product Compliance**

Versions of the Specac ProCell Vortex can be designed and manufactured to meet a wide range of international pressure and hazardous area standards. Please contact Specac to discuss your requirements.

**ProCell Vortex**

Liquid Phase Process Flow Cell



**ANSI coupling flange details**

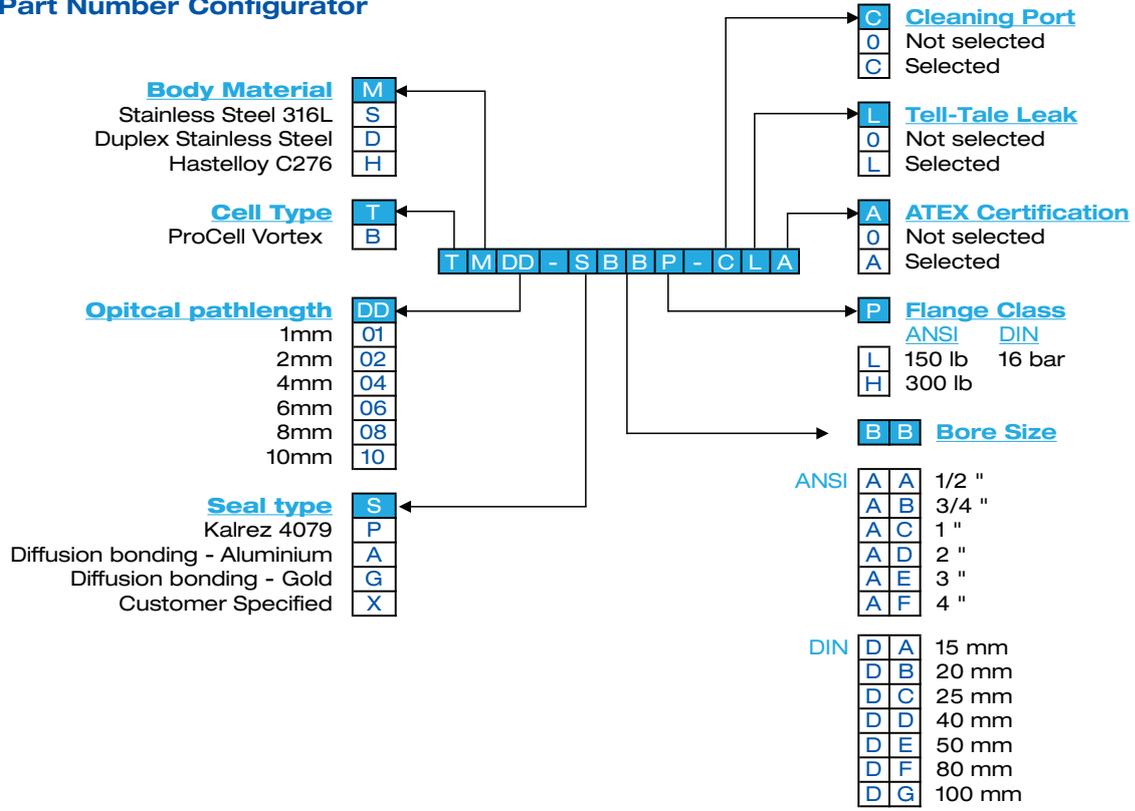
Designation	Bore Diameter "C" (mm)	Flange Diameter "D" (mm)	Mounting Hole PCD "E" (mm)	Fixings "UNC"	Dimension "A" (mm) Minimum	Dimension "B" (mm) Minimum
150 lb 1/2"	12	89.0	60.3	4 x 1/2"	120	170
150 lb 3/4"	12	98.4	69.8	4 x 1/2"	120	180
150 lb 1"	24	108.0	79.4	4 x 1/2"	120	186
150 lb 2"	49	152.4	120.6	4 x 5/8"	120	237
150 lb 3"	74	190.5	152.4	4 x 5/8"	120	288
150 lb 4"	97	228.6	190.5	8 x 5/8"	120	314
300 lb 1/2"	12	95.2	66.7	4 x 1/2"	100	174
300 lb 3/4"	12	117.5	82.5	4 x 1/2"	100	181
300 lb 1"	24	123.8	88.9	4 x 5/8"	108	188
300 lb 2"	49	165.1	127.0	8 x 5/8"	108	214
300 lb 3"	74	209.5	168.3	8 x 3/4"	115	240
300 lb 4"	97	254.0	200.0	8 x 3/4"	115	266

**DIN coupling flange details**

Designation	Bore Diameter "C" (mm)	Flange Diameter "D" (mm)	Mounting Hole PCD "E" (mm)	Fixings Metric "Course"	Dimension "A" (mm) Minimum	Dimension "B" (mm) Minimum
DIN 15	12	95	65	4 x M12	120	182
DIN 20	20	105	75	4 x M12	120	187
DIN 25	25	115	85	4 x M12	120	192
DIN 40	40	150	110	4 x M16	120	232
DIN 50	50	165	125	4 x M16	120	242
DIN 80	80	200	160	8 x M16	120	272
DIN 100	100	220	180	8 x M16	120	292

Please note: these dimensions are intended for guidance only. The application and other customer requirements will render adjustments to the sizes stated. The dimensions can be approximated upon quotation.

**ProCell Vortex - Liquid Phase Process Flow Cell**  
**Part Number Configurator**



**Please note:** Dual seal & Tell-Tale Leak Port are available only with ANSI fittings 1/2" and 3/4" or DIN fitting of 15mm

## ProCell Typhoon - Gas/Vapour Phase Process Flow Cell

Rugged pipe-mounted spectroscopic transmission cell for gas phase process monitoring in the UV/Vis or NIR.



### ProCell Typhoon

The Specac ProCell Typhoon gas/vapour phase process cell is an extremely robust cell that delivers optimum sensitivity to process characteristics. Through partnerships with leading multinational companies, Specac have developed unrivalled engineering design expertise and manufacturing techniques for process cells. With a wide choice of cell metallurgies and sapphire windows as standard, ProCell Typhoon process cells have an established reputation for ruggedness and reliability. Product solutions customized to individual requirements are available in addition to the range of standard products.

### Key Features

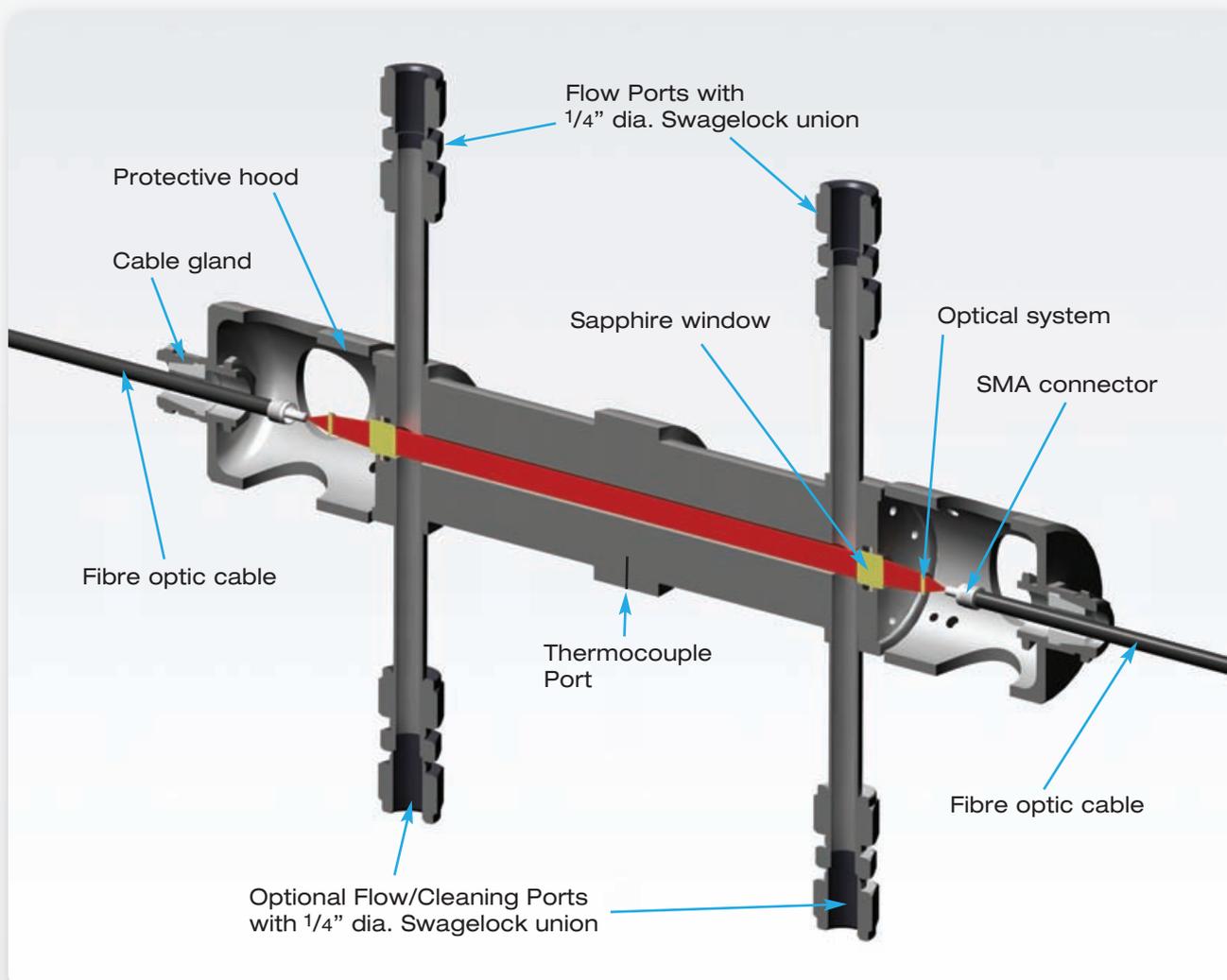
- Proven reliability in aggressive environments.
- Range of cell body and seal materials
- Simple and flexible options for process integration
- Cleaning port option for in-situ servicing
- Factory-aligned optics to ensure optimum stability and cell sensitivity

**ProCell Typhoon:**

**Configured for the application**

The ProCell Typhoon series process cell is designed for continuous in-situ monitoring of gas or vapour-phase process streams. The rugged design allows simple connection to the cell via 1/4" bore stub pipes, and the cell is easily trace-heated and insulated for elevated temperatures. Additional ports can be added to facilitate flexibility in choice of flow arrangement. A choice of cell body materials, typically starting with Stainless Steel, Duplex Stainless Steel, or

Hastelloy®, and a selection of high performance perfluoroelastomer window seals ensures appropriate chemical compatibility for the application. Furthermore, to ensure optimum UV/Vis or NIR spectroscopic absorption features for analysis, standard optical transmission pathlengths are available at 20cm, 30cm, or 50cm. Optical components within the cell are selected to be compatible with the wavelength range of interest and the diameter of optical fiber specified by the user. Optical fiber connectivity is ensured by industry standard SMA 905 connectors.



**ProCell Typhoon:****Reliability, for peace of mind**

All aspects of the ProCell Typhoon process cell were developed to give long-term reliability under the tough conditions of thermal shock, high operating temperatures, and aggressive chemistries that are encountered in the process environment. Sapphire windows give outstanding abrasion and chemical resistance, in addition to the ability to withstand severe thermal shock (e.g. high pressure steam cleaning). Specac employ a design of anti-extrusion seal arrangement to give high pressure capability and long-term reliability. Special “hoods” are included that fit over

the optical fiber connectors and supports the cable outer sheath or armouring. Standard versions of these hoods allow air circulation around the fiber cable termination in order to lower the cable temperature and extend its lifetime. Enclosed versions of the hoods are available where environmental protection is necessary (keeping out water, dust, and dirt). Special high temperature terminated cables are available from Specac, if necessary. In situations where the cell is already physically protected (e.g. in an enclosure) the hoods can simply be left off and the cables cable-tied to the inside of the enclosure to provide strain relief.

**ProCell Typhoon:****Enhanced Optional Features****Cleaning Ports**

A unique feature of the Specac ProCell Typhoon process cell is the option for “cleaning ports” to give access to the window surfaces. This allows the internal cell windows to be cleaned without removing the cell from the pipe work, in the event that fouling occurs (either from long term use or following a process upset that caused material to be deposited within the plant). To assist this functionality, the cell would typically be installed in a ‘by-pass’ loop where valves can isolate it from the main process when servicing occurs. These cleaning ports are a major advantage in situations where the cell has been heat-traced as part of the installation.

**ProCell Typhoon:****Application Support**

Specac endeavor to provide the most reliable and appropriate process cell solution for the customer’s application. We ensure that an application engineer is always close at hand throughout the product purchase and implementation stages, so customers can have complete confidence in our quality of service. Specac has an active program of ongoing innovation to ensure that our process cell solutions are at the forefront of the market.

**ProCell Typhoon - Vapour Phase Flow Cell**

**Standard Specification**

**Optical range**

Specify UV/Vis or NIR operation

**Pathlength**

20, 30, and 50 cm (others available on request)

**Window material**

Sapphire

**Body material**

Stainless Steel 316, Hastelloy C276, and Duplex Stainless Steel (others available on request)

**Temperature range**

0 to 280°C

**Pressure range**

Vacuum to 1500 psi.

**Seals**

Kalrez 4079 (others available on request)

**Cell bore**

10mm

**Fibre diameter**

300 to 600µm (contact Specac for other options)

**Fiber fitting**

SMA 905

**Inlet/outlet tubing:**

1/4" (others available upon request)

**Thermocouple well**

1/8" BSP

**Optional Features**

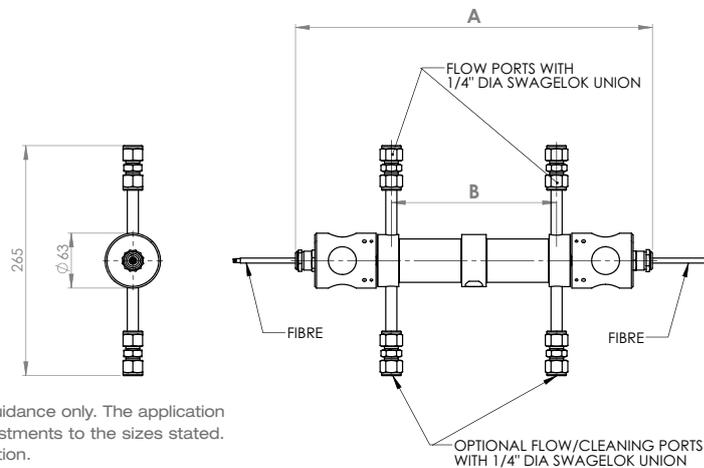
Window cleaning ports

**Product Compliance**

Versions of the Specac ProCell Typhoon can be designed and manufactured to meet a wide range of international pressure and hazardous area standards. Please contact Specac to discuss your requirements.

**ProCell Vortex**

Liquid Phase Process Flow Cell

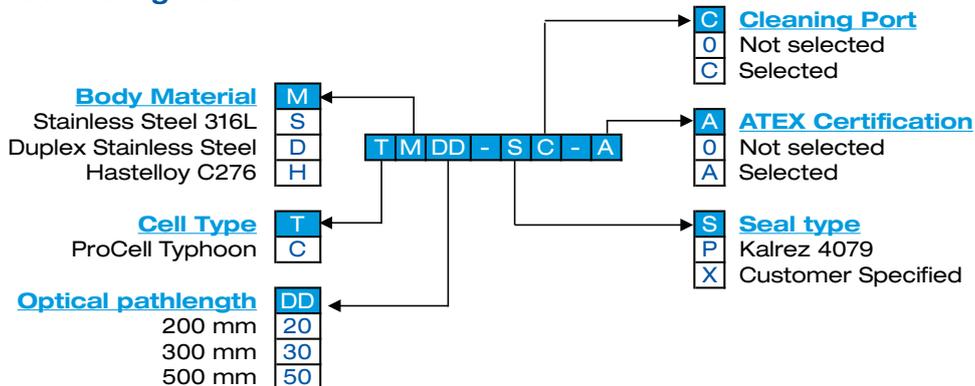


Please note: these dimensions are intended for guidance only. The application and other customer requirements will render adjustments to the sizes stated. The dimensions can be approximated upon quotation.

**Cell dimension guide**

Designation	Dimension "A" min.	Dimension "B" min.
200 mm	410 mm	189mm
300 mm	510 mm	289mm
500 mm	710 mm	490mm

**ProCell Typhoon - Vapour Phase Process Flow Cell**  
**Part Number Configurator**



# Specac

brilliant spectroscopy™

Specac Ltd. is a market-leading provider of UV/Vis, NIR, and IR spectroscopic sample handling accessories to academic, industrial, and research institutions worldwide. With purpose-built facilities in the UK, our team of design and manufacturing engineers work closely with our customers to provide the right product for the application. Our products are often designed to tolerate extremes of temperature from  $-190^{\circ}\text{C}$  to  $800^{\circ}\text{C}$ , pressures from vacuum up to 5000 psi, and corrosive chemical conditions.

State of the art CAD/CAM systems and the latest manufacturing techniques, ensure that our manufacturing processes are compliant with the demanding requirements of ISO 9001. Specac is an environmentally aware, ISO14001 accredited company. As part of Smiths Group Plc., Specac has its headquarters based in the uk and a sales and support office in the usa. Specac also has a global network of distributors and dealers. Smiths Group is an international company employing 16,000 people in some 50 different businesses located in the UK, USA, and Europe.



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