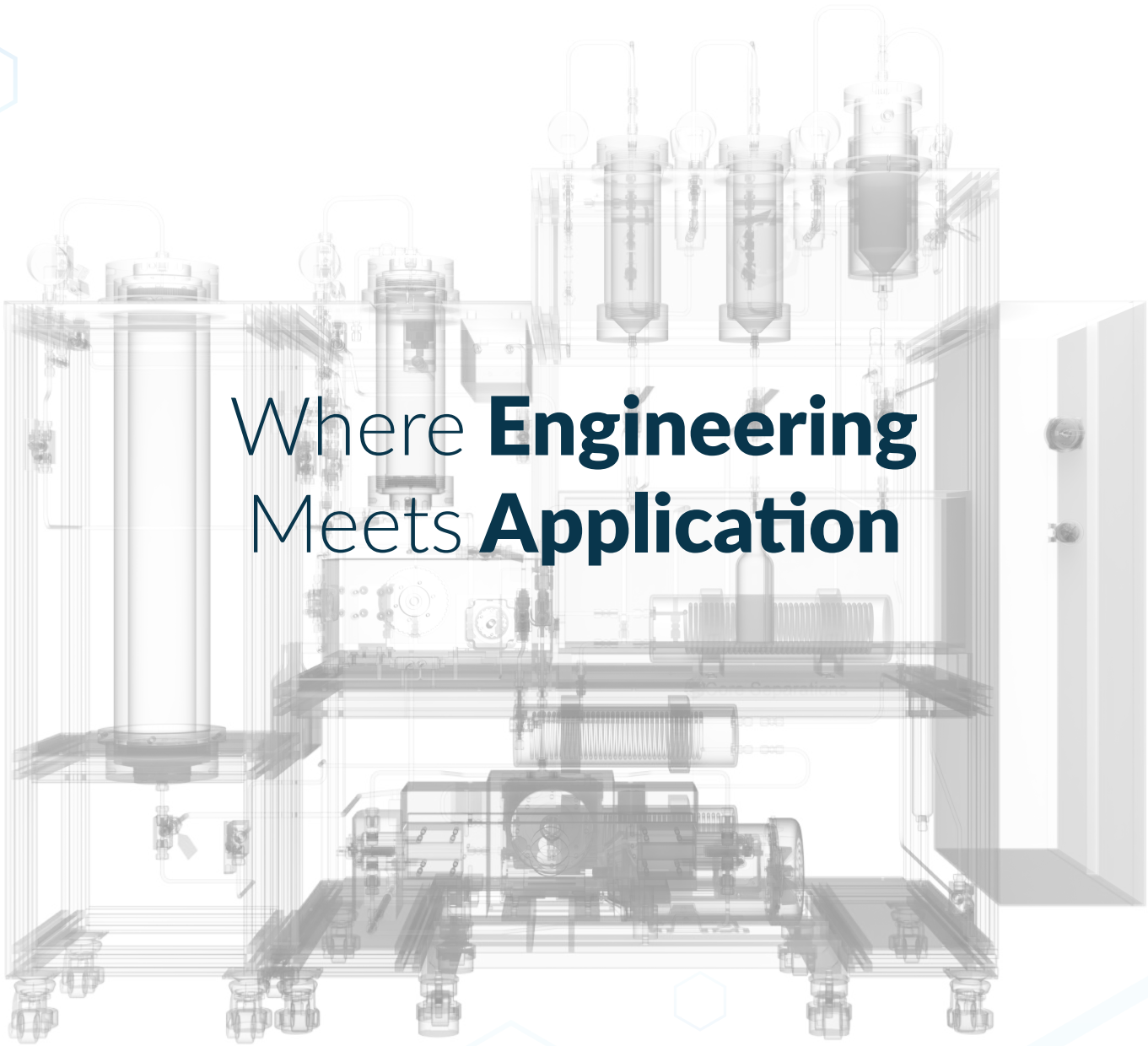


Where **Engineering**
Meets **Application**

Core | **Catalogue**

2022 v1.4

SciMed™
Core Separations

Core | **Contents**


SciMed
www.scimed.co.uk
(+44) 0161 442 9963
Core Separations
Supercritical Fluid Extraction System
Core Separations

01. Core | About

Here at Core Separations we supply advanced Supercritical and Subcritical Fluid (SCF) extraction systems harnessing the true power of carbon dioxide as a solvent. Emphasizing separations over extractions, we design systems by fractionating, thereby separating different components during the collection process.

Our systems embody extensive, unparalleled experience in SCF technology, leveraged on Core Separation team's decades of innovative and extensive supercritical fluid experience. Anyone can build a system and perform an extraction. But it takes true understanding of supercritical fluids to perform a separation.

We deliver reliable solutions built to perform in the most demanding environments, whether that be small or large industrial scale systems. Supplying systems from 5 ml up to 500 L capacity in single or multi-vessel configurations with extract fractionation.

With our facility based in Dallas Texas USA, we control, design and manufacture all of our systems. This permits us to engineer systems to solve specific application problems.

Since the inception of our new office and staff in the UK, we are set not only to build on our knowledge of the local market, but to extend our position throughout Europe.

Here at Core Separations we make the link between Engineering and Application.

Core Separations

Where **Engineering** Meets **Application**

02. Core | **Certifications**

Here at Core, we work with our partners across the globe to ensure our products meet both the highest standards whilst complying with all local laws and legislation. All our products comply with AMSE, PED (CE), UKCA and CRN standards allowing us to provide a truly global product.

ASME VIII - Our vessels are built to ASME VIII pressure vessel codes as used in North America and many other countries. The code describes design, construction, maintenance and alteration of pressure vessel systems.

European Pressure Directive - In order to place a product on the market within the European market, our product needs to meet a variety of European directives including the European Pressure Directive. This directive covers the standards that need to be met in order to comply with the stringent safety requirements required in the EU for pressure systems.

The directive describes two individual processes that we compile with:

1. Firstly, our vessels are assessed against a risk category as described in the PED directive. Depending on the category the design and safety implications will be reviewed independently by an EU-recognised notifying body (NoB). If approved a CE stamp will be awarded against a registered NoB which will include an identifying number. For example SGS Portugal is CE1029.

2. Our assemblies also go through rigorous assessment. A notifying body will again assess the system for safety and will award a CE stamp on assemblies deemed in a risk category III or higher.

UKCA - With the UK leaving the European union, the UK government has issued separate UK safety standards to replace the European conformity mark (CE) with the UKCA directives. The directives came into force on January 2021 which included a pressure system standard.

The standard as of 2021, echoes the European PED standard, requiring two conformity assessments:

1. Design assessment of a pressure vessel by an authorised UKCA body such as SGS UK.

2. Assembly assessment of all pressure components.

If assessed to meet these standards the UKCA bodies issue a UKCA stamp to allow the product to enter the UK market.

CRN (CSA B51:19) - For some of our larger vessels we comply with Canadian Registration Number (CRN). This is the Canadian system for reviewing and registering the design of pressure vessels and systems. It follows a similar assessment when compared to the European risk category system described in the PED.

Our designs follow the ASME VIII code coupled with requirements described in the CSA B51:19 Boiler, pressure vessel, and pressure piping code.

SGS United Kingdom Ltd
Industrial Services

"EU DESIGN-EXAMINATION" IN ACCORDANCE WITH MODULE "B PRODUCTION TYPE" OF THE PRESSURE EQUIPMENT DIRECTIVE	SGS Reference No. 341344/B/01
Manufacturer of Equipment Name: **Core Separations** Address: 2834 Geesling Road, Denton, Texas 76208 USA	**Notified Body: 0353** SGS United Kingdom Ltd Industrial Services Station Road, Oldbury, West Midlands B69 4LN

Pressure Equipment Description:	5 litre SFE Extraction Vessels
Drawing Number :	EV5L Rev. Original
Design Code :	ASME VIII Division 1
PED Category :	IV
Maximum Allowable Pressure:	689 barg
Volume:	5 litre
Design temperature :	5 °C to 150 °C
Corrosion allowance :	Nil
Contents :	Gas
Test pressure :	958.27 barg
Report No. :	341344-B

The undersigned declares that the Design of the pressure equipment conforms with the requirements the Pressure Equipment Directive (2014/68/EU).

Verified Date : 16th December 2020 Name : M.A. Homer Position : Technical Manager

Stamp: SGS Signature:

Note:

1. Technical and Production File (341344 Technical and Production File)

VS/AD/F56	Issue : 03	Date: July 2004	Page 1 of 1

03. Core | MOC

There are many alloys used in pressure vessel construction, the most common and recognisable being Alloy 300, which includes 316 and 316L stainless steel. Its chemical resistance to corrosion with both acids and bases at temperatures below 100 degrees Centigrade makes it a good choice for supercritical extraction vessels.

However, at pressures exceeding 689 bar, the use of 316 starts to show its limitations with thick side walls limiting heat transfer.

17-4PH is a martensitic precipitation-hardened stainless steel that offers good chemical resistance properties of much higher strength when compared to 316 stainless steel. 17-4PH is almost 60% stronger than its 316 counterpart, thereby allowing reduction of the wall thickness in our vessels by over 50%, subsequently improving heat transfer.

Stainless Steel **17-4PH (H1150)**		Stainless Steel **316**
Hardness (Brinell) **277**	VS	Hardness (Brinell) **217**
Ultimate Tensile Strength **135,000 psi**		Ultimate Tensile Strength **97,175 psi**
0.2% Yield Strength **105,000 psi**		0.2% Yield Strength **42,060 psi**

Stainless Steel **17-4PH (H1150)**		Stainless Steel **316**
Carbon **0.07**		Carbon **0.08**
Chrominium **15.0 - 17.5**		Chrominium **16.0 - 18.0**
Columbian + Tantalum **0.15 - 0.45**		Columbian + Tantalum **0.15 - 0.45**
Copper **3 - 5**	VS	Mo **2 - 3**
Manganese **1**		Manganese **2**
Nickel **3 - 5**		Nickel **10.0 - 14.0**
Phosphorus **0.04**		Phosphorus **0.045**
Silicon **1**		Silicon **0.75**
Sulfur **0.03**		Sulfur **0.03**

04. Core | What is CO_2 Processing

Most people are familiar with CO_2 presenting as three states of matter: solid, liquid and gas. These states depend on the temperature and pressure of CO_2. In its natural state, CO_2 is most abundant as a gas making up around 0.04 % in the earth's atmosphere. However by altering the ambient conditions we can transform CO_2 into either a liquid or a solid.

A phase diagram can be used to determine the state at which CO_2 exists at a defined temperature and pressure (see figure 1-1). For CO_2 we see two intersect points on the phase diagram, the triple point and the critical point.

The triple point is where the three states of matter (solid, liquid and gas) co-exist in equilibrium. For CO_2 the triple point is 5.1 bar and -56 °C. Any change from these conditions alters the state of matter in favour of one of these forms.

For example CO_2 as a liquid exists when the pressure exceeds 5.2 bar at temperatures between -56 °C and 31 °C (these are the temperatures between the triple and the critical point - See figure 1-1).

At the critical point we observe a 4th state of matter known as the supercritical region. In this region CO_2 is no longer a gas or a liquid, but exhibits properties of both and is known as the supercritical phase. Supercritical CO_2 exhibits some unique properties

1. High densities similar to that observed in liquids
2. Low viscosities near those of gases
3. Virtually no surface tension.
4. Higher diffusion coefficients than liquids

These properties give an extremely versatile solvent that can be used for a number of applications ranging from extraction of natural materials to chemical reaction.

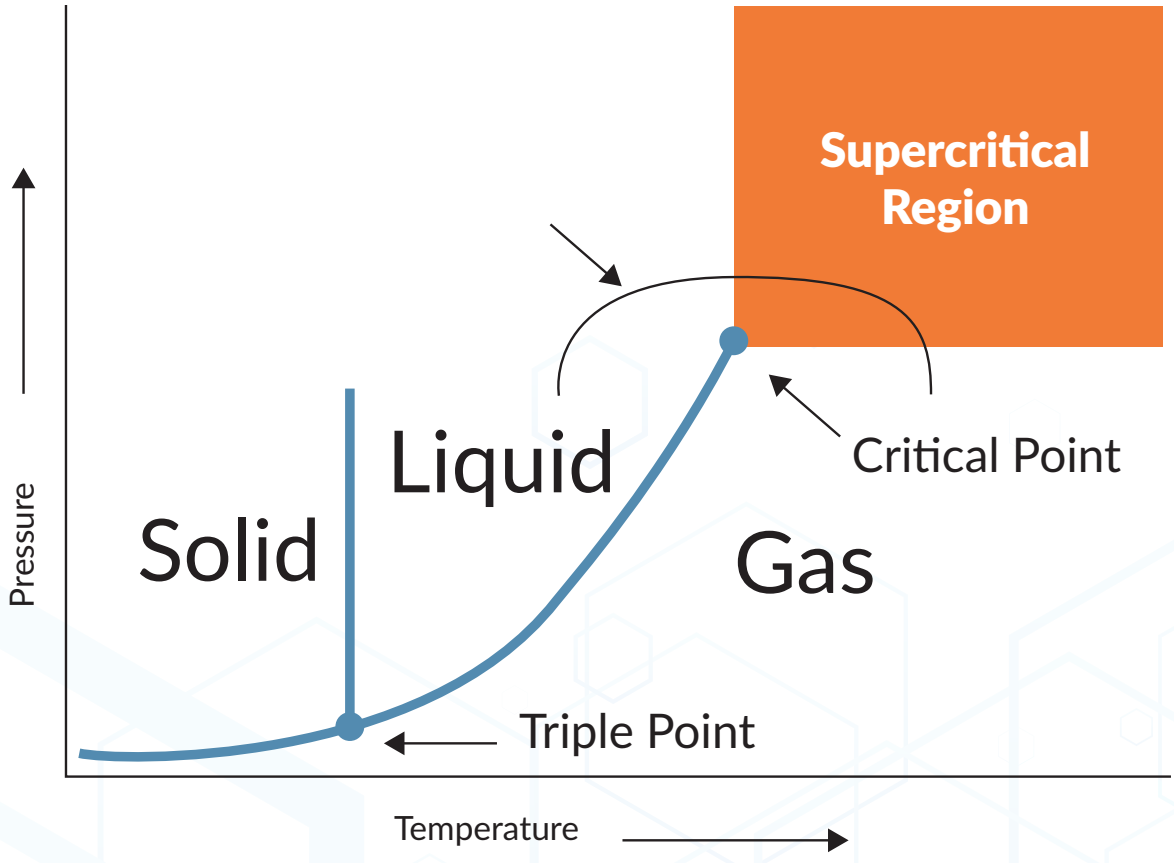


Figure 1–1: Supercritical CO_2 is tuneable without changing phases

05. Core | Why use Supercritical CO_2

Supercritical Fluid Extraction (SFE), is commonly used to extract compounds from solid botanical materials due to its achievable pressure and low temperature (critical temperature and pressure of 31 °C and 74 bar). It has a number of benefits unique to CO_2 over traditional petrochemical derived alternatives.

Tunable Density - Supercritical CO_2 occurs when CO_2 is compressed to 74bar @ 31 ° C. This results in a density of around 440 kg/m³. However as the pressure and temperature alters the density can increase to over 1000kg/m³ (density of water). This tunable density gives CO_2 its selective extraction properties and makes it a very versatile solvent.

Tunable Polarity - CO_2 is a good extraction solvent for lipophilic and hydrophobic molecules, which is why it is popular in natural product extraction. However there are times when the product of interest is more polar. The polarity of the CO_2 can be adjusted with the addition of a solvent of higher polarity such as ethanol. Small percentages of more polar solvents can have a significant effect on which components are extracted. It can also help reduce the pressures required to extract components such as polyphenols.

Selective Fractionation - During an extraction, conditions can be adjusted to alter the density of the CO_2 to selectively extract specific components. The same tunability is possible on the collection side.

With a system that has multiple collectors with their own back pressure regulators, the conditions in each separator can be adjusted to achieve a specific density. Selectively precipitating different compounds into each of the separators.

Recyclable - One of the most powerful aspects of CO_2 as a solvent is witnessed when collecting the product from the separator as it reverts to a gas, so leaving your product uncontaminated. We can also re-use the CO_2 by re-compressing it. The most common method is to drop the pressure of the CO_2 in the final collector to 55 bar (bottle pressure) so that it can be recycled back into a storage tank for re-use.

However, this can present some challenges, as materials can carry over and cause blockages. The material that is carried over can also contaminate the extraction process. By understanding the material and process conditions, these effects can be minimised and/or removed.

Isolation - When isolating the extract from a CO_2 extraction, it requires depressurisation of the CO_2. This involves a phase change from a supercritical fluid into a gas. This ultimate change in density results in the separation of the dissolved compounds from the CO_2. The CO_2 gas is then able to escape leaving the extract uncontaminated by the extracting fluid.

Environmentally Responsible - Unlike other solvent extraction, CO_2 is recovered from other industrial processes as a by-product. It is purified and stored ready for use in many different processes including supercritical CO_2 extractions. The renewable and abundant nature of CO_2 is one of the most attractive properties when using CO_2 as an alternative solvent, however it also has other benefits:

1. Non-toxic,
2. Non-flammable
3. Non-Eco toxic

This combination of properties makes CO_2 a powerful alternative solvent for industrial processing.

06. Core | **CO_2 Applications**

Supercritical fluids have many unique properties that gives them advantages over traditional solvents. Their use extends beyond replacing traditional petrochemical solvents, as their properties can make them more selective in reactive and extractive chemistries. The use of supercritical fluids particle engineering has resulted in the formation of nanoparticles and has given pharmaceutical companies the ability to access different crystal polymorphs, otherwise difficult to access using traditional re-crystallisation techniques.

Extraction - One of the more common applications for sub and supercritical CO_2 is the extraction of natural materials. However CO_2 is a powerful non-polar solvent and can be used to extract a variety of components traditionally extracted using petrochemical derived solvents such as hexane. CO_2 has been used in a number of industries for decades with the most recognisable applications being the de-caffeination of coffee, extraction of hops, defatting cacao and in the more recent years, extraction of cannabis. The process involves CO_2 either as a pressurised liquid or in its supercritical state passing over a solid bed of the material, extracting soluble compounds. These then can be collected by precipitating them once the CO_2 is depressurised to a gas.

Drying - This process is closely related to extraction but rather than the primary interest being the collection of soluble components, it uses CO_2 to remove unwanted compounds from the solid matrix. For example many solvents are highly soluble in CO_2 and can therefore be dried when CO_2 is passed over them. This technique utilises the low surface tension of the CO_2 in its supercritical phase, to remove the solvent without collapsing the structure of the material. Surface tension still present as a result of direct evaporation of solvent causes highly porous structures to collapse. This technique is commonly used to dry high value compounds such as aerogels.

Cleaning and degreasing - Similar to drying, unwanted components can be removed from solid materials when the traditional methods pose a risk to the material being extracted. A good example is the removal of residual organic compounds such as grease and finger prints from electronic wafers, such as removal of such residue from telemetry equipment used in missile guidance systems for example.

See our extraction systems in our Core | Extraction **range**

Particle Formation - CO_2 can be used in particle formation and particle size control. There are two main methods - RESS which stands for Rapid Expansion of Supercritical Solution and SAS for Supercritical Anti-solvent.

RESS requires the compounds to be soluble in supercritical CO_2 which are then depressurised via a nozzle, to atmospheric pressure. The rapid depressurisation causes high supersaturation at the nozzle which leads to small particle sizes with a narrow particle size distribution. Re-crystallistion using RESS has also been used in polymorph conversion traditionally not possible with conventional solvents.

In SAS the compound does not require to be soluble in CO_2, instead it is dissolved in an appropriate organic solvent and introduced via a pump, into a vessel containing CO_2. The CO_2 acts as an anti-solvent precipitating the solute as either micro or nano sized particles. The particle size can be controlled though a number of variables including pressure, temperature and flow rate.

Both RESS and SAS have been used to enhance dissolution rates of active pharmaceuticals improving bioavailability.

See our extraction systems in our Core | Reaction **range**

07. Core | **Vessels (EV-Mini)**

upto 689 bar

Core Separations EV Series are high pressure, high performance extraction and reaction vessels. Using an innovative threaded cap and energised sprung seal, these vessels are designed to be easily opened and closed without tools while remaining safe whilst under pressure.

The vessel bodies are made from high quality 17-4PH stainless steel, 60% stronger than 300 series steel. This reduces the weight and wall thickness of these vessels with the added benefit of improving heat transfer.

Core | **Mini**

System sizes available

EV10 - 10mL | EV25 - 25mL | EV50 - 50mL

Max Pressure: 689 bar (design)
Max Temperature: 150 degC
Material of Construction: 17-4PH

Core | **Features**

Double Ended Vessels

Double ended design allows for easy cleaning, these analytical vessels are available in a range of sizes from 5-50mL. By utilising the 17-PH for material of construction, these vessels have a high strength and corrosion resistance ideal for higher pressure applications such as supercritical processing.

Single Part Cap

A single part threaded cap design utilising an energised sprung seal to retain the pressure. gives our EV-mini series vessels a user friendly tool-less operation for both opening and closing

Replaceable Filter

A screw in filter holder with replaceable filter allows for flexibility when processing different materials with varying particle sizes.

For more infomation: contact@coreseperations.com

07. Core | Vessels (EV-Maxi)

upto 689 bar

Core Separations EV Series are high pressure, high performance extraction and reaction vessels. Using an innovative threaded cap and energised sprung seal, these vessels are designed to be easily opened and closed without tools while remaining safe whilst under pressure.

The vessel bodies are made from high quality 17-4PH stainless steel, 60% stronger than 300 series steel. This reduces the weight and wall thickness of these vessels with the added benefit of improving heat transfer.

Core | **Max**

System sizes available

EV100 - 100mL | EV500 - 500mL | EV1L - 1L | EV3L - 3L | EV5L - 5L | EV10L - 10L

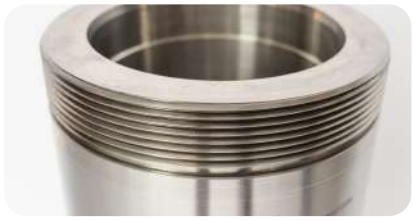
Max Pressure: 689 bar (design)
Max Temperature: 150 degC
Material of Construction: 17-4PH

Pressure, bar	Temperature, °C	Volume, mL	Body Material	Opening
689	**150**	**5 - 10,000**	**17-4PH**	**Double ended**

Core | **Features**

Tool-less Design

The two part cap design prevents premature wearing of the energised sprung seal, by allowing the inner cap which houses the seal, to be placed into position without rotation. The threaded outer cap can then be installed without disturbing the seal.



External Threads

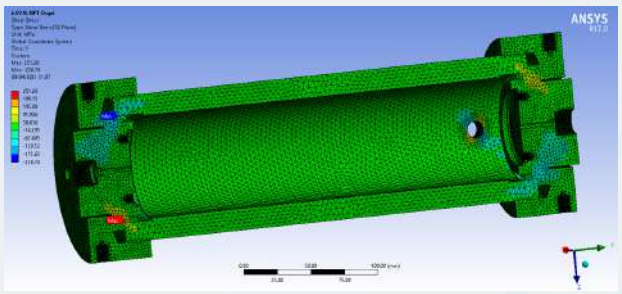
Externally threaded body, leaves a smooth internal finish resulting in easy cleaning for both research and cGMP environments.

Material of Construction

Utilisation of 17-4PH with its higher-strength and corrosion resistance compared to 304 and 316SS makes it more cost-effective for higher pressure applications such as supercritical processing.

Safety of our Products | **Finite Elemental Analysis (FEA)**

We take safety of our customers extremely seriously. Our pressure vessels are designed using Section VIII, Division 1 of the ASME Code. This design by formula approach uses a range of rules for calculating wall thicknesses and reinforcement around openings, and other details of a vessel. To ensure the safety of our products we also apply Finite element analysis (FEA) simulations to predict how our pressure vessels might behave under various extreme conditions and help inform us of predicted life and inspection cycles of our pressure vessels.



The key to safety is knowledge!

For more infomation: contact@coreseperations.com

Closure	Seal	Entry	Mount	Certification
Threaded	**Energised Sprung**	**Tooless**	**Split Collar**	**ASME, PED, CSA, UKCA**

07. Core | Vessels (EVK series)

upto 1100 bar

Building on the EV series vessels, the EVK series pushes the boundaries in CO_2 research offering extraction and reaction vessels that can withstand pressures exceeding 1,100 bar.

Produced from 17-4PH and using a toolless, threaded design, these vessels offer flexibility in tough research environments at extremely high pressures.

Core | **EVK1L**

System sizes available

EVK1L - 1L

Volume: 1L
Max Pressure: 1100 bar (design)
Max Temperature: 150 degC
Dimensions: ID 4.25"; OD 6.875"; H 18.251"

Pressure, bar	Temperature, °C	Volume, mL	Body Material	Opening
1,100	**150**	**1,000 - Custom**	**17-4PH**	**Double ended**

Core | **Features**

Material of Construction

Utilisation of 17-4PH with its higher-strength and corrosion resistance compared to 304 and 316SS makes it more cost-effective for higher pressure applications such as supercritical processing.

Multi Cap Design

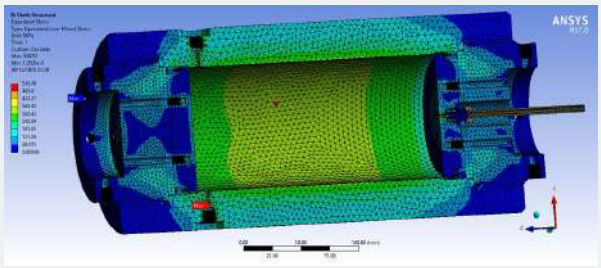
The multi-part design prevents premature wearing of the energised sprung seal, by allowing the inner cap which houses the seal, to be placed into position without rotation. The threaded outer cap can then be installed without disturbing the seal.

EV Tec Basket

EV-Tec series baskets make loading and unloading the pressure vessels quick and efficient, while also reducing manual handling risks. The use a lip seal design for superior sealing while allowing the vessel to be easily loaded and unloaded.

Safety of our Products | **Finite Elemental Analysis (FEA)**

We take safety of our customers extremely seriously. Our pressure vessels are designed using Section VIII, Division 1 of the ASME Code. This design by formula approach uses a range of rules for calculating wall thicknesses and reinforcement around openings, and other details of a vessel. To ensure the safety of our products we also apply Finite element analysis (FEA) simulations to predict how our pressure vessels might behave under various extreme conditions and help inform us of predicted life and inspection cycles of our pressure vessels.



The key to safety is knowledge!

For more infomation: contact@coreseperations.com

Closure	Seal	Entry	Mount	Certification
Threaded	**Energised Sprung**	**Tooless**	**Split Collar**	**ASME, PED, CSA, UKCA**

08. Core | **Pumps (CL series)**

upto 689 bar

Core Separations CL series pumps are ideal for high pressure liquid and CO_2 applications. The CL pumps are specifically designed to meet a demanding research environment where space is at a premium.

Using a tried and tested cam driven piston design, utilising a stepper motor for improved accuracy, the CL pumps can generate pressures up to 689 bar.

With the heads machined with an innovative groove allowing the addition of cooling fluid, these pumps can easily be used to pump both solvents and CO_2

Core | **P50 Pump**

Whether looking to deliver liquids into a high pressure autoclave or generate supercritical CO2, the Core Separations **P50** can deliver a maximum flow of 50g/min upto 689 bar. Ideal for reactors upto 500mL.

Flow Rate: 5 – 50g/min
Maximum Discharge Pressure: 689 bar (design)
Power: 208-240 V, 13 A

Core | **P250 Pump**

When research requires a boost the P250 is an ideal pump for generating high pressure liquid CO2 at a maximum flow rate of 200g/min for either supercritical CO2 rections or extractions. Ideal for reactors upto 5L.

Flow Rate: 20 – 200g/min
Maximum Discharge Pressure: 689 bar (design)
Power: 208-240 V, 13 A

Pressure, bar	Flow Rate, g/min	Media	Head Material	Number of Heads
689	**upto 250**	**CO_2, Solvent**	**316**	**2**

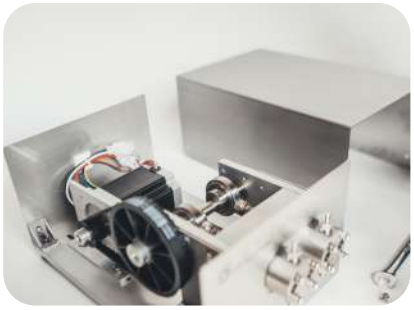
Core | **Features**

Core | **Research**

Our Laboratory pumps are designed with research in mind. A high tech and robust design with a host of upgradable options all packed into a compact shell. As with our industrial pumps we have taken the elements that make these pumps reliable and robust and built them into our laboratory pumps.

Core | **Design**

The Sapphire piston design reduces friction, resulting in less seal wear and lower maintenance. Dual stainless-steel heads with a cam driven piston assembly eliminates pulsed flow.



Core | **Precision**

Utilising either stepper or servo motors the CL pumps are capable of control, based on feedback from the pressure sensor or flow meter and can be regulated using a touch screen display, or via a PC through an ethernet connection.

SFX Control Software

When dealing with high pressure systems, pressure control is key. Core Separations developed APC (Advanced Pressure Control). This multilevel PID control achieves superior operational management while maintaining rapid pressure build up.

SCAN ME

For more infomation: contact@coreseperations.com

Type	Piston Material	Control	Mount	Certification
Piston	**Sapphire**	**Standalone, System**	**Rubber Feet**	**ASME, PED, UKCA**

08. Core | Pumps (CI & CU series)

upto 1000 bar

Core industrial pumps (CI Pumps) are engineered to operate with the highest level of performance and precision. Designed using a combination of a fixed stroke piston and variable frequency drive technology, we accurately control the delivery of high-pressure fluids including CO_2.

Our Industrial series pumps are highly energy efficient and have a proven long service life for all mechanical components. Combined with particularly low maintenance and operating costs, our pumps are well suited for the conditions required in manufacturing environments.

Core | **P1K Pump**

Using the same core design as our P500 pump, the **P1K** delivers a increase in performance without compromising reliability. Delivering 1kg/min at pressures upto 400 bar this pump is suitable for reactors upto 25L.

Flow Rate: 100 – 1000g/min
Maximum Discharge Pressure: 400 bar (design)
Power: 208-240 V, 13 A

Core | **P500 Pump**

Pilot scale manufacturing needs a pump with a robust design with capable of delivering high flow rates. The **P500** can deliver 500g/min at 689 bar and can be integrated into a new system or as an upgade to a current SFE system. Suitable for reactors upto 10L.

Flow Rate: 50 – 500g/min
Maximum Discharge Pressure: 689 bar (design)
Power: 208-240 V, 13 A

Pressure, bar	Flow Rate g/min	Media	Head Material	Number of Heads
upto 1,000	**upto 1,000**	**CO_2, Solvent**	**316**	**2**

Core | **P251K Pump**

Designed to deliver liquids including CO2 into extremely high pressure enviroments upto 1000 bar. Built from the ground up the P251K can deliver 250g/min at 1000 bar utilising a highly efficient Core Separations designed check valve.

Flow Rate: 25 – 250g/min
Maximum Discharge Pressure: 1000 bar (design)
Power: 208-240 V, 13 A

Core | **Features**

Core | **Production**

Our Industrial pumps are designed for high flow, high pressure and robust operation. Used in our Core | **Systems** to ensure reliability and high throughput.

Core | **Design**

Dual cam driven pistons designed to reduce pulsation during operation.

Sealed for life bearings removing the requirement for an oil pan reducing the required maintenance over the lifetime of the pump.

Core | **Precision**

Use of high purity ceramic pistons increases the durability of the pump at high pressures, allowing them to be used not only with CO2 but a number of organic solvents as well.

For more infomation: contact@coreseperations.com

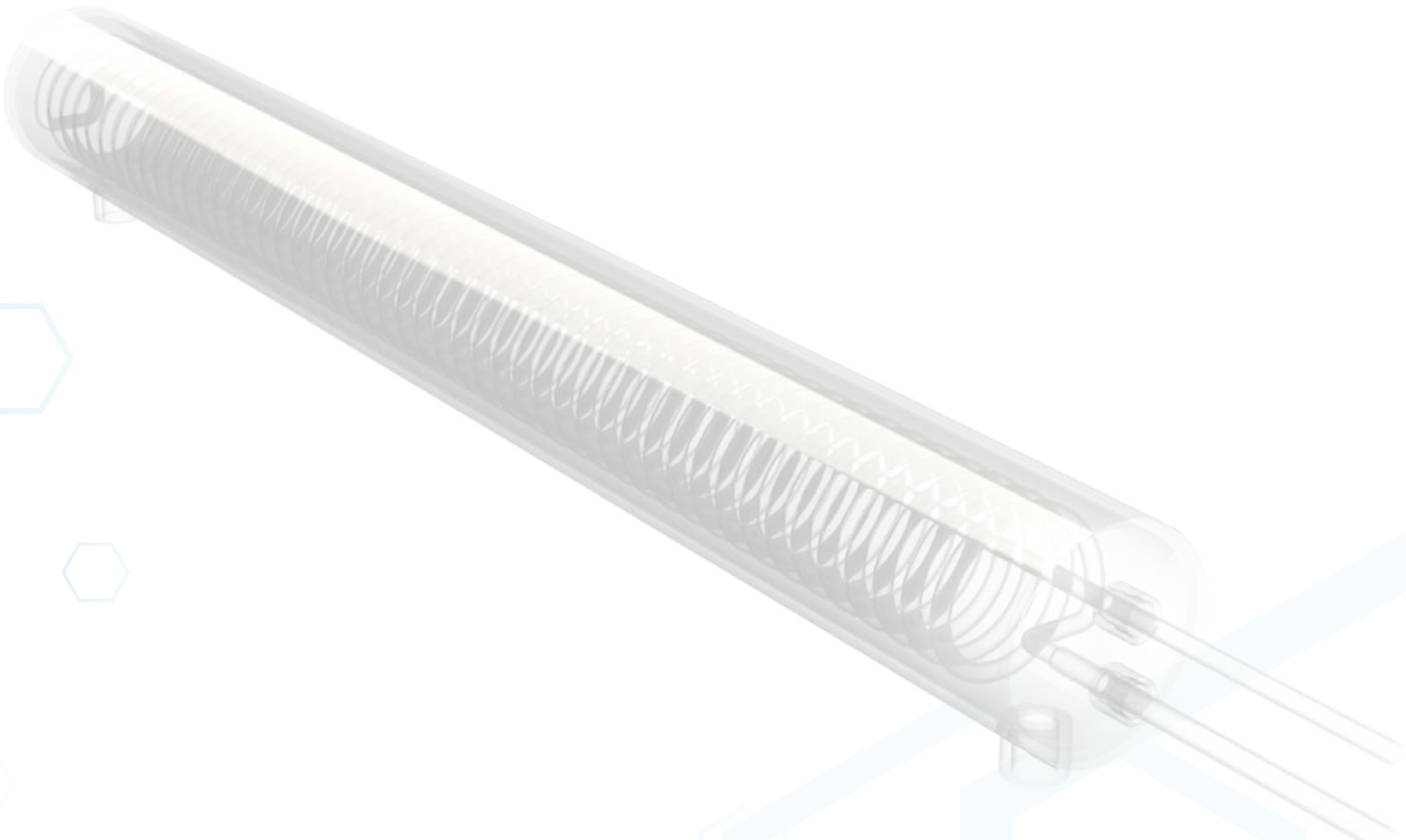
Type	Piston Material	Control	Mount	Certification
Piston	**Ceramic**	**Standalone, System**	**Wheels**	**ASME, PED, UKCA**

09. Core | Heat Exchangers

upto 1000 bar

Supercritical fluids by their nature require heat to pass the supercritical phase boundary. However to compress CO_2 using our liquid pumps we need to ensure the incoming CO_2 supply remains as a liquid. We do this by cooling it to below 5° C.

So, at Core we offer 2 types of tube in shell heat exchangers, to either chill the incoming CO_2 feed or heat it after compression. Our heat exchanger range is designed to operate at different pressures, making them the heat exchangers of choice when building both supercritical and subcritical extraction systems.



Pressure, bar	Temperature, °C	Media	Type	Shell Material
upto 1000	**upto 150**	**CO_2, Solvent**	**Tube in Shell**	**304**

Liquid | **Heat Exchangers**

Part Number	Heating	Tube OD	Tube Length	Surface area	Pressure
LHE403520	Liquid	1/4"	20 ft	0.65 ft²	353 bar
LHE404920	Liquid	1/4"	20 ft	0.65 ft²	517 bar
LHE406520	Liquid	1/4"	20 ft	0.65 ft²	703 bar
LHE603540	Liquid	3/8"	40 ft	1.95 ft²	227 bar
LHE606540	Liquid	3/8"	40 ft	1.95 ft²	448 bar

Electric | **Heat Exchangers**

Part Number	Heating	Tube OD	Tube Length	Surface area	Pressure
HE60T4049-4CE	Electric	1/4"	20 ft	0.65 ft²	517 bar
HE60T4065-4CE	Electric	1/4"	20 ft	0.65 ft²	703 bar

For more infomation: contact@coreseperations.com

Tube Material	Tube	Control	Certification
316	**Seamless coil**	**Standalone, System**	**ASME, PED, UKCA**

10. Core | Extraction

upto 1000 bar

Core Separations specialises in the manufacture of many of the key components found in our extraction systems. As one of the industry leaders in the supercritical extraction process, our production and codes of practice ensure that the quality, safety and functionality are of the optimum standard.

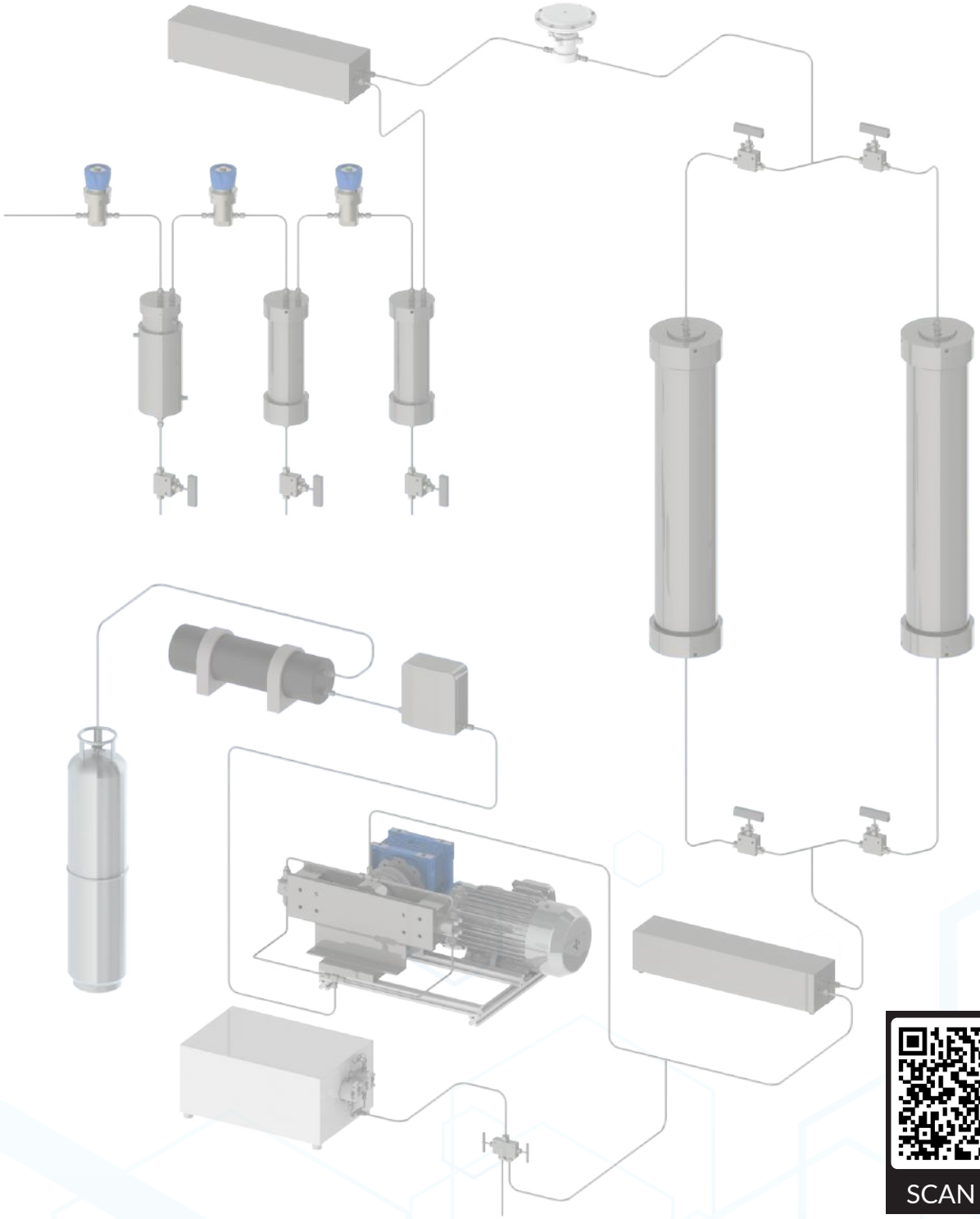
With our extensive knowledge built on over 20 years of experience working with supercritical fluids, we are experts in the field of delivering bespoke systems which have been comprehensively developed to process a variety of natural products. These solutions include extractions from herbs, seeds and leaves. Furthermore, our systems are designed to extract Cannabinoids from the Cannabis plant, as well as any materials that have a solubility in CO_2, or CO_2 with a modifying solvent.

Applications

- Natural Products
- Cannabis, THC and CBD
- Terpenes
- Oils and Lipids
- Polyphenols

Pressure, bar	Temperature, °C	Volume, L	Flow Rate, g/min	Flow Meter
upto 1000	**upto 150**	**upto 10**	**upto 1,000**	**Optional**

Core | **How Extraction works?**



SCAN ME

For more infomation: contact@coreseperations.com

Co-solvent Pump	Automated BPR	Cyclones	Fractionation	Recycling
Optional	**Standard**	**200 bar Std**	**upto 3 cyclones**	**Optional**

Multi vessel system

Our systems are designed to be modular and upgradeable. This allows our customers to modify the systems to meet their research needs or processing requirements. Dual extraction vessels offer the flexibility to make the system semi continuous by allowing the user to extract from one vessel while preparing another. Or by varying extraction vessel volumes to allow different scale extractions to be performed, making the system both a versatile research tool and a pilot scale production system.

System sizes available

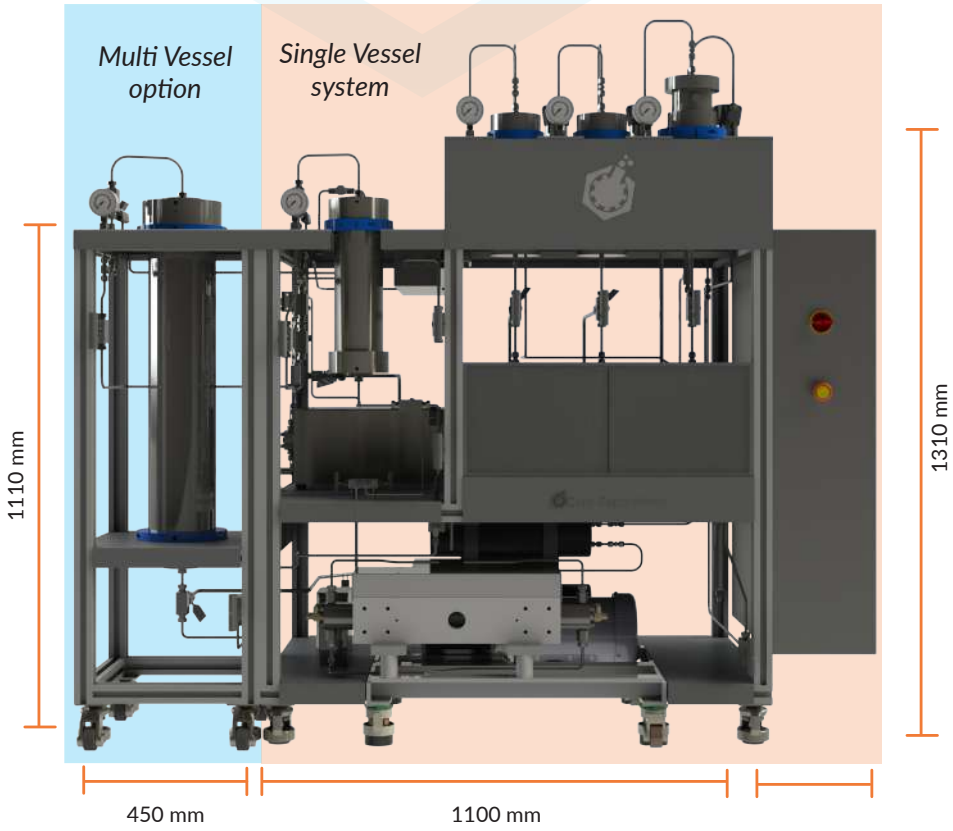
SFX 500 | SFX 1L | SFX 3L | SFX 5L | SFX10L

Extraction

Extractor volume upto 10L	
CO_2 flowrate	upto 1kg/min
Max pressure	600 bar
Max temperature	150°C

Separation

Capacity	1L
Max pressure	200 bar
Max temperature	150°C



Specification

Power requirements
415 V (3PH+N+E); upto 64A (depends on heating options)

Pneumatic Air Pressure (bar/psi)
6.9 bar / 100 psi, 1/4" compression inlet

CO_2 Inlet
55 bar, 1/4" compression inlet

Vent Line
3/4" compression inlet

Weight
350/400 kg (depending on options)

Chiller
Required

PC & Monitor
Minimum of 1.5 GHz, 16 GB RAM, 250 GB storage, Ethernet port for control panel, wired or wireless connection for Internet connectivity. Google Chrome browser. Monitor 21" minimum with 1920 x 1080 pixels resolution

SFX Software

- Dashboard visualisation of key processing parameters
- Manual control of key components within the SFX system in real time using APC to accurately control the pressure
- Recipe menu allows you to automate a variety of conditions including flow rates, temperatures and pressures over a defined time limit.
- Real time data logging and visualisation via Grafana Dashboard
- Programmable warning and alarm limits to alert the user that the system conditions are approaching the cut off safety limits.
- SQL database logs all the alarms and user activity to aid in fault detection and diagnosis.

When dealing with high pressure systems, pressure control is key. Standard control is accomplished using proportional, integral and derivative control (PID). Unsatisfied with the standard level of control, Core Separations developed APC (Advanced Pressure Control). This multilevel PID control achieves superior operational management while maintaining rapid pressure build up.

Core | **Co-solvent**

The polarity of the CO_2 can be adjusted with the addition of a more polar solvent like ethanol. Small percentages of more polar solvents can have a significant effect on which components are extracted. It can also help reduce the pressures required to extract components such as polyphenols.

Core | **Flow Upgrade**

CO_2 flow rate plays an important role when looking at extracting a variety of biomass materials. This is why we build modular systems which allow us to offer CO_2 pump upgrades to increase flow.

Core | **Fractionation**

Extraction conditions can be adjusted to alter the density of the CO2 to selectively extract specific components. The same tunability is possible on the collection side.

A system with multiple collectors with their own back pressure regulators, the conditions in each separator can be adjusted to achieve a specific density. Selectively precipitating different compounds into each of the separators.

Certification

Core | **Extraction**

09. Core | **Cyclones**

Offering both double end and single ended cyclone designs using either standard PTFE o-rings or sprung seals our systems can accommodate either multiple cyclones for either single pot collection or multi pot fractionation.

08. Core | **Vaporiser**

Joule-Thomson effect is observed when we go from a high pressure to a low pressure resulting in a drop in temperature. To overcome this, we use a Vaporiser to heat the CO2 exiting the ABPR. The vaporiser also helps to expand the CO2 from its liquid state into a gas in-order to help precipitate the extracted components.

06. Core | **Extraction**

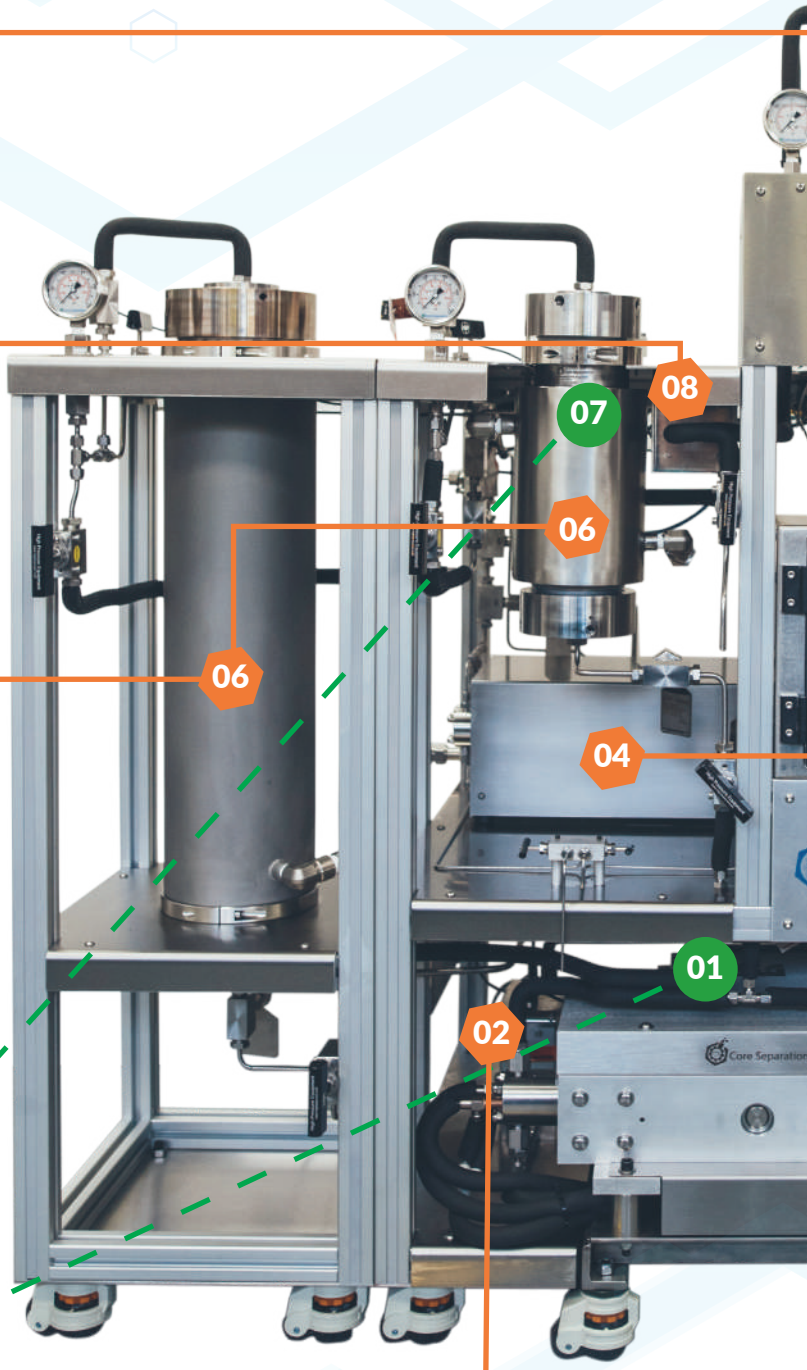
Ultilising a static sprung seal we offer tool-less threaded pressure vessel, designed to withstand 1000's cycles at 689 bar (10,000 psi). We offer a variety or volumes to meet a number of production rates, with our vessels meeting a variety of regional regulations (ASME and PED). this allows us to offer our systems all round the world.

07. Core | **ABPR**

Utilising a electopneumatic back pressure regulator with our APC control mechanism we are able to automatically regulate the pressure in our extractions, maintaining pressures +/- 1 bar of the setpoint.

01. Core | **Condenser**

Although we use a liquid CO_2 feed in our extraction systems, its important that the incoming CO_2 remains liquid. The condenser acts to maintain the incoming temperature of the CO_2 ensuring it remains a liquid during the pumping phase. Additional condensers can be added with higher flow rate pumps or the addition of a recycling unit.



02. Core | **Flow Meter**

Addition of a flow meter improves delivery accuracy by adjusting the flow to compensate for changes in the CO_2 feed density. Although we control the incoming temperature of the CO_2 a drop in pressure from the CO_2 bottle as we consume the CO_2, can result in a density shift causing the pump to under deliver the CO_2 to the process. The flow meter also offers additional process data to be collected in the system, such as total CO_2 used.

Part viewed from the front

Part can be viewed from the back

10. Core | Cold Trap

While its important to expand the CO2 into its gas phase in-order for the extracted components to precipitate from the CO2 feed into one of the cyclone separators, the more volatile components can vaporise and escape with the CO2. The addition of a cold trap after the last cyclone can aidsin trapping the more volatile components obtinained from example terpenes terpenoids.

11. Core | MBPR

Whether it be a cyclone separator or a cold trap controlling the pressure inside these vessels can aid in collection or in the case of multi cyclone systems result in selective fraction of the extraction feed. By modifying the pressure and temperature in each separator the density can be accurately control to favour the precipitation of some components over other. The manual back pressure regulators facilitate the control of the pressure in each of the separators.

04. Core | Co-Solvent Pump

The use of co-solvent pumps have a number of benefits when incorporated into a system. They allow the introduction of solvent to modify the CO2 polarity. But they can be used for cleaning and the introduction of solutes in the SAS process. The co-solvent pumps like our CO2 pumps have been designed from the ground up. In fact they can be used for both operations with the addition or removal of our cooling cartridges.

05. Core | Pre-Heater

The pre-heater is located just after the pump to control the temperature of the CO2 reaching the extractor. It ensures the CO2 entering the extraction vessel is already at the extraction temperature ensuring a controlled extraction process.

03. Core | CO2 Pump

Built from the ground up using our extensive knowledge of CO2 processing the Core CO2 pumps are designed for high demand environments such as research and production. Our systems can be built to utilise our wide range of pumps allowing us to achieve flow rates between 5g/min upto 1kg/min.

Core Separations

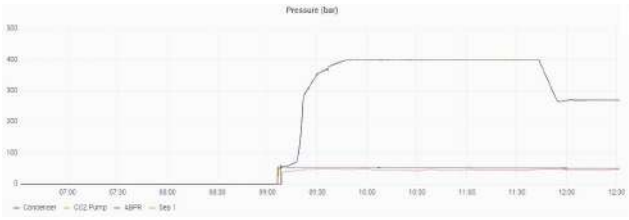
11. Core | **Reaction**

upto 1000 bar

Supercritical fluids (SCF) are not just good in extraction and separation processes. Their unique properties give rise to several different applications such as chemical reaction and particle size formation.

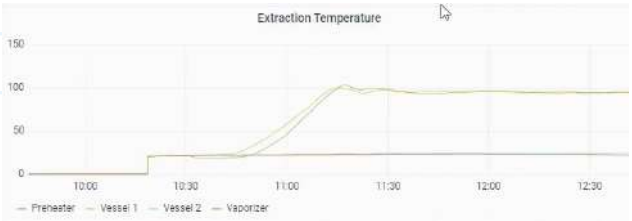
The Core | **Reaction** systems have been designed to harness the power of supercritical fluids to either explore SCF as an alternative solvent in chemical transformations or in the formation of nano and micro-sized particles to improve dissolution of active pharmaceutical ingredients (API) for example utilising either the rapid expansion of supercritical solution (RESS) techniques or supercritical anti-solvent method (SAS).

Core | **Controlled Depressurisation**



Depressurisation control on many other control systems simply involves the controlled opening of the BPR needle over time. The user calibrates the needle speed to achieve the necessary setpoint. The SFX software removes this trial and error and introduces true depressurisation control through a ramp rate setpoint and pressure control feedback.

Core | **Temperature Ramp**



Building on our pressure control, the SFX Software has a built-in temperature ramp feature, allowing the user to control the rate of heating.

Pressure, bar	Temperature, °C	Volume, L	Flow Rate, g/min	Flow Meter
upto 1000	**upto 150**	**upto 10**	**upto 1,000**	**Optional**

Applications

- Hydrogenations and Hydroformylation
- C-C bond Formation
- Enzymatic Biotransformations
- Particle Engineering
- Aerogel Formation

For more infomation: contact@coreseperations.com

Co-solvent Pump	Automated BPR	Cyclones	Control	Stirrer
Optional	**Standard**	**200 bar Std**	**PLC-PC**	**Optional**

Multi-Vessel System

Within the reaction range both single dual vessels combinations are available. The configuration depends upon the application required. With a simple reaction or transformation using ScCO2 fluid as the solvent only a single vessel configuration is required. However if you are looking at exploring particle size reuction using either RESS (rapid expansion of supercritical solutions) or SAS (supercritcal anti-solvent then both a dissoution and spray vessel maybe reuqired. All vessels come with the option to include a high pressure overhead stirrer.

System sizes available

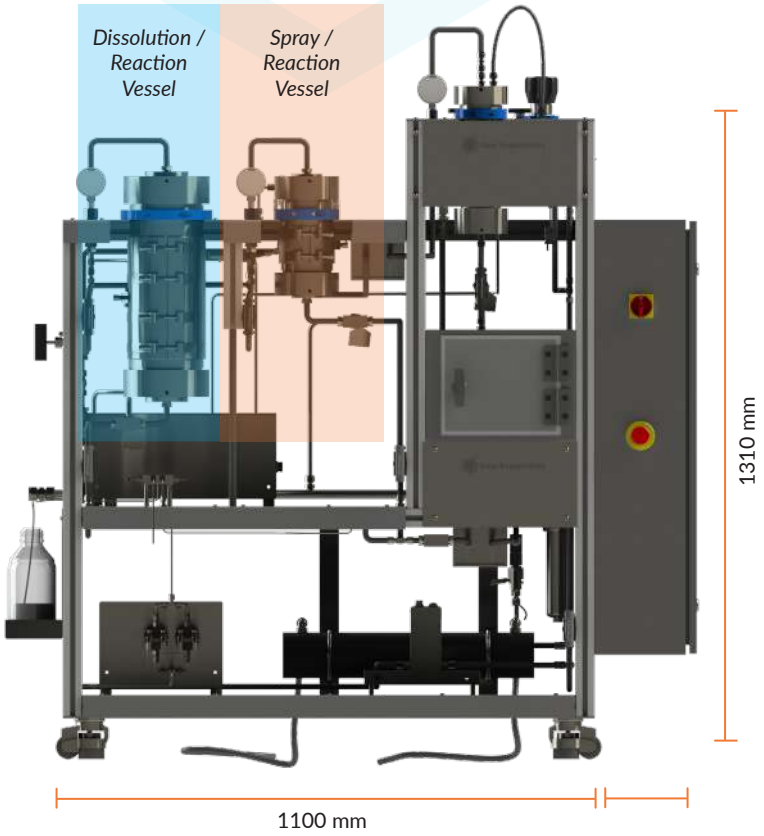
SFXR 500 | SFXR 1L | SFXR 3L | SFXR 5L | SFXR 10L

Extraction

Extractor volume	upto 10L
CO_2 flowrate	upto 500g/ min
Max pressure	600 bar
Max temperature	200°C

Separation

Capacity	upto 1L
Max pressure	200 bar
Max temperature	150 °C



Specification

Power requirements
415 V (3PH+N+E); upto 64A (depends on heating options)

Pneumatic Air Pressure (bar/psi)
6.9 bar / 100 psi, 1/4" compression inlet

CO_2 Inlet
55 bar, 1/4" compression inlet

Vent Line
3/4" compression inlet

Weight
350/400 kg (depending on options)

Chiller
Required

PC & Monitor
Minimum of 1.5 GHz, 16 GB RAM, 250 GB storage, Ethernet port for control panel, wired or wireless connection for Internet connectivity. Google Chrome browser. Monitor 21" minimum with 1920 x 1080 pixels resolution

SFX Software

- Dashboard visualisation of key processing parameters
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Core | **Control**

Our advanced and propriety pressure control system known as adaptive pressure control (APC™), is able to achieve precise control of the back pressure to +/-1 bar. This gives our systems superior control during an extraction process.

Core | **Safety**

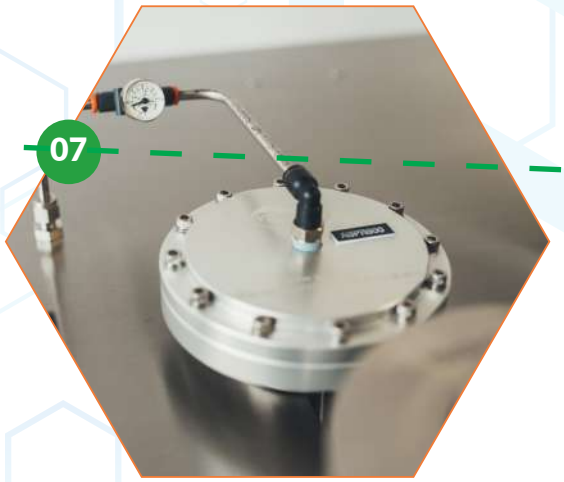
Core systems are designed with modularity in mind. We understand that research requires flexibility, so we build our systems with a robust set of standard features, but leave space to include specialised components to help drive your research forward.

Core | **Flexibility**

With safety being our highest priority we professionally hard pipe all of our systems using stainless-steel tube. This allows us to offer higher pressure systems giving access to higher CO_2 densities than can be achieved on low pressure systems commonly found on the market.

Certification

Core | **Reaction**



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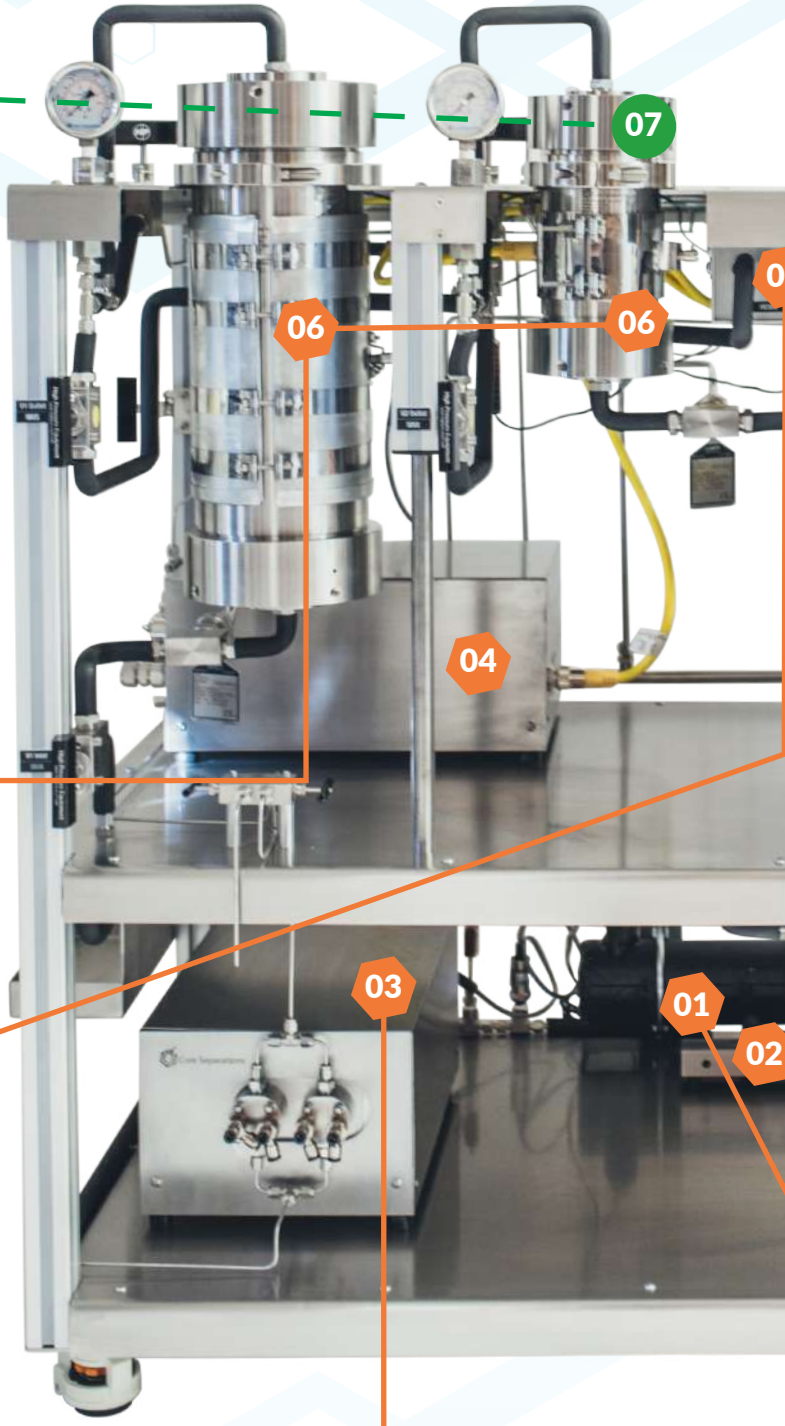

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Part viewed from the front

Part can be viewed from the back

09. Core | **Cyclones**

Offering both double end and single ended cyclone designs using either standard PTFE o-rings or sprung seals our systems can accommodate either multiple cyclones for either single pot collection or multi pot fractionation.

11. Core | **MBPR**

Whether it be a cyclone separator or a cold trap controlling the pressure inside these vessels can aid in collection or in the case of multi cyclone systems result in selective fraction of the extraction feed. By modifying the pressure and temperature in each separator the density can be accurately control to favour the precipitation of some components over other. The manual back pressure regulators facilitate the control of the pressure in each of the separators.

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01. Core | **Condenser**

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Core Separations

12. Core | **Counter Current Column**

upto 689 bar

Counter Current column is a multi-stage liquid-liquid extraction. Unlike their solid-liquid counter parts (see Core | **Extraction** systems), counter current columns involve continuous separations to produce two feeds. A raffinate which is the fraction depleted of the more volatile components and the extracted phase containing the volatile compounds.

The Core | **Counter Current Column** is a robust addition to supercritical fluid extraction techniques. Designed as a multi piece column for flexibility, our columns can be easily expanded with the addition of further heated zones, making them suitable for the most demanding extraction processes.

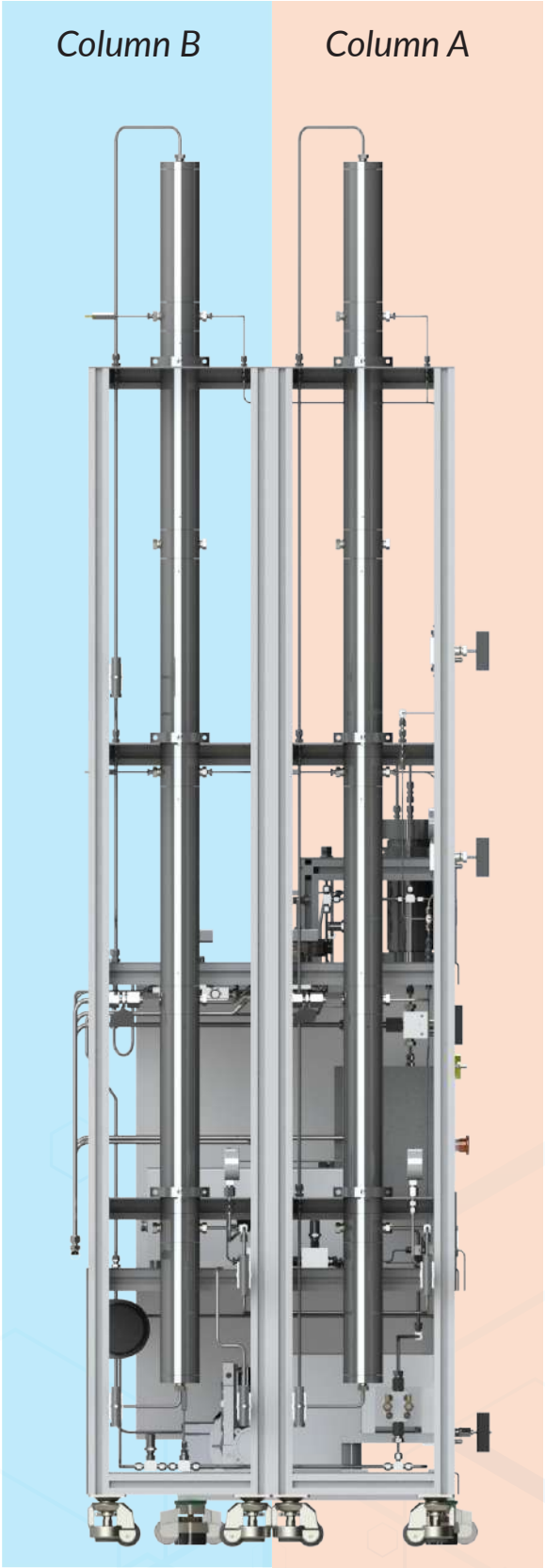
Applications

- Essential oil
- Seed Oil
- Solvent Recovery
- Fat removal
- Alcohol extraction

Pressure, bar	Temperature, °C	Volume L	Heated Zones	Flow Rate, g/min
upto 689	**upto 100**	**2.017**	**4**	**upto 1,000**

Multi column system

To improve productive multiple columns can be installed on a single system. Why not in touch to discuss the different configurations we can offer.



For more infomation: contact@coreseperations.com

Flow Meter	Automated BPR	Cyclones	Control	Certification
Optional	**Standard**	**200 bar Std**	**PLC-PC**	**ASME, PED, CSA, UKCA**

Multi-Section Column

The counter current column is built up of couplers and main body sections. A 2m long column has 6 body sections and 5 couplers joining each section and 2 caps. Only 4 of the main body sections make up the heated zones, with the top section unheated and the bottom section acting as the heavy fraction collection vessel. The couplers each have 2 ports allowing the addition of liquid entry pipes, rupture disk for safety and in-process thermocouples to measure the process temperature at points along the column. Due to the modular nature of the column design further bodies and couplers can be added to increase the effective length of the column to improve separation.

System sizes available

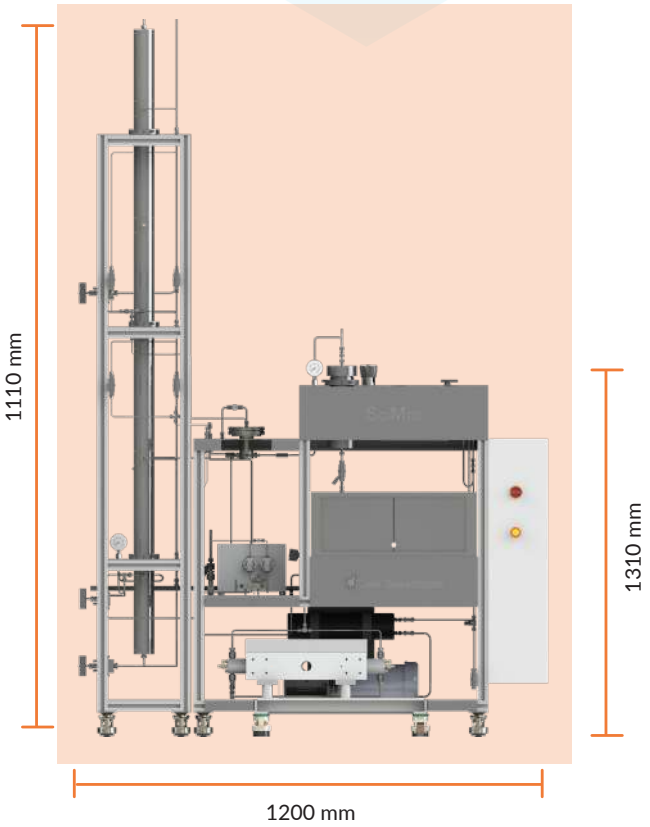
SFX CC2M

Extraction

Extractor volume	2L
CO2 flowrate	500g/min
Max pressure	600 bar
Max temperature	100°C

Separation

Capacity	1L



Specification

Power requirements
415 V (3PH+N+E); upto 64A
(depends on heating options)

Pneumatic Air Pressure (bar/psi)
6.9 bar / 100 psi, 1/4" compression inlet

CO2 Inlet
55 bar, 1/4" compression inlet

Vent Line
3/4" compression inlet

Weight
350/400 kg (depending on options)

Chiller
Required

PC & Monitor
Minimum of 1.5 GHz, 16 GB RAM, 250 GB storage, Ethernet port for control panel, wired or wireless connection for Internet connectivity. Google Chrome browser. Monitor 21" minimum with 1920 x 1080 pixels resolution

SFX Software

Dashboard visualisation of key processing parameters

Manual control of key components within the SFX system in real time using APC to accurately control the pressure

Recipe menu allows you to automate a variety of conditions including flow rates, temperatures and pressures over a defined time limit.

Real time data logging and visualisation via Grafana Dashboard

Programmable warning and alarm limits to alert the user that the system conditions are approaching the cut off safety limits.

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High Surface Area

Packed with prismic springs the CO_2 flows over the packing placed within the column. Introduction of the liquid feed wets the surface of the packing whcih acts to improves mass transfer.

Mass transfer - total movement of mass from one location to another. The selective interaction of the CO_2 with the compounds creates this separation.

Flexible Design

The column is joined together with couplers This allows the column to be extended to increase the spearation gradient or reduced when height restrictions are present.

Multizone Separation

Our columns are split into several heated zones. Each zone is heated to a different temperature creating a gradient of CO_2 densities throughout the column. Zones can be added and removed to improve separation.

Certification

Core | **Counter Current Column**

05. Core | **Counter current column**

The counter current column is made up of 4 heat zones with an effective length of 2M. A temperature gradient is created along the column altering the CO2 density at each zone, allowing the spearation process to take place. The modular design allows multiple liquid entry points, including the abilty to shorten and lengthen the column.

04. Core | **Co-Solvent**

The use of co-solvent pumps have a number of benefits when incorporated into a system. They allow the introduction of solvent to modify the CO2 polarity. But they can be used for cleaning and the introduction of solutes in the SAS process. The co-solvent pumps like our CO2 pumps have been designed from the ground up. In fact they can be used for both operations with the addition or removal of our cooling cartridges.

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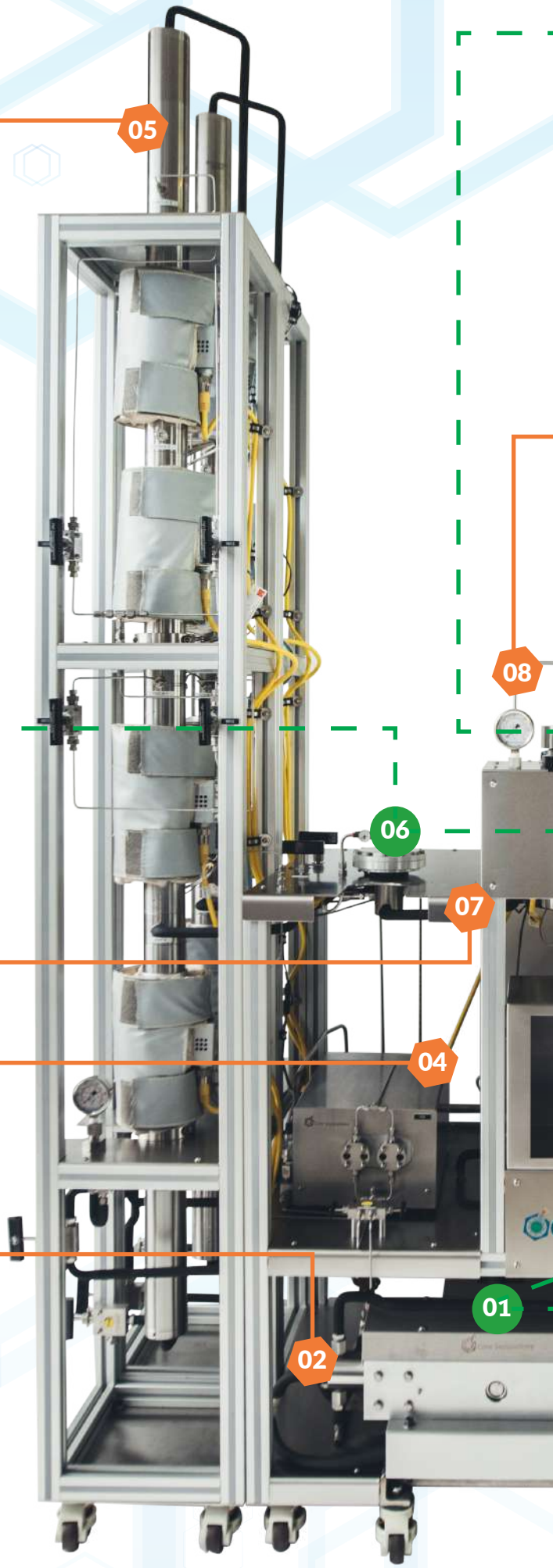

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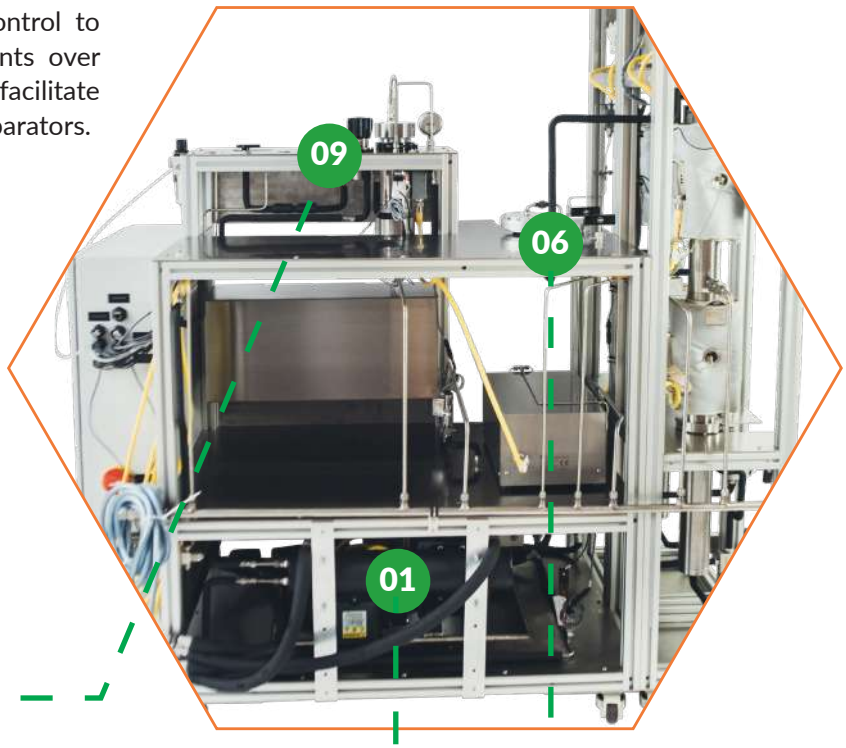
Part can be viewed from the back



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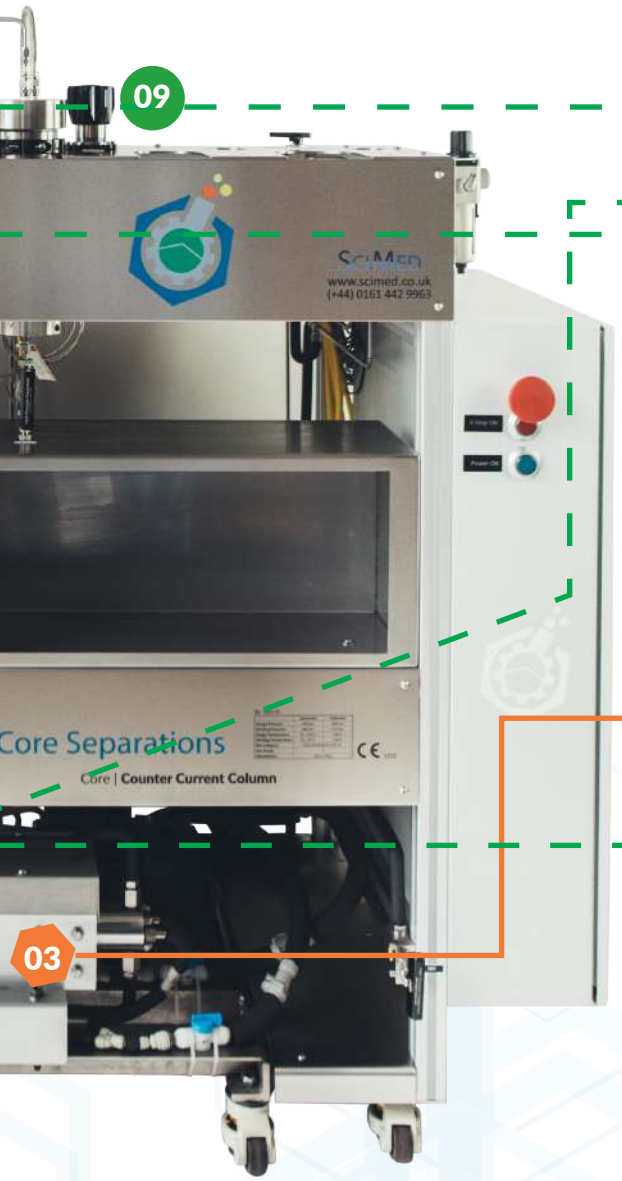

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03. Core | **CO_2 Pump**

Built from the ground up using our extensive knowledge of CO_2 processing the Core CO_2 pumps are designed for high demand environments such as research and production. Our systems can be built to utilise our wide range of pumps allowing us to achieve flow rates between 5g/min upto 1kg/min.

13. Core | **Water**

upto 550 bar

The Core | Water system is a subcritical water extraction system that can perform extractions over a range of temperatures and pressures (500 bar @ 400°C).

Compared to organic solvents, subcritical water has tuneable properties such as density, and dielectric constant which can be adjusted by temperature. For example, subcritical water's polarity can be decreased with increasing temperature.

These versatile properties allow the Core | Water system to perform selective extractions of polar compounds at lower temperatures and less polar ingredients at higher temperatures.

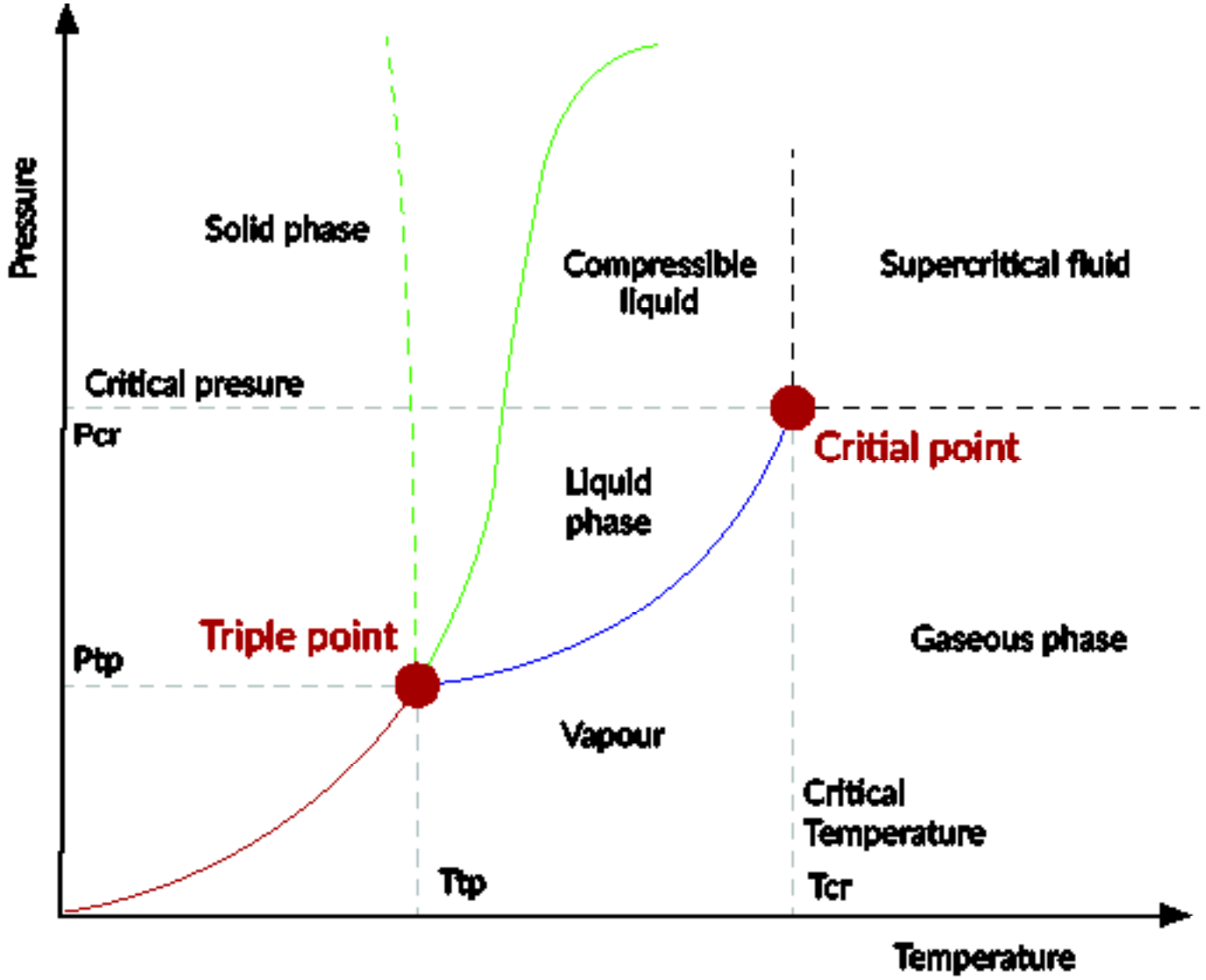
Applications

- Polyphenols
- Flavoids
- Sugars
- Gyclosides
- Natural Products

Core | **What is SWE Processing**

Subcritical-water extraction (SWE) occurs when water is maintained in a liquid state under high pressure at temperatures between 100 and 374 °C. At theses temperatures water has a lower dielectric constant, weakening the hydrogen bonds making subcritical water more like less-polar organic solvents such as methanol and ethanol.

At temperatures above 374oC and 220 bar water passes its critical point and enters its supercritical state. In this region water becomes a strong oxidiser and is more destructive than in its subcritical state, making more suitable for reaction over extraction.



High Temperature Water Extraction

The Inconel vessel uses a bolted enclosure sealing on a graph-oil gasket. Encased in a clam-shell furnace to provide superior heating and shield the user from the extreme temperature. Before the water enters the vessel, it is pre-heated to temperatures up to 400 °C via the electrical heat exchangers. Once the water exits the vessel it is cooled via a tube in shell heat exchanger to below 50 °C before entering the ABPR. The water extract is then collected in a 1L colt trap located on the right-hand side of the system.

System sizes available

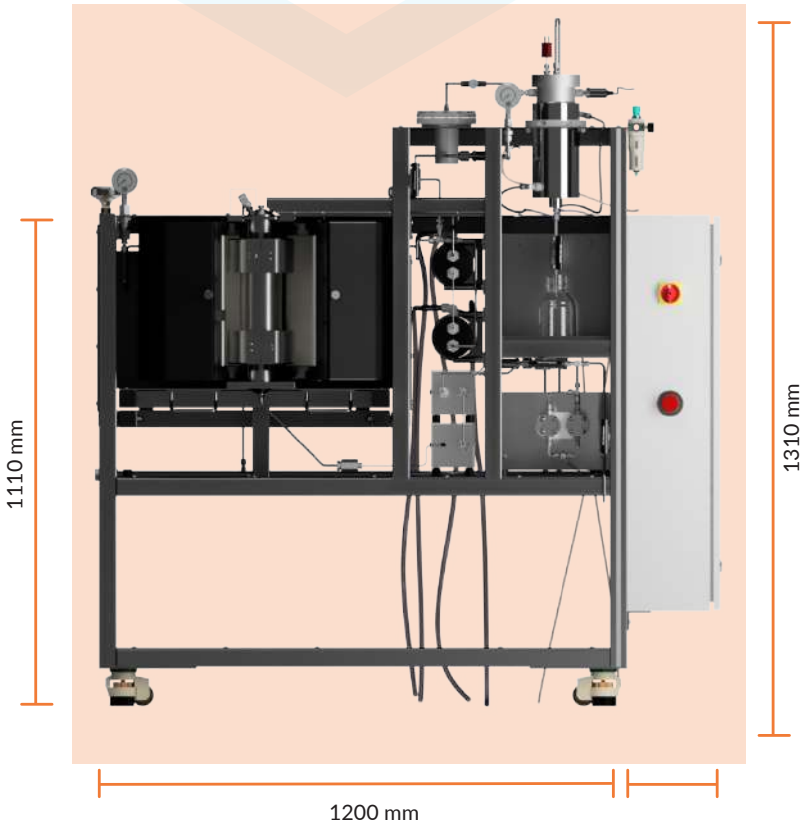
SFXW 500

Extraction

Extractor volume	500mL
Water flowrate	50mL/min
Max pressure	500 bar
Max temperature	400°C

Separation

Capacity	1L



Specification

Power requirements
415 V (3PH+N+E); 32A

Pneumatic Air Pressure (bar/psi)
6.9 bar / 100 psi, 1/4" compression inlet

Vent Line
3/4" compression inlet

Weight
350/400 kg (depending on options)

Chiller
Required

PC & Monitor
Minimum of 1.5 GHz, 16 GB RAM, 250 GB storage, Ethernet port for control panel, wired or wireless connection for Internet connectivity. Google Chrome browser. Monitor 21” minimum with 1920 x 1080 pixels resolution

SFX Software

- Dashboard visualisation of key processing parameters
- Manual control of key components within the SFX system in real time using APC to accurately control the pressure
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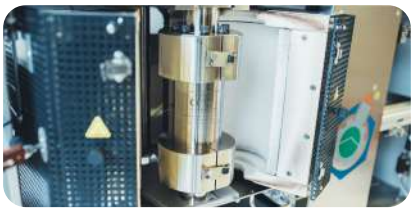
When dealing with high pressure systems, pressure control is key. Standard control is accomplished using proportional, integral and derivative control (PID). Unsatisfied with the standard level of control, Core Separations developed APC (Advanced Pressure Control). This multilevel PID control achieves superior operational management while maintaining rapid pressure build up.



Speciality Metal : **Inconel**

The Core | **Water** system uses an Inconel extraction vessel, heat exchangers and high-pressure pipework where ever superctitical water is generated. This limits potential corrosion which otherwise would pose safety risk and reduce the life of the system

High Temperature : **upto 400°C**

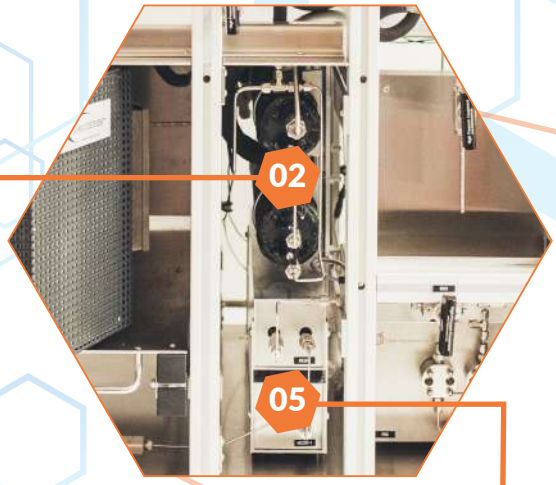
To generate the high temperatures required for subcritical and supercritical water processing, the Core | **Water** system interagtes a high temperature clamp shell furance to the heat the extraction vessel.

High Pressure : **500 bar**

The Core | **Water** system has a design rating upto 550 bar and an operating pressure of 500 bar. This wide range of pressures allow for an array of processing conditions making this system ideal for a number of applications, including subcritical water extraction or supercritical water oxidation.

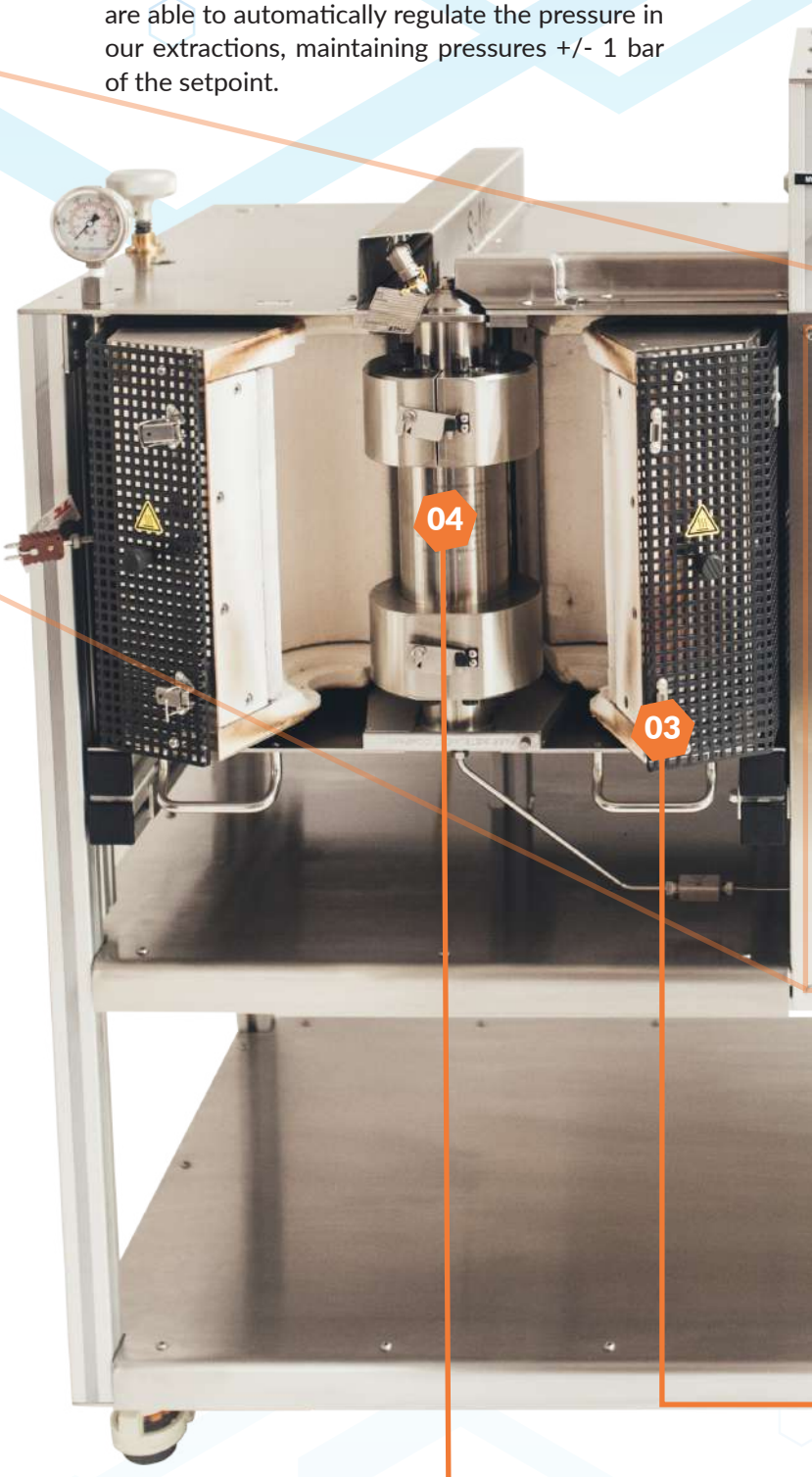
Certification

Core | **Water**



06. Core | **ABPR**

Utilising a electopneumatic back pressure regulator with our APC control mechanism we are able to automatically regulate the pressure in our extractions, maintaining pressures +/- 1 bar of the setpoint.



05. Core | **Condensers**

The heat exchangers are located after the vessel and cool the aqueous stream to below 50 degC before entering the ABPR. This improves the life of the soft seals within the ABPR and helps delivers a aqueous stream at a safe temperature for collection.

02. Core | **Pre-Heater**

Dual pre-heater designed to heat the water up to 400 °C. These pre-heaters are located just after the pump to control the temperature of the water reaching the extractor. It ensures the water entering the extraction vessel is already at the extraction temperature ensuring a controlled extraction process.

04. Core | **Extraction**

Specially designed to within stand the extreme conditions generated by supercritical and subcritical water conditions this Inconel vessel is able to resist the corrosive properties of water at these extreme conditions.

07. Core | **Cold Trap**

As the aqueous extract passes through the ABPR and is depressurised, it is collected in a cold trap. The cold trap acts to ensure the collected material is maintained below 40 °C for safe collection.

01. Core | **P50 Water Pump**

Based on our robust dual piston design, the P50 pump delivers 50mL/min of water up to 500 bar generating a pulseless flow during the extraction process.

03. Core | **Furnace Heater**

Designed to heat the extraction vessel to temperatures exceeding 400 °C, this insulated furnace heater allows rapid heat up times while protecting the user from the extreme temperatures required for subcritical and supercritical water processing.

Core Separations

14. Core | ESS Extraction Screening System

The ESS (Extraction Screening System) is aimed at users wanting to screen multiple supercritical conditions to optimise their process. It can also be used to prepare samples for HPLC or GC analysis, for instance in food safety and pesticide analysis. Utilising 8 extraction vessels (10mL, 25mL or 50mL) the ESS can be programmed to screen a variety of conditions automatically collecting each extract into separate collection bottles. Capable of generating pressures on up to 10,000 psi (689 bar) and 100 °C this versatile system is suitable for even the most demanding extractions.

Applications

- Environmental
- Food
- Pharmaceuticals
- Consumer Products
- Polymers

Extraction Screening

Optimising an extraction, when using CO_2 as a supercritical fluid can be time consuming when exploring both the effect of varying the pressure and temperature on the yield and purity. This optimisation can be greatly improved using the ESS which can be programmed with up to 8 individual conditions to help quickly screen for the best results.

Sample Preparation

Preparing samples for analysis is key for ensuring results are both repeatable and reproducible. Correct sample preparation also helps to improve sensitivity and prolongs column life by removing unwanted contaminants that may interfere with the analysis. The ESS can be used with either CO_2, CO_2 and a modifier or just pure solvent to effectively prepare any solid sample ready for analysis. Samples can be prepared in duplicate using the dual vessel arrangement. Every 2 vessels are in one of the 4 heated zones ensuring each dual pair is heated to the sample temperature. This makes the ESS the ideal choice for sample preparation capable or opening under a wide variety of conditions.

PLE (Pressurised Liquid Extraction)

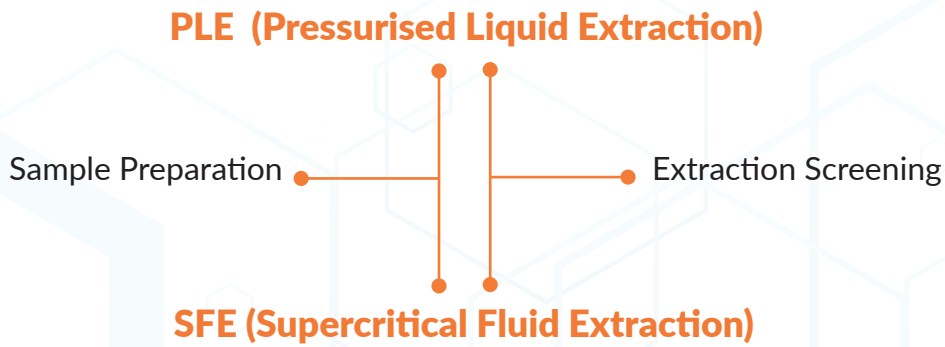
PLE also known as accelerated solvent extraction (ASE) and pressurised solvent extraction (PSE) uses both high pressure and temperature liquids to improve liquid solid extraction process. High pressures and temperatures act to improve solvation promoting mass transfer through high sample penetration increasing extraction efficiency.

The ESS implements dual fluid delivery system allowing both the induction of CO_2, CO_2 + solvent or just solvent into the 8 extraction vessels.

SFE (Supercritical Fluid Extraction)

Like PLE, Supercritical fluid extraction (SFE) using CO_2 is a technique to extract material from a solid matrix. Higher pressures are required compared to PLE to effectively extract compounds from solids. CO_2 in its critical phase behaves like a non-polar, lipophilic solvent that has the benefit of being cheap, renewable and leaves the extracted residue solvent free once the CO_2 returns to its gas state.

The ESS delivery system includes a high pressure CO_2 pump capable of delivering pressures up to 600 bar @ 15g/min.



The ESS

The ESS is a fully automated extraction system, consisting of 8 extraction vessels, 8 collection vessels and a fluid delivery system capable of delivering 15g/min of CO_2 and 10mL/min solvent at pressures up to 689 bar. The system includes multiple heater zones allowing the CO_2 and solvent to be pre-heated before entering the extraction vessels, 4 heated zones for the vessels and a heater located after the ABPR to help vaporise the CO_2. The CO_2 pump has an independent flow meter to both measure and control the incoming CO_2 and 16 pneumatically actuated valves to control which vessel is selected from the method.

Vessel sizes available

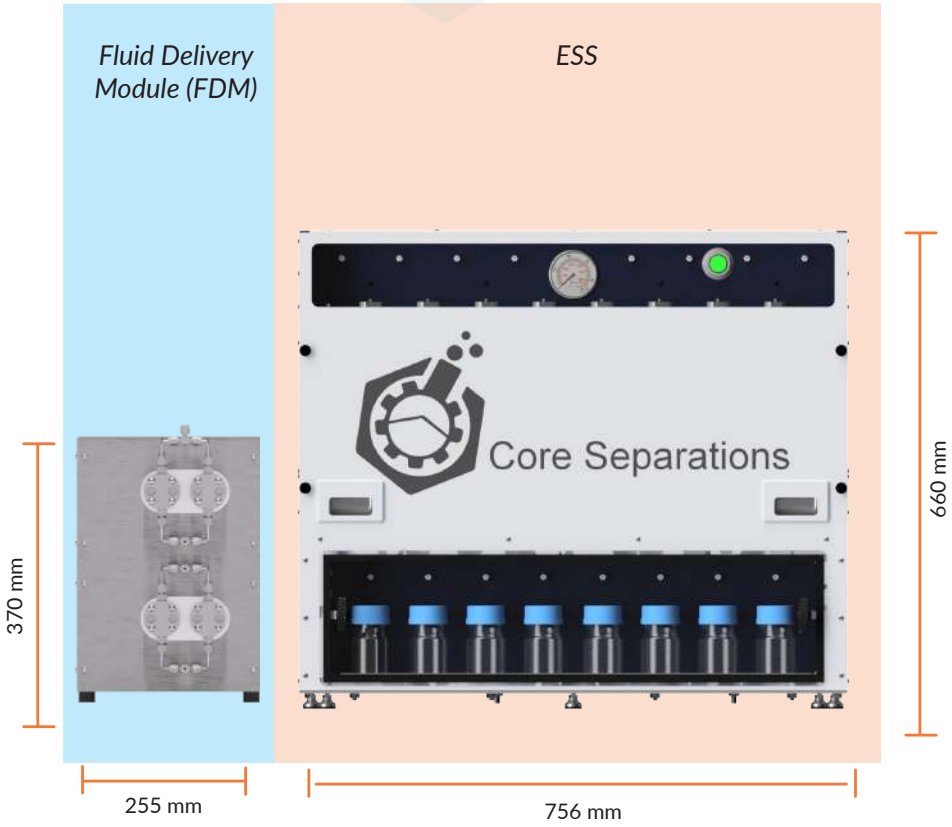
EV10 | EV25 | EV50

Extraction

Number of Extractors	8
Extractor volume	10mL 25mL 50mL
CO_2 flowrate	15g/min
Co-solvent	
Flowrate	10mL/min
Max pressure	600 bar
Max temperature	100°C

Separation

Number of Collectors	8
Capacity	100mL



Specification

Power requirements
200-240 V (13A)

Pneumatic Air Pressure (bar/psi)
6.9 bar / 100 psi, 1/4" compression inlet

CO_2 Inlet
55 bar, 1/4" compression inlet

Vent Line
3/8" compression inlet

Weight
100 kg (depending on options)

Chiller
Required

PC & Monitor
Minimum of 1.5 GHz, 16 GB RAM, 250 GB storage, Ethernet port for control panel, wired or wireless connection for Internet connectivity. Google Chrome browser. Monitor 21" minimum with 1920 x 1080 pixels resolution

SFX Software

- Dashboard visualisation of key processing parameters
- Manual control of key components within the SFX system in real time using APC to accurately control the pressure
- Recipe menu allows you to automate a variety of conditions including flow rates, temperatures and pressures over a defined time limit.
- Real time data logging and visualisation via Grafana Dashboard
- Programmable warning and alarm limits to alert the user that the system conditions are approaching the cut off safety limits.
- SQL database logs all the alarms and user activity to aid in fault detection and diagnosis.

When dealing with high pressure systems, pressure control is key. Standard control is accomplished using proportional, integral and derivative control (PID). Unsatisfied with the standard level of control, Core Separations developed APC (Advanced Pressure Control). This multilevel PID control achieves superior operational management while maintaining rapid pressure build up.

Automated Extraction

Extractions run sequentially over the 8 positions controlled by the SFX software. Automated valving allow for unattended operation.

Independent Conditions

System runs sequential through the 8 vessel positions allowing the user to define different pressures for each vessel, The temperature is controlled through 4 heater zones allowing for each vessel pair to be controlled to the same temperature.

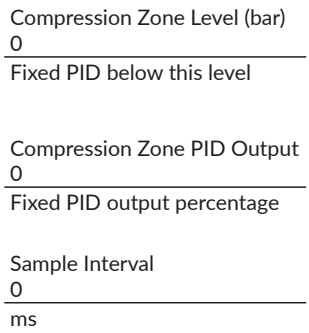
Automated Collection

Each vessel is paired with a collection position allowing each individaul extraction to be isolated and collected in its own bottle.

Certification

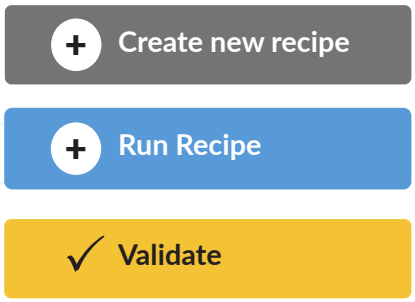
15. Core | **Software**

The Core SFX software is the heart of our systems. Developed from the ground up based on over 20 years of extraction experience, the SFX software incorporates some of the most advanced control features found in any supercritical extraction system, including our new APC™ control method for the ABPR. It was designed to be not only a powerful companion to the extraction process but offering flexibility to allow the user to tailor the software to the process.



Core | **APC™**

APCTM stands for adaptive pressure control. This is our advanced and propriety pressure control system used in the SFX software. It uses multi point PID control to ensure the pressure set-point is achieved quickly and accurately.



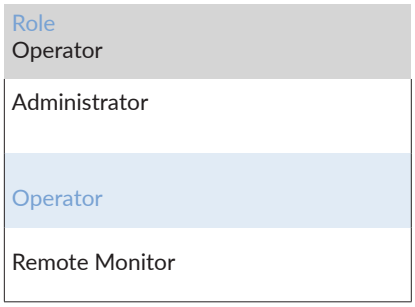
Core | **Recipes**

Create a stepwise recipe that automatic adjusts the process parameters at defined time points. The pressure and temperarture can be increased at a defined time points, including switching on and off the pumps.

Interface	Recipes	Data collection	Data Download	User Control
Web browser	**Standard**	**Realtime**	**CSV file**	**Standard**

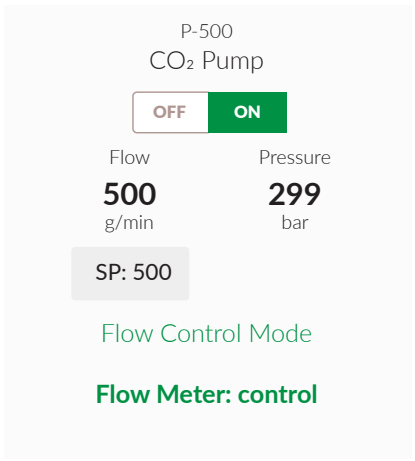
Core | **Data**

Real-time plots describing flow, pressure and temperature are available The data can be viewed at different time points and time ranges in real-time.



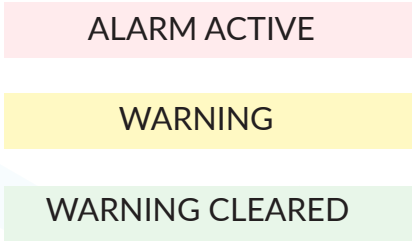
Core | **User**

Multiple users can be created from this screen.



Core | **Modules**

The modules on dashboard gives the user an overview on the systems performance. It represents the system and its components. Each component can be controlled from this screen and displays all the relevant set-points and process data.



Core | **Safety**

The system has two levels of safety, WARNING which is set below the cut out alarm. This is used to warn the user it is approaching the cut-out alarm. The ALARM limit is where the high level alarm level has been reached. If the ALARM level is reached the system shuts down.

For more infomation: contact@coreseperations.com

PID Settings	Modes	ABPR Control	Alarms	Upgradable
Adjustable	**Computated, Flow meter, Pressure**	**APC™**	**Warning and High**	**Yes**

16. Core | *Upgrade*

There is a long history to Core Separations, which starts with Thar instruments. For many years Harbaksh Sidhu (CEO of Core Separations) spent many years as the President and co-owner of Thar Instruments and oversaw many of its development projects helping develop the SFE system used by many over all over the world.

In 2012 Thar instruments was acquired by Waters Corporation who continued to offer the SFE systems along with the Chromatography units.

Where this product is a robust solution for research and small-scale production it is no longer offered by Waters. So here at Core we have decided to offer an upgrade program to enhance any old Waters or Thar system with our newer technology improving both the flow and pressure currently available to our old Thar Waters Customers.

For more infomation: contact@coreseperations.com

Heat exchangers	Extraction Vessel	Cyclones	Valves	Chiller
Re-used	**Re-used**	**Re-used**	**Re-used**	**Re-used**

Pump	Flow Meter	ABPR	Control System	Pipework
Upgraded	**Replaced**	**Replaced**	**Replaced**	**Replaced**

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