



Core Separations

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

Core | **Catalogue**

2023 v3.0



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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.



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****SGS****"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



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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)

Hardness (Brinell)
277

Ultimate Tensile Strength
135,000 psi

0.2% Yield Strength
105,000 psi



Stainless Steel 316

Hardness (Brinell)
217

Ultimate Tensile Strength
97,175 psi

0.2% Yield Strength
42,060 psi



Stainless Steel
17-4PH (H1150)

Carbon
0.07

Chromium
15.0 - 17.5

Columbian + Tantalum
0.15 - 0.45

Copper
3 - 5

Manganese
1

Nickel
3 - 5

Phosphorus
0.04

Silicon
1

Sulfur
0.03

VS

Stainless Steel
316

Carbon
0.08

Chromium
16.0 - 18.0

Columbian + Tantalum
0.15 - 0.45

Mo
2 - 3

Manganese
2

Nickel
10.0 - 14.0

Phosphorus
0.045

Silicon
0.75

Sulfur
0.03

04. Core | What is CO₂ Processing

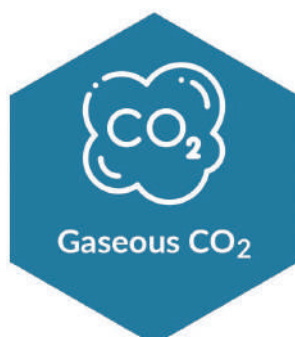
Most people are familiar with CO₂ presenting as three states of matter: solid, liquid and gas. These states depend on the temperature and pressure of CO₂. In its natural state, CO₂ is most abundant as a gas making up around 0.04 % in the earth's atmosphere. However by altering the ambient conditions we can transform CO₂ into either a liquid or a solid.

A phase diagram can be used to determine the state at which CO₂ exists at a defined temperature and pressure (see figure 1-1). For CO₂ 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 CO₂ 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 CO₂ 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 CO₂ is no longer a gas or a liquid, but exhibits properties of both and is known as the supercritical phase. Supercritical CO₂ 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.

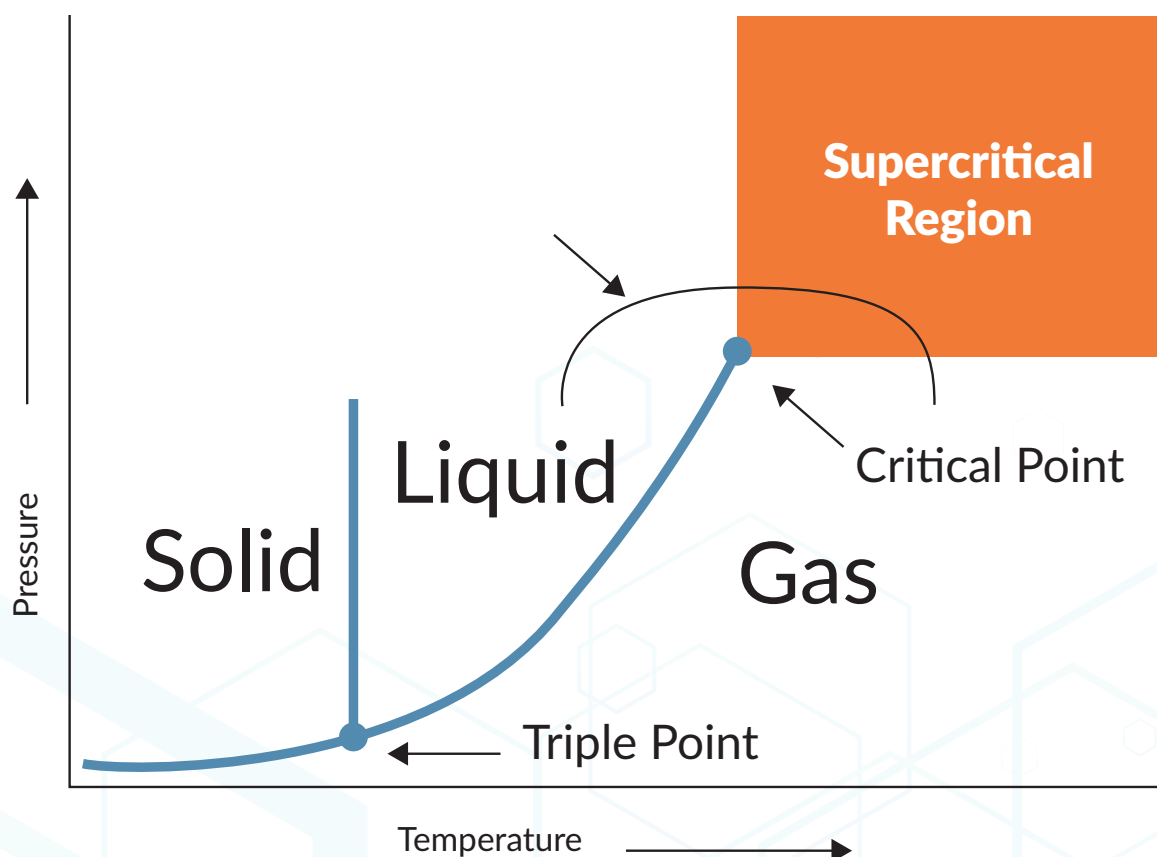


Figure 1-1: Supercritical CO₂ is tuneable without changing phases

05. Core | Why use Supercritical CO₂

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 CO₂ over traditional petrochemical derived alternatives.





Selective Fractionation

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.



Isolation

When isolating the extract from a CO₂ extraction, it requires depressurisation of the CO₂. 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 CO₂. The CO₂ gas is then able to escape leaving the extract uncontaminated by the extracting fluid.



Environmentally Responsible

Unlike other solvent extraction, CO₂ is recovered from other industrial processes as a by-product. The renewable and abundant nature of CO₂ is one of the most attractive properties when using CO₂ as an alternative solvent.



Tunable Polarity

The polarity of the CO₂ 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.



Tunable Density

By altering the pressure and temperature alters the CO₂ density is tuneable giving CO₂ its selective extraction properties.



Recyclable

One of the most powerful aspects of CO₂ 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 CO₂ by re-compressing it.



06. Core | Extraction Applications



Natural product extraction is a key area of research whether your exploring new food supplements that have enhanced nutrition value or food substitutes such as oat milk as a replacement for dairy, CO₂ extraction is now playing a key role.

Not only have extracted natural products become more relevant in food research but much research has been carried out to explore their pharmaceutical properties too. With the most publicised examples of Cannabis and Hemp, for the isolation of CBD and THC in pain management.

As a result, our Core | Extraction systems have been designed for researchers looking to push the boundaries of natural product extraction. We have implemented some of the most advanced features found in a supercritical extraction system to allow our users to perform some of the most complex and challenging isolations found in Natural products.

A number of commonly extracted materials are described on the next page.



Seaweed

Seaweed is a rich source of bioactive compounds that have medicinal and pharmaceutical properties.

CO₂ has been used to extract a variety of compounds including Carotenoids, fatty acids and phytosterols.



Coffee

CO₂ extraction of coffee has long been an alternative method for the removal of caffeine to make decaffeinated coffee. However coffee also contains many interesting bioactive compounds such as polyphenols, flavanols and flavones. All ideal for CO₂ extraction.



Cannabis and Hemp

The extraction of Cannabis and Hemp have well established over the last 15 years with the legalisation in many countries. CO₂ technology is a popular technique in producing extracts for both recreational and medicinal products. These oils contains a variety of bioactive compounds such as Cannabinoids and terpenes.

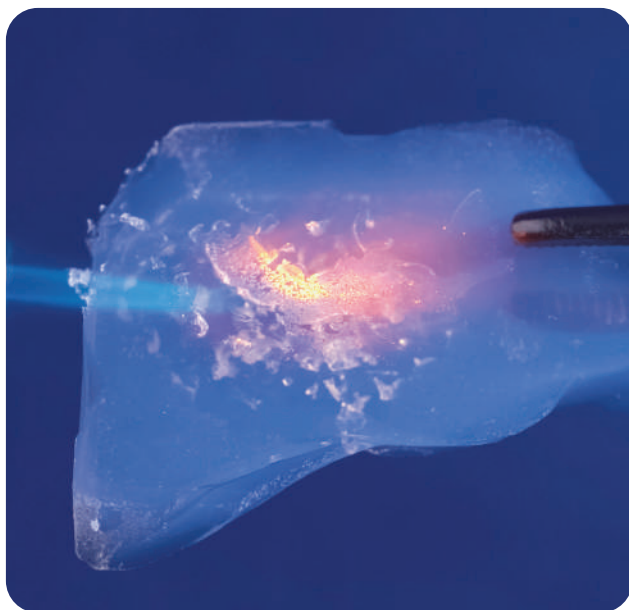


Hops

Hops extraction is one of the biggest commercial uses for CO₂ technology. It has long been used to produce hop oils rich in alpha and beta acids which add the bitterness present in brewing. Monoterpenes are also extracted and are what infuses the hop taste into beer.

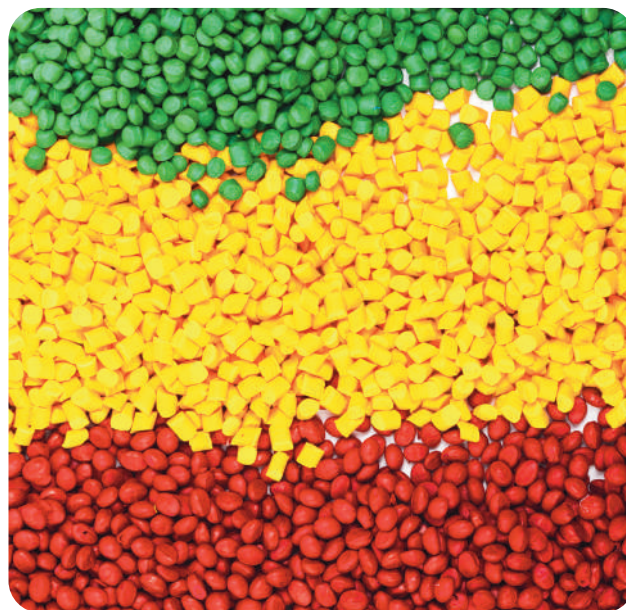
06. Core | Drying Applications

Drying is a process is closely related to extraction but rather than the primary interest being the collection of soluble components, it uses CO₂ to remove unwanted compounds from the solid matrix. For example, many solvents are highly soluble in CO₂ and can therefore be dried when CO₂ is passed over them. For example this technique utilises the low surface tension of the CO₂ in its supercritical phase, to remove solvent without collapsing porous materials. In contrast surface tension still present as a result of direct evaporation of solvent causes highly porous structures to collapse.



Aerogels

Aerogels are porous materials that have highly insulative properties while being light weight. CO₂ has long been used to form these structures by removing the solvents used in the gelation process, while maintaining the porous structure. This is due in part to the low surface tension of CO₂ in its supercritical state.



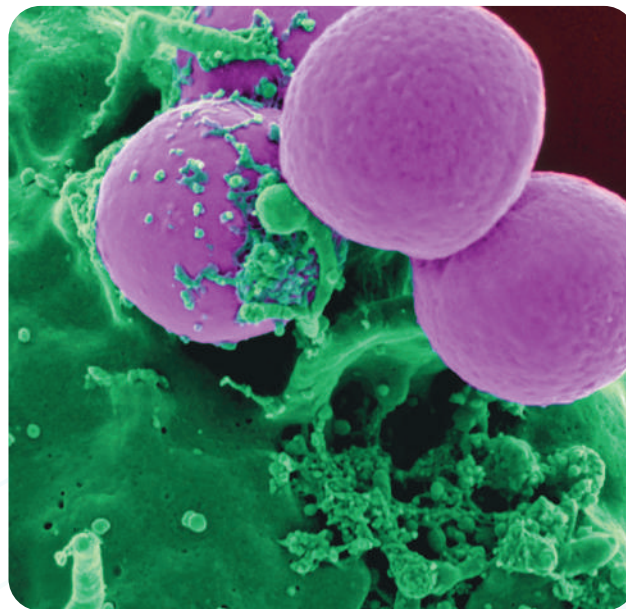
Polymers

Polymers often contain trace solvents and unreacted monomers after the polymerisation process. Due to the diffusive properties of CO₂, it is able to penetrate the polymer matrix removing the trace solvents and unreacted monomers from the polymer. This can be beneficial in polymers used in healthcare products.



Food

CO₂ can be used to remove the residual moisture from food similar to that of freeze drying. Unlike freeze drying however CO₂ produces a dried product that retains a better texture and porous structure while reducing the shrinkage of the material.

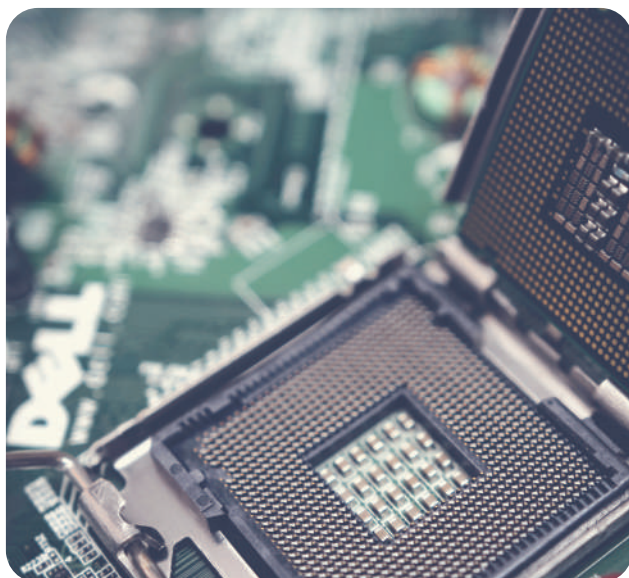


Biological Samples

CO₂ can effectively remove residual moisture from biological samples while preserving the materials structure. Ideal for preparing samples for SEM analysis.

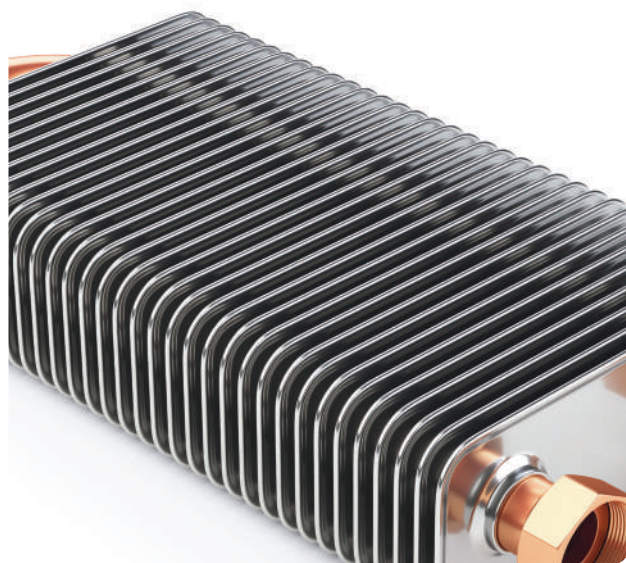
06. Core | Cleaning Applications

Like drying, cleaning and degreasing removes unwanted components from solid materials. The benefit when using supercritical CO₂ is it can penetrate complex shapes or small-bore orifices like heat exchangers when the traditional methods either fail or pose a risk to the material. A good example is the removal of residual organic compounds such as grease and fingerprints from electronic wafers such as semi-conductors. The same technique has been used to remove residues from telemetry equipment used in missile guidance systems. This makes supercritical CO₂ ideal cleaning fluid for high value components when traditional methods fail.



Semiconductor

Supercritical CO₂ can be used to remove photoresistive and etch residues from Semiconductor wafers while avoiding stiction and collapsing of the micro-structures commonly found when cleaned using conventional techniques.



Micro Heat Exchangers

Heat has a negative effect on many electronics, with most electronics employing some sort of heat exchange to dissipate the heat generated. Micro Heat Exchangers are used in high end electronics to remove the residual heat, but cleaning of these exchangers require a fluid like CO₂ that can penetrate microbores tubes.



Corks

Micro-organisms found in Corks produce several secondary metabolites that result in what is known as "cork taint". CO₂ is used to remove TriChloroAnisole from the corks down to the limits of detection. This commercial process is used to clean 2500 granulated cork per year.



Mechanical Parts

Complex mechanical parts can be cleaned and degreased using supercritical CO₂. It is ideal for cleaning complex shapes and blind holes with the added benefit the part does not need drying after the process.

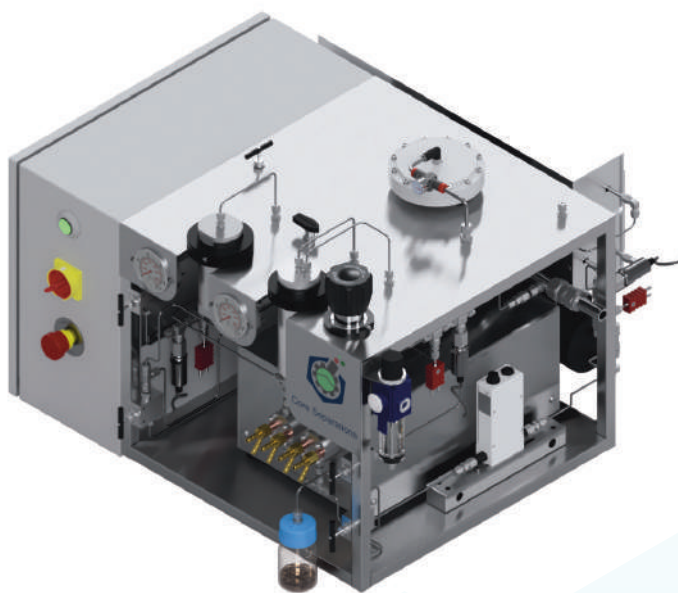
07. Core | Bench Top Extractor

upto 450 bar

Our bench top system is designed for users looking to explore supercritical fluid processing. Compact and able to fit on a bench or within a fume cupboard, the bench-top system retains all the key features of our larger systems, flexibility, robustness and precise control. As with our larger SFX systems this bench top version utilises the same SFX software and adaptive pressure control (APC™) allowing the user to easily scale up and take the next step there journey.

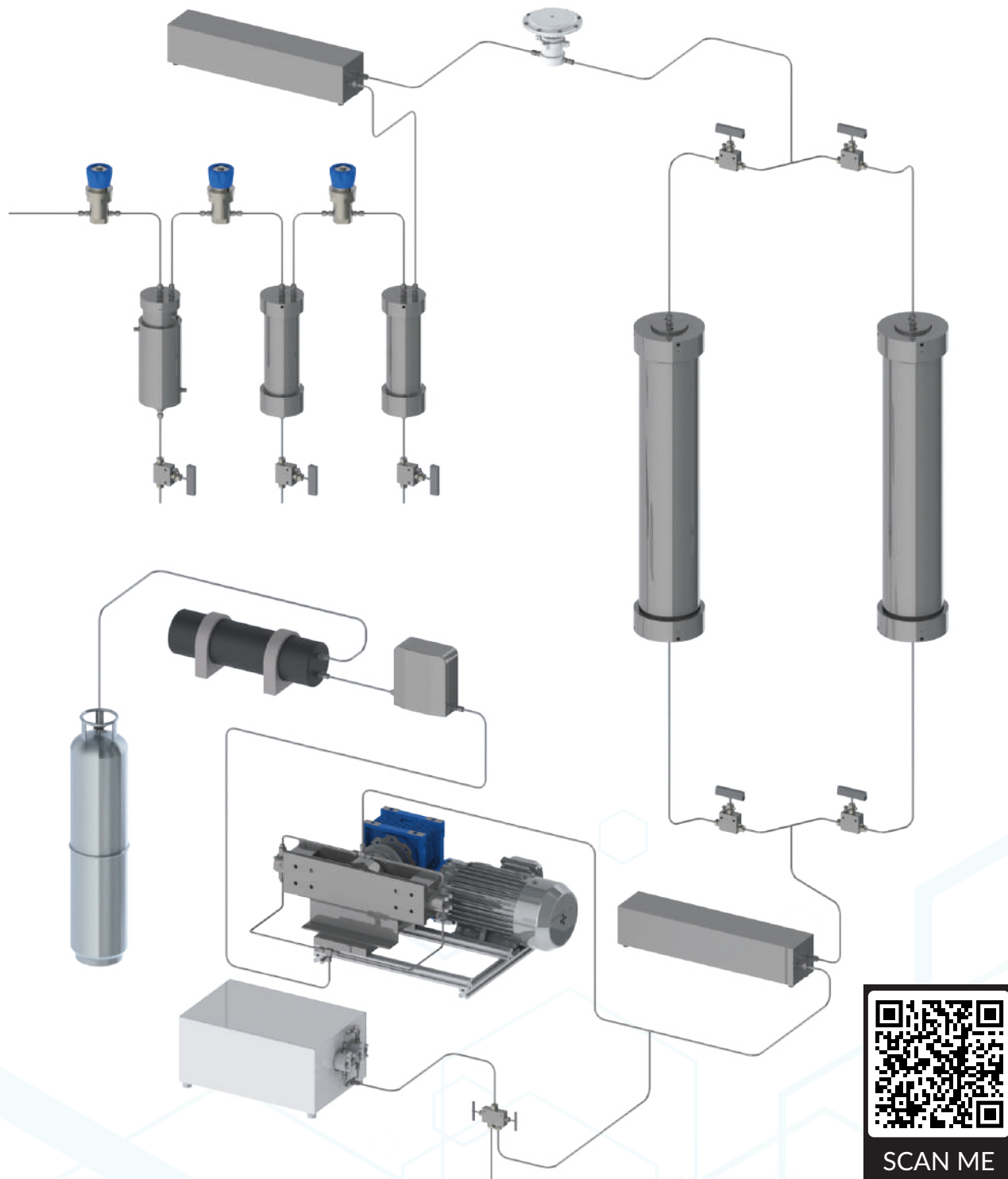
Applications

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





Core | How Extraction works?



For more information: contact@coreseparations.com



Small Scale Processing

When screening different materials, the bench top system is ideal for those quick exploratory runs without comprising on the quality of the extraction. Offering either a 100mL or 200mL extraction vessel which can operate upto 450 bar the user has a large range of extraction conditions to explore. Our P50 pump allows can pump either CO₂ or water as the extracting media making this a extremely versatile system.

System sizes available

SFX 100 | SFX 200

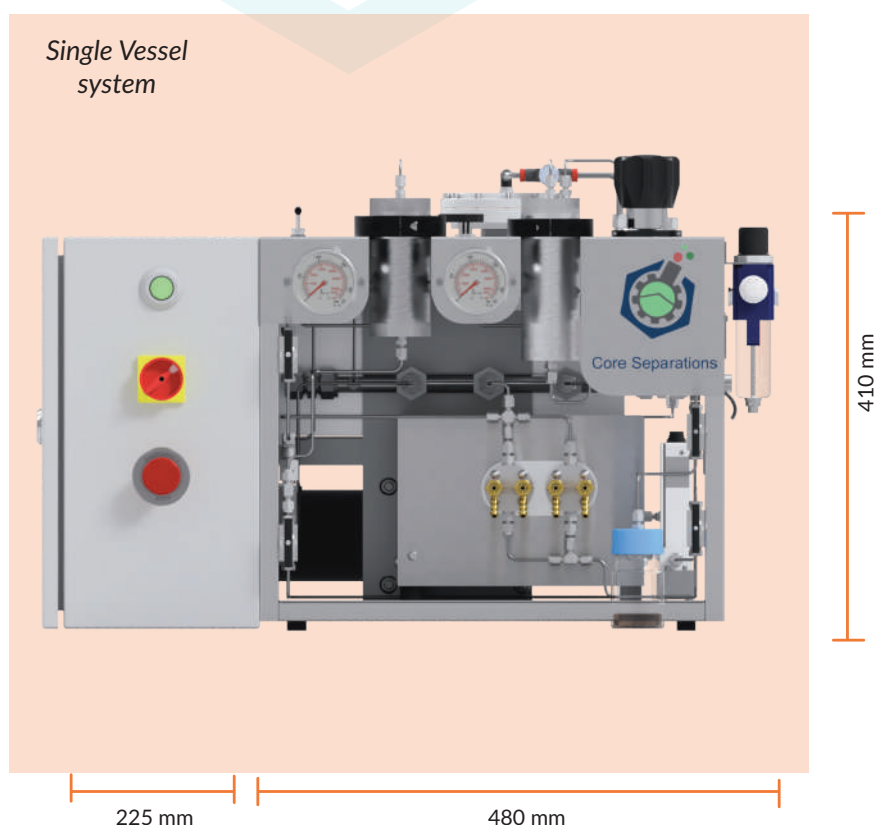
Extraction

Extractor volume	200mL
CO ₂ flowrate	50g/min
Max pressure	450 bar
Max temperature	150°C

Separation

Capacity	100mL
Max pressure	200 bar
Max temperature	150°C

Single Vessel system



Specification



Power requirements

220-240 V (1PH+N+E); upto 13A



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

50/60 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 CO₂ 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.

Certification



08. 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 CO₂, or CO₂ with a modifying solvent.

Applications

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



Pressure, bar
upto 1000

Temperature, oC
upto 150

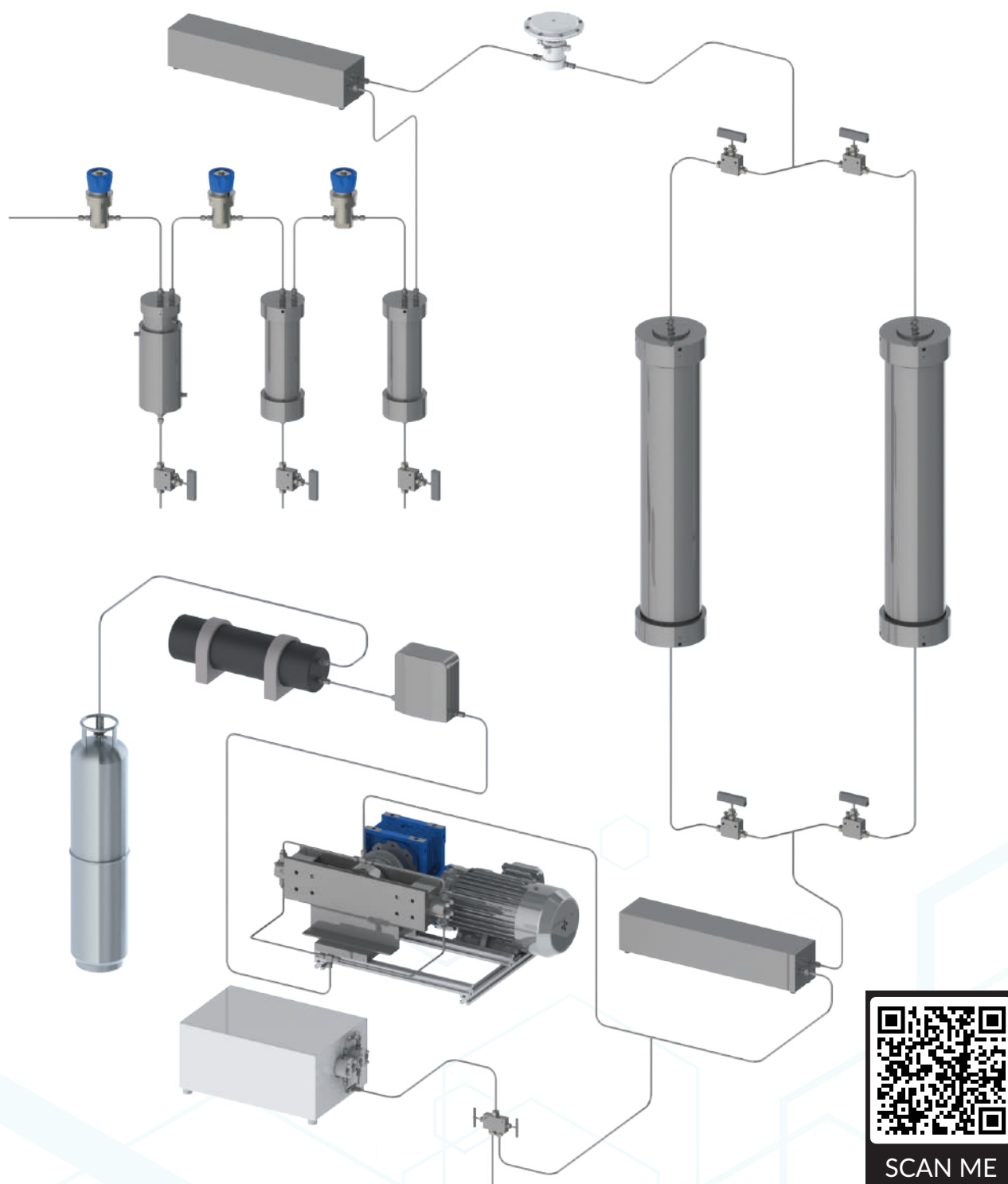
Volume, L
upto 10

Flow Rate, g/min
upto 1,000

Flow Meter
Optional



Core | How Extraction works?



For more information: contact@coreseparations.com

Co-solvent Pump
Optional

Automated BPR
Standard

Cyclones
200 bar Std

Fractionation
upto 3 cyclones

Recycling
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

CO₂ flowrate upto 1kg/min

Max pressure 600 bar

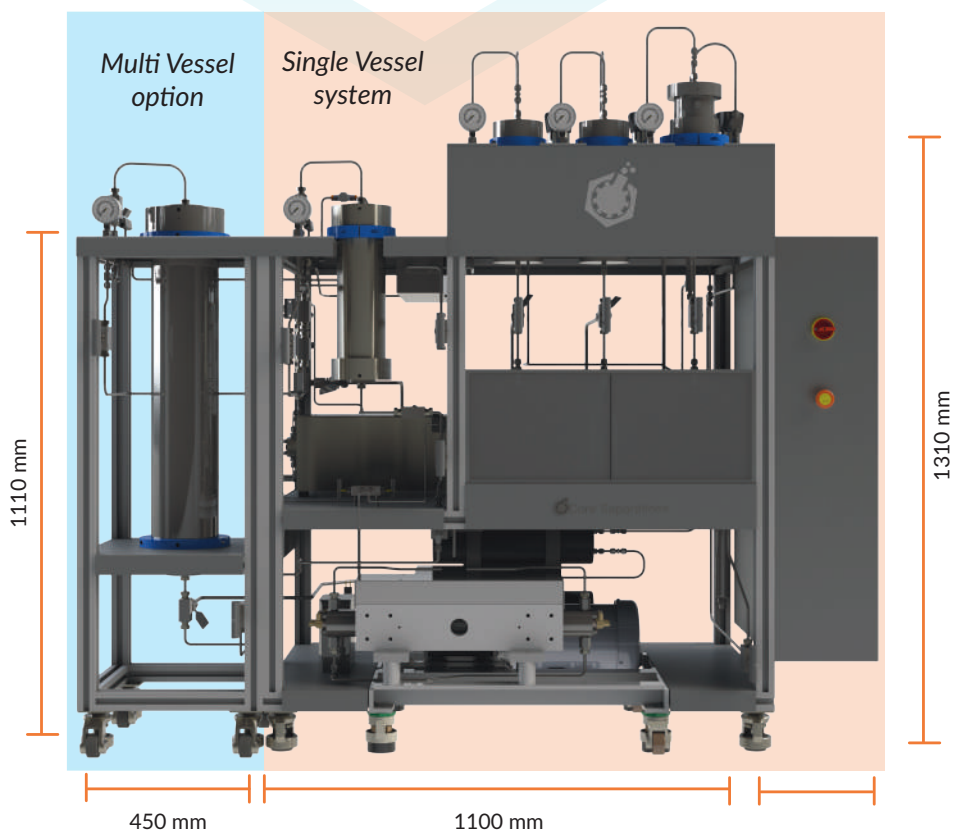
Max temperature 150°C

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



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.



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 CO₂ 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

CO₂ flow rate plays an important role when looking at extracting a variety of biomass materials. Our modular systems allow CO₂ 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 allows the conditions in each separator to be adjusted to achieve a specific density. This can be used to selectively precipitate 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 single pot collection or multi pot fractionation.

08. Core | Vaporiser

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

06. Core | Extraction

The extraction vessels are designed to withstand 1000's cycles at 689 bar (10,000 psi). We offer a variety of 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

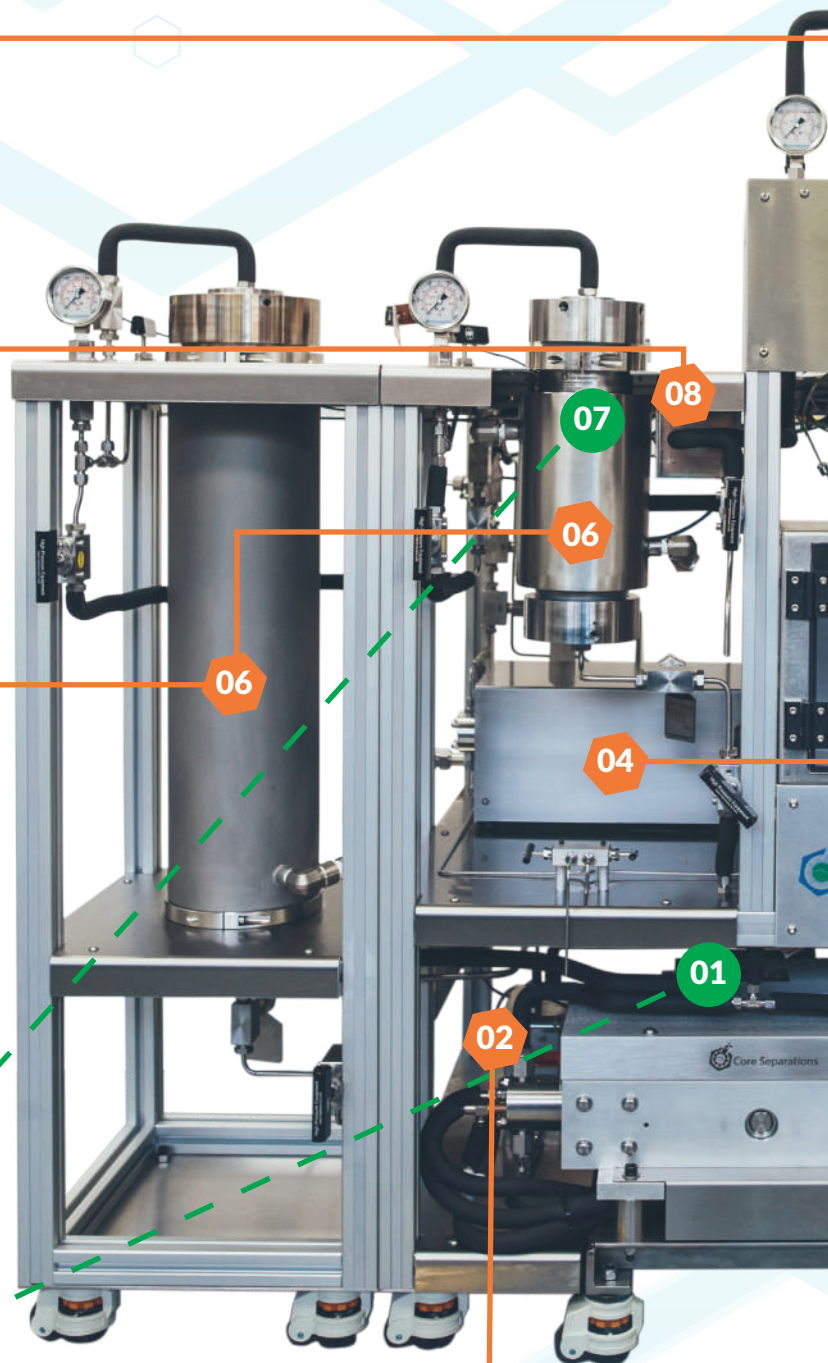
Utilising a electropneumatic back pressure regulator with our APC control mechanism we are able to automatically regulate the pressure in our extractions, maintaining pressures +/- 1 bar of the setpoint.

01. Core | Condenser

Although we use a liquid CO₂ feed in our extraction systems, its important that the incoming CO₂ remains liquid. The condenser acts to maintain the incoming temperature of the CO₂ ensuring it remains a liquid during the pumping phase. Additional condensers can be added with higher flow rate pumps or with 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 CO₂ feed density. Although we control the incoming temperature of the CO₂ a drop in pressure from the CO₂ bottle as we consume the CO₂, can result in a density shift causing the pump to under deliver the CO₂ to the process. The flow meter also offers additional process data to be collected in the system, such as total CO₂ used.



Part viewed from the front

Part can be viewed from the back



10. Core | **Cold Trap**

While it's important to expand the CO₂ into its gas phase in order for the extracted components to precipitate from the CO₂ feed, the more volatile components can vaporise and escape with the CO₂. The addition of a cold trap after the last cyclone can aid in trapping the more volatile components obtained for example terpenes and 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 fractionation of the extraction feed. By modifying the pressure and temperature in each separator, the density can be accurately controlled to favour the precipitation of some components over others. The manual back pressure regulators facilitate the control of the pressure in each of the separators.

04. Core | **Co-Solvent Pump**

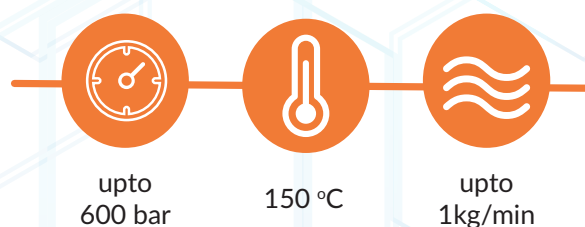
The use of co-solvent pumps has a number of benefits when incorporated into a system. They allow the introduction of solvent to modify the CO₂ polarity. But they can be used for cleaning and the introduction of solutes in the SAS process. The co-solvent pumps like our CO₂ pumps have been designed from the ground up. In fact, they can be used for both to operate solvent and CO₂ 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 up to 1kg/min.



09. Core | Fractionation

Did you know fractionation uses a unique feature to supercritical fluid extraction? It utilises the tunability of the CO₂ through temperature and pressure to vary the fluids density and subsequently its solubility to certain classes of compounds. There are three main methods for fractionation.



Option 1 - Extraction Conditions

The **first** is to vary the extraction conditions, by increasing the CO₂ density by altering the pressure or temperature. Fractionation would start with the extraction of the highly soluble compounds such as terpenes and low molecular weight oils. Once collected the density would be increased to extract the next classification until all compounds of interest were collected. This method only uses one collection vessel.



Option 2 - Collection Conditions

The **second** method is to use the same principals as before, but this time we extract using a single process condition, usually a high-density fluid, but we collect over multiple collectors – not in a single pot as before. We created a density gradient along the collectors resulting in varying solubilities in each collector. As compounds flow into each collector they become deposited as their solubility in the fluid decreases. Depending on the level of fractionation 3 or 4 collectors can be added to a system.



Option 3 - Time

Finally, fractionation can be based on time. Natural products are complex mixtures often containing 100's of discrete compounds. As you would expect during an extraction the most soluble ones will extract first. However, when these compounds dissolve in the CO₂ they can act as a co-solvent changing the solubility of the fluid. This can lead to unexpected results with some compounds eluting in unusual order. Therefore, fractionation can be done on time either into a single collection vessel or over multiple vessels.



Core | Sub-critical

Generating a subcritical fluid, using CO₂ requires controlling the temperature below 31 °C. This is achievable when using electrical heating if the room temperature is below 20 - 25 °C. Although control will be difficult if heat is generated from compression of the CO₂.

Core Separations offer liquid heating and cooling of the pre-heater and extraction vessel allowing the user to control the temperature from 0 - 80 °C and achieve subcritical CO₂ conditions.

Instead of having to replace the autoclave with an extraction vessel with a welded jacket, we offer a water jacket that replaces the electrical barrel heater. This allows the circulation of liquid around the vessel, controlling the temperature between 0 - 80 °C.

This upgrade can either be bought with the system or upgraded at a later stage.



But why extract with subcritical CO₂?

Subcritical CO₂ is a high density liquid with similar properties to that of CO₂ in its supercritical phase. It is ideal for extractions requiring a high density fluid without the need to elevate the temperature as required in supercritical fluids.

In fact to achieve the densities found in subcritical CO₂, the pressure has to be significantly elevated for a supercritical fluid. This offers another dimension to extraction selectivity as certain components soluble in supercritical fluids may NOT be soluble using a subcritical fluid like CO₂, due to the lower temperature.

Core | Extraction - Configurator

The product configurator helps choose the correct options and size of equipment for specific research and production by answering the commonly asked questions when building a system.

Supercritical CO₂ or Subcritical CO₂

Although supercritical CO₂ has a range of tuneable densities, subcritical CO₂ adjusts the polarity allow even further selectivity during an extraction

Vessel Volume

Correct volume for the available material. Don't over size your system as material packing is essential to efficient extraction

CO₂ flow rate

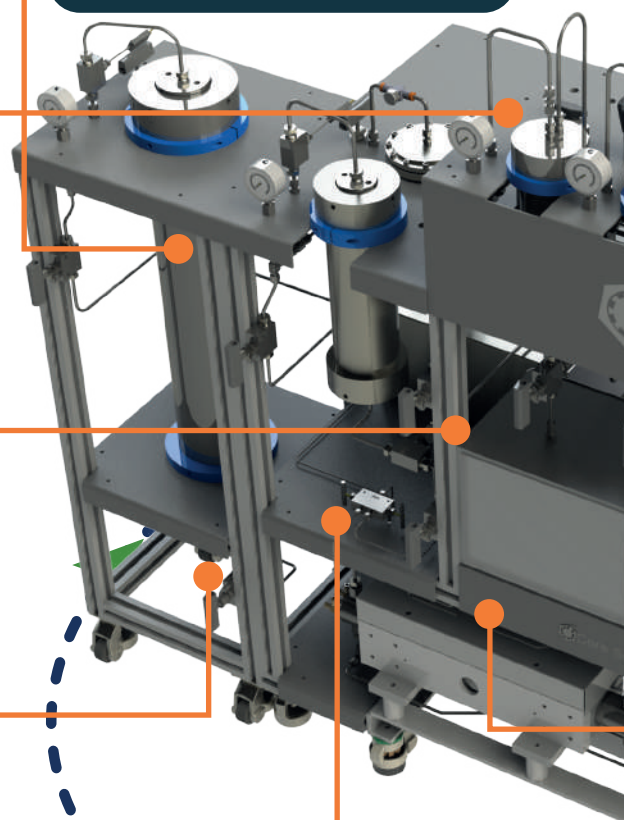
The CO₂ flow rate should be matched to the extraction vessel volume and aspect ratio. Fast flow rates can improve extraction but it can also cause channelling in the material reducing its effectivity.

Flow meter control

Are you losing pressure control or not building pressure? A flow meter measures the incoming CO₂ density and adjusts the pump speed to compensate

Tuneable Density

The power of CO₂ comes from the ability to adjust its solvating power by altering the pressure or temperature.



What you need to consider - scCO₂ Conditions

Extraction conditions.
Thermal liable?

What are the unwanted
impurities

What are the
compounds of interest



Do you need to recycle? One of the benefits of CO₂ is that it can be vaporised to a gas and then re-compressed back to a liquid for recycling. This improves the cost effectiveness of the processing on a larger scale.

Co-Solvent and Polarity

Are you extracting polar or non-polar compounds? scCO₂ extracts non-polar compounds with ease but requires a small amount of modifier such as ethanol to extract more polar ones.

High Pressure Collection

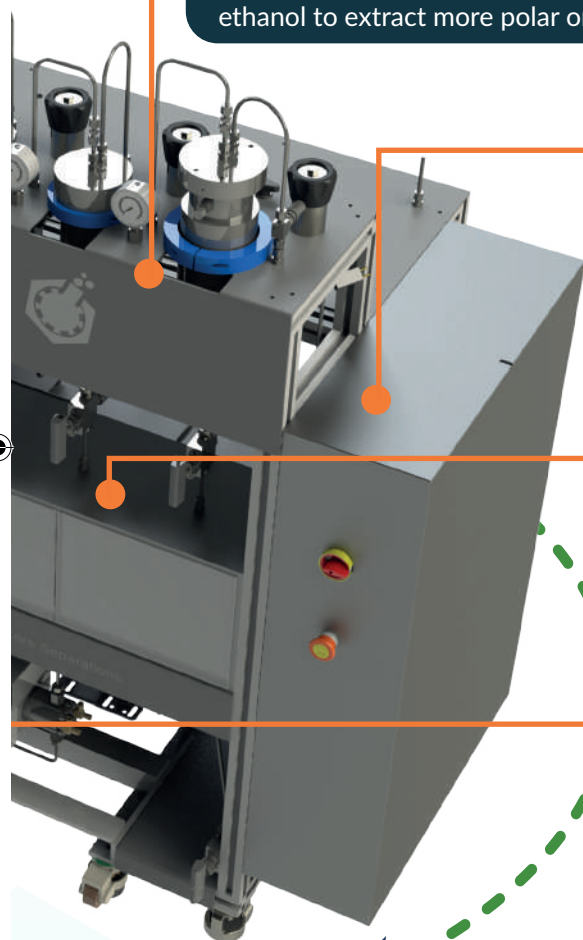
Are you having problems collecting volatiles? By applying a small amount of pressure to your collector you can reduce the volatility of these components

Fractionation

Are you trying to separate a complex mixture? Separation can be achieved using a pressure and temperature gradient along multiple collection vessels

Vaporisation

Do you experience carryover? This may be due to a build of liquid CO₂ in your collector. This is controlled by the temperatures used on the vaporiser and collectors.



Polarity, use of
Co-solvent or
subcritical CO₂

Fractionation using pressure
or temperature gradient.
Requires multiple collectors

**Fractionation
by time**



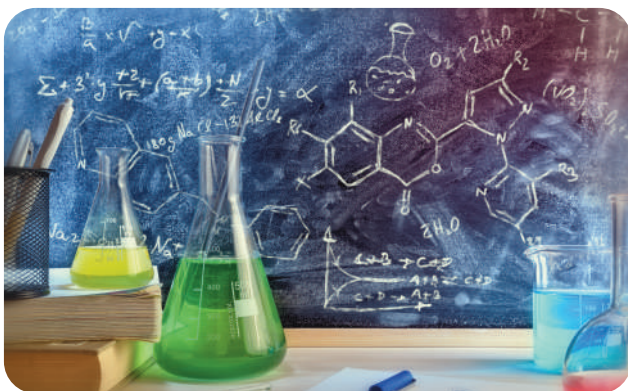
10. Core | Reaction Applications

Supercritical CO₂ is a versatile solvent that can be used in a variety of processes such as chemical transformations and the formation of structural materials. Its use as a reaction medium has several advantages, such as:

1. Increased reaction rates and selectivity: Supercritical CO₂ can act as a more efficient reaction medium than traditional solvents, leading to faster reaction rates and higher selectivity.
2. Improved product purity: Supercritical CO₂ can easily be removed from the reaction mixture, leaving behind a highly pure product.
3. Environmentally friendly: Supercritical CO₂ is non-toxic, non-flammable, and readily available, making it a sustainable and environmentally friendly solvent option.

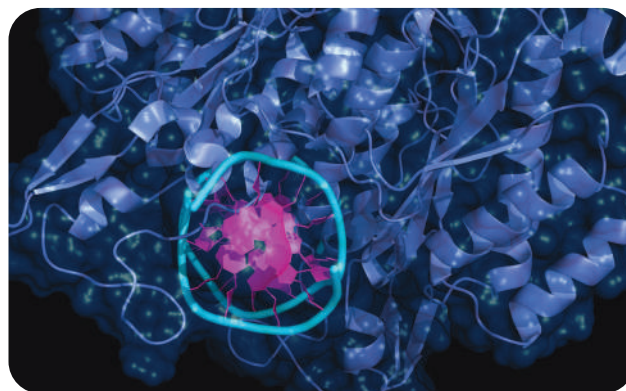
These are some common applications where CO₂ has been effective and advantageous over traditional solvents.





Chemical transformations

Chemical transformations in CO₂ have been studied for over 20 years with many traditional reactions resulting in improved selectivity and yield. For example hydrogenations have been found to improve not only process safety, but reaction rates, selectivity and yields. Oxidations such as hydroformylations and alkylation's like Friedel-Crafts reactions have all shown to be effective when using supercritical CO₂ as the solvent.



Enzymatic transformations

Enzymatic transformations in scCO₂ have several advantages over conventional solvents, including high solubility for both polar and non-polar compounds, low toxicity, and the ability to control the reaction conditions by adjusting the pressure and temperature. In addition, the use of scCO₂ can result in high reaction rates and selectivity, and can often be performed under mild conditions, reducing the need for harsh reaction conditions and minimizing the potential for unwanted side reactions.



Supports

Aerogels are one of the most famous examples, using CO₂ to form a mesoporous gel structure where the structure is over 98% air filled pores. These porous structures are formed due to scCO₂ low surface tension allowing its evaporation without collapsing the porous structure formed. Aerogels have low thermal conductivity and structure density making them an effective light weight insulation – used by NASA to create a thermal blanket to maintain the cryogenic temperatures required by the fuel used in the rockets.



Particle engineering

Particle engineering is another area where scCO₂ has been used is in the formation of highly controlled particle sizes. A common application area has been in the production of API's in the pharmaceutical industry. Small particle sizes can improve drug solubility which can be one of the leading issues in drug discovery and design.

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).

Applications

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



Pressure, bar
upto 1000

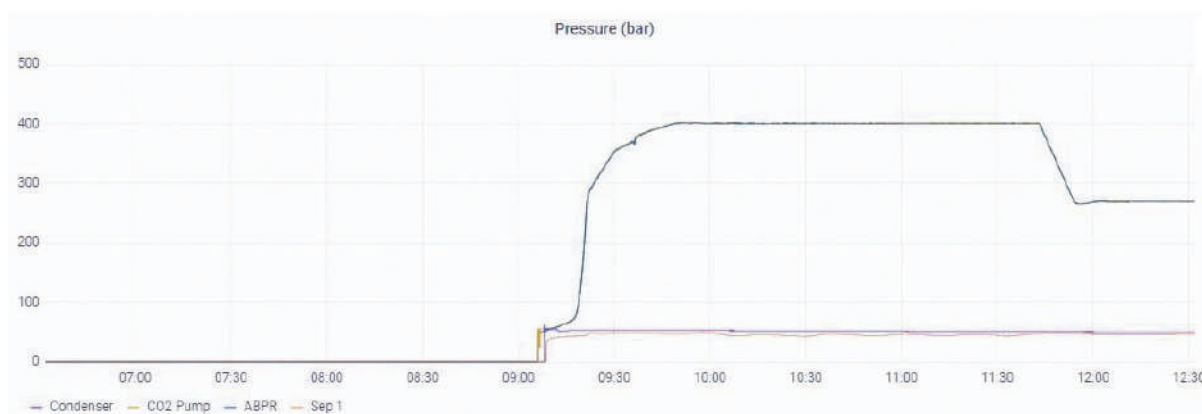
Temperature, oC
upto 150

Volume, L
upto 10

Flow Rate, g/min
upto 1,000

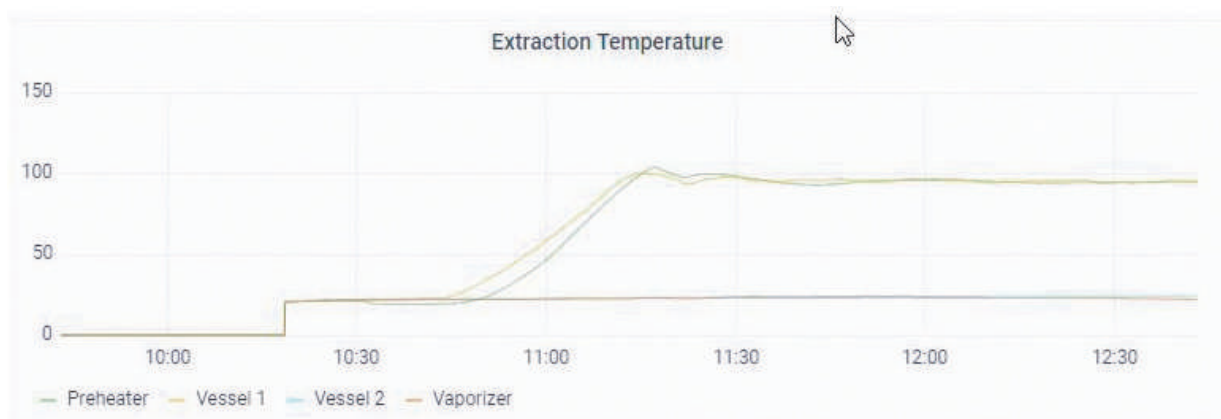
Flow Meter
Optional

Why Chose Core Products?



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.

For more information: contact@coreseparations.com

Co-solvent Pump
Optional

Automated BPR
Standard

Cyclones
200 bar Std

Control
PLC-PC

Stirrer
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 reduction using either RESS (rapid expansion of supercritical solutions) or SAS (supercritical anti-solvent) then both a dissolution and spray vessel maybe required. All vessels come with the option to include a high-pressure overhead stirrer.

System sizes available

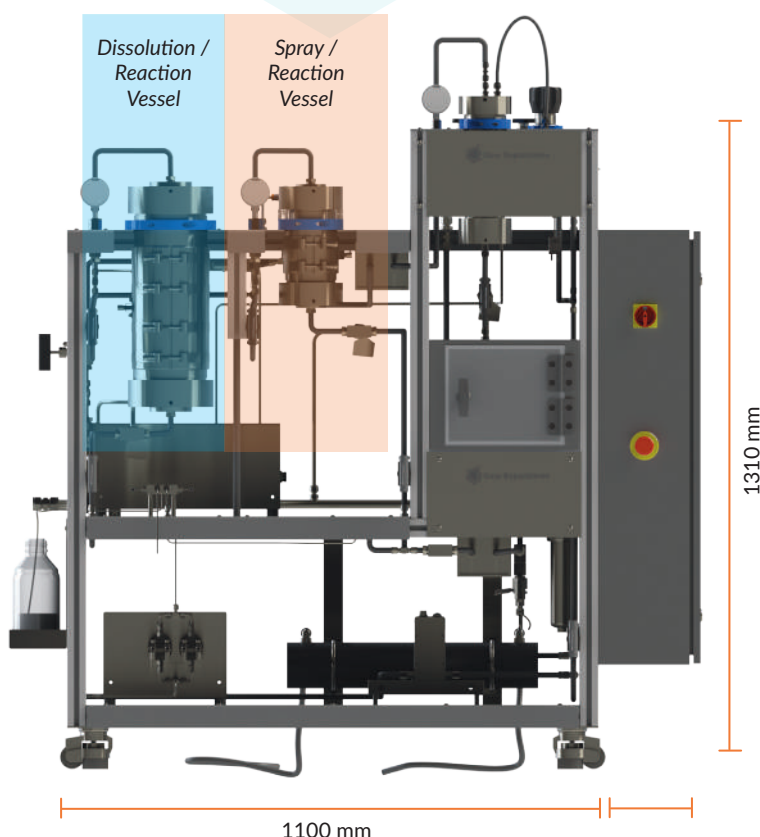
SFXR 500 | SFXR 1L | SFXR 3L | SFXR 5L | SFXR 10L

Extraction

Extractor volume upto 10L
CO₂ 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



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.



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 (Adaptive Pressure Control). This multilevel PID control achieves superior operational management while maintaining rapid pressure build up.



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 a reaction process.



Core | Safety

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 CO₂ densities than can be achieved on low pressure systems commonly found on the market.



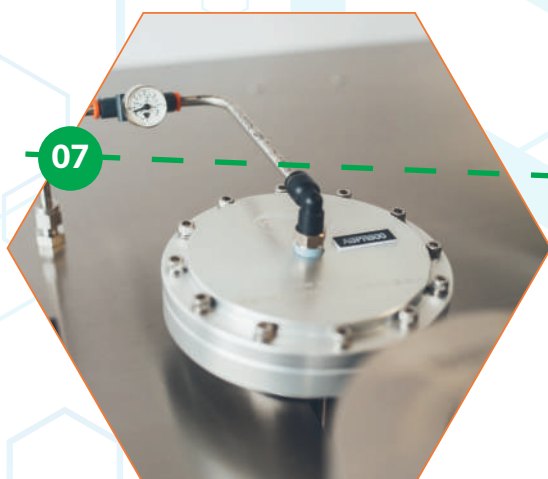
Core | Flexibility

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.

Certification



Core | Reaction



07. Core | **ABPR**

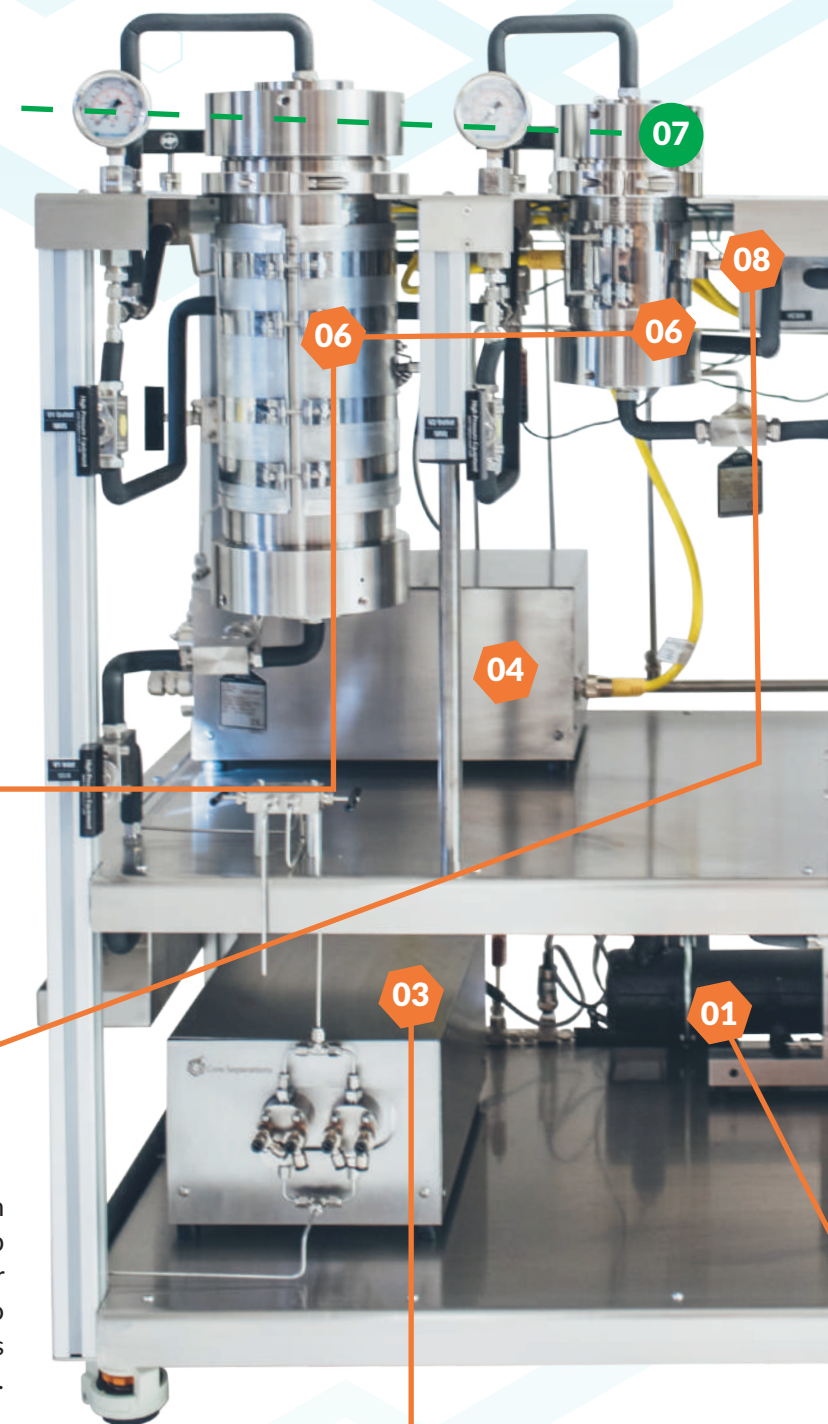
Utilising a electopneumatic back pressure regulator with our APC control mechanism we are able to automatically regulate the pressure in our extractions, maintaining pressures +/- 1 bar of the setpoint.

06. Core | **Reaction**

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.

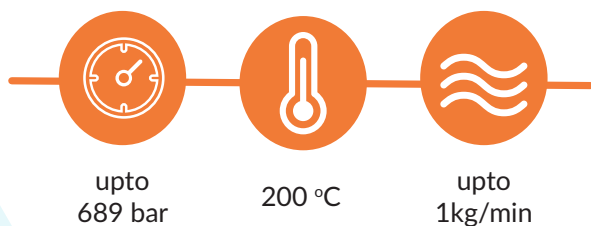
08. Core | **Vaporiser**

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.



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.



 Part viewed from the front

 Part can be viewed from the back

09

11

09. Core | Cyclones

Offering both double end and single ended cyclone designs using either standard PTFE o-rings or sprung seals. The cyclone acts as a catch pot for reactions.

11. Core | MBPR

Whether it be a cyclone separator or a cold trap controlling the pressure inside these vessels can aid in collection. By modifying the pressure and temperature the density can be accurately controlled. The manual back pressure regulators facilitate the control of the pressure in each of the separators.

05

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.

02

02. Core | Flow Meter

Addition of a flow meter improves delivery accuracy by adjusting the flow to compensate for changes in the CO₂ feed density. Although we control the incoming temperature of the CO₂ a drop in pressure from the CO₂ bottle as we consume the CO₂, can result in a density shift causing the pump to under deliver the CO₂ to the process. The flow meter also offers additional process data to be collected in the system, such as total CO₂ used.

01. Core | Condenser

Although we use a liquid CO₂ feed in our extraction systems, its important that the incoming CO₂ remains liquid. The condenser acts to maintain the incoming temperature of the CO₂ ensuring it remains a liquid during the pumping phase. Additional condensers can be added with higher flow rate pumps or with the addition of a recycling unit.

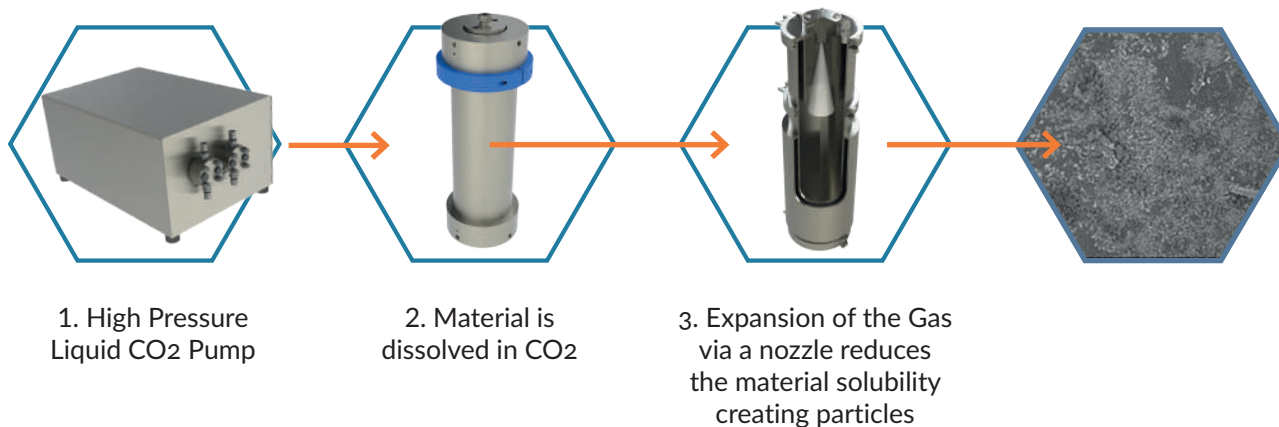
Core | Reaction - Configuration

If you are looking at particle engineering, Core | **Reaction** systems can be configured in several different modes depending on whether the substrate is soluble in CO₂ or a more polar solvent. Four common configurations are described below to help configure the appropriate system for either research or production.

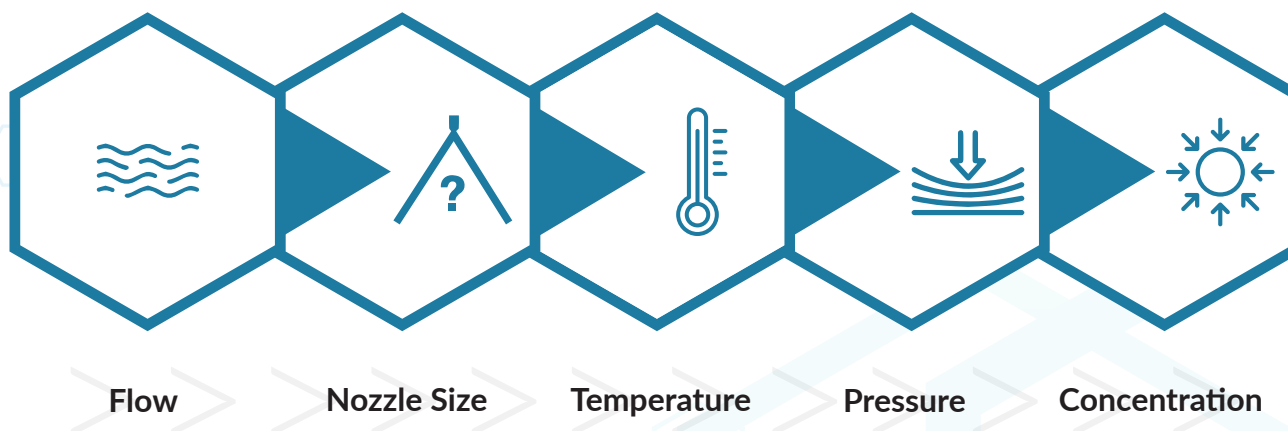
RESS – Rapid Expansion of Supercritical fluids

This technique involves dissolving the solute in a supercritical fluid and expanding it through a nozzle with a fixed orifice. The resulting pressure drop dramatically decreases the density of the supercritical solvent leading to precipitation of the solute.

The morphology and size distribution of the precipitated material is a function of the nozzle size, back pressure and CO₂ flow.



By changing one or a number of these parameters control of the particle size, crystal form and the morphology can be achieved.

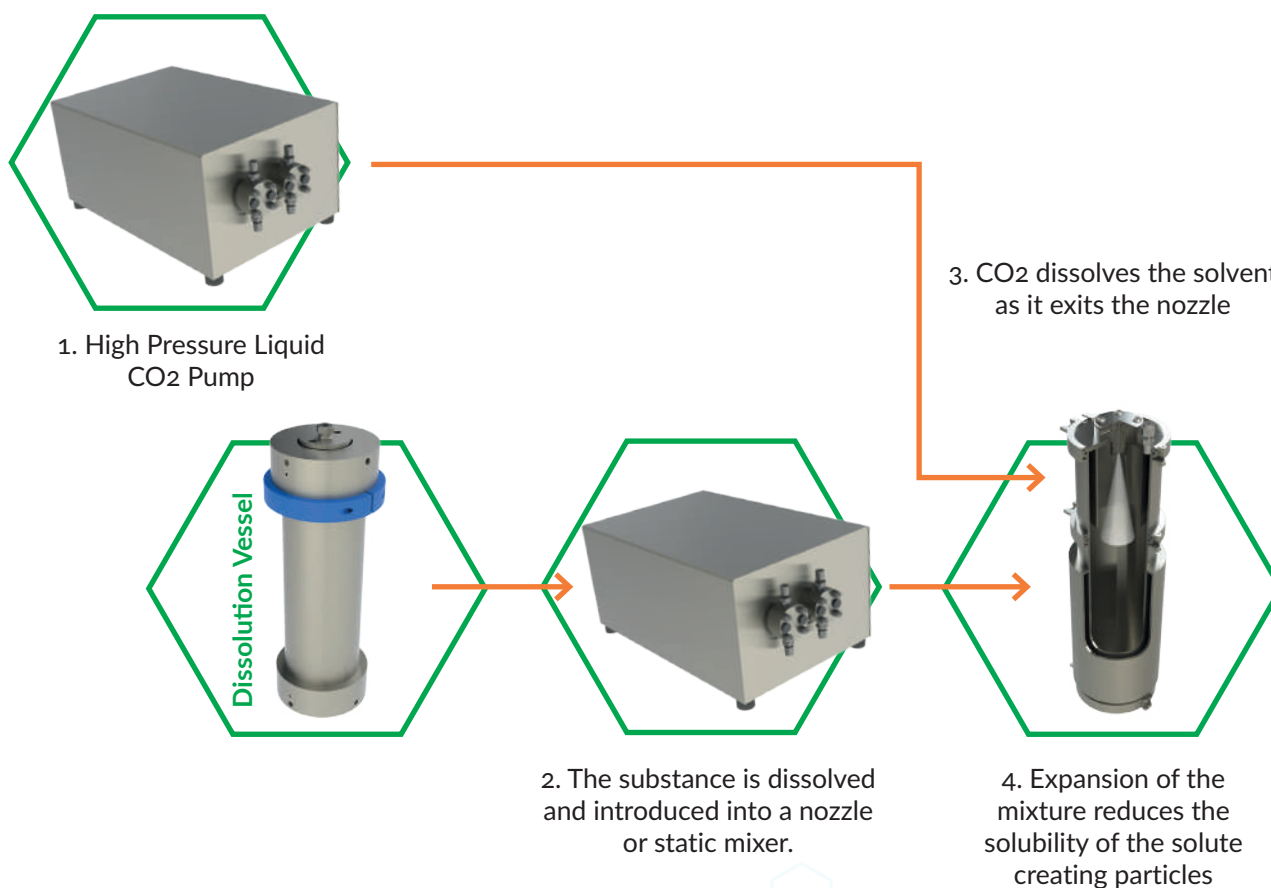


The higher the concentration, the smaller the particles will be and the narrower the particle size range

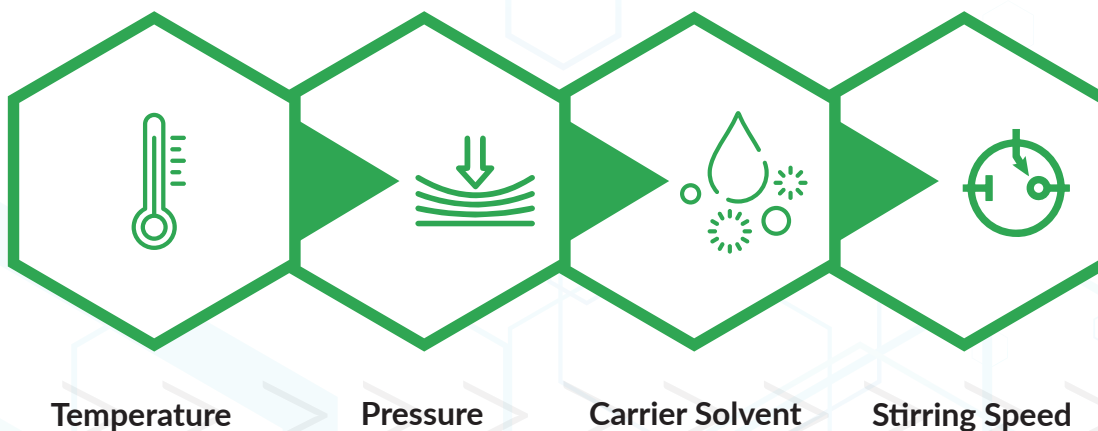
GAS – Gas anti-solvent

In batch GAS technique a subcritical fluid is used as an anti-solvent that causes the precipitation of solids. The solids are first dissolved in a organic solvent, which is then added to subcritical CO₂ to precipitate the solids. The rapid addition of solute dissolve in the organic solvent results in a sudden reduction of the liquid density and a volumetric expansion of liquid, a sharp rise in the supersaturation in the liquid mixture, and a consequent formation of small and uniform particles.

The advantages are, that the particle size can be easily controlled by the addition rate of anti-solvent, by the initial concentration of formed material in solutions and by temperature



Volumetric liquid expansion profile is a function

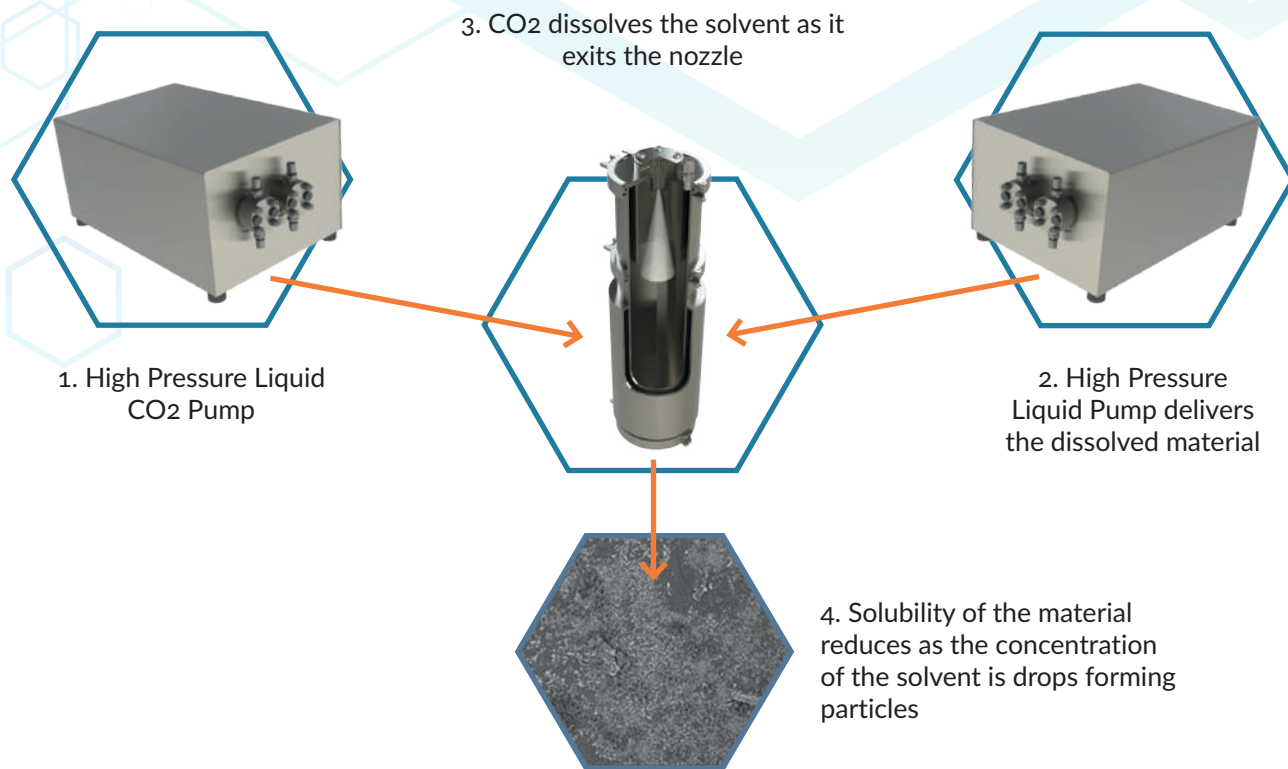


Particle sizes range from 0.5 to 500 μm

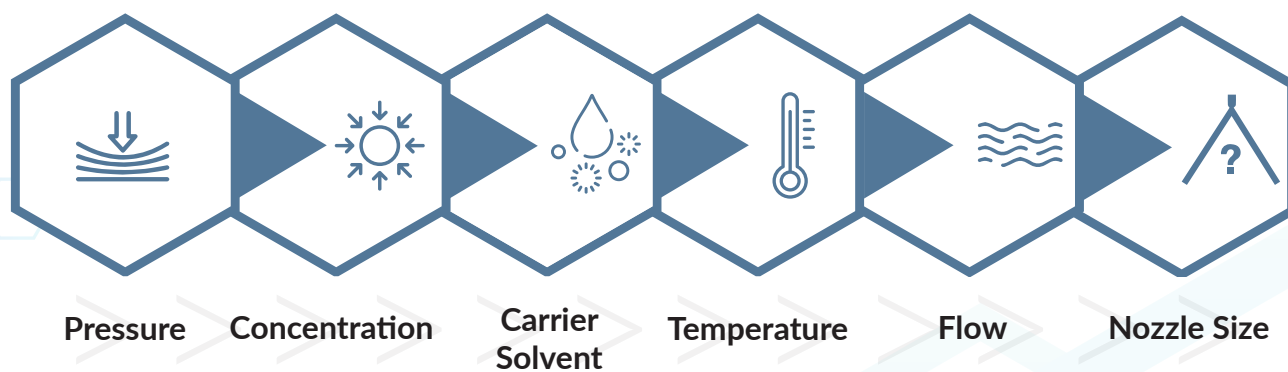
SAS – Supercritical anti-solvent

Also known as continuous GAS techniques

In this technique the material is dissolved in an appropriate organic solvent and is continuously fed with the supercritical fluid into a precipitator. Small, liquid droplets are contacted with an excess of supercritical fluid producing dry particles through the expansion of the organic solvent.



Effect of processing variables

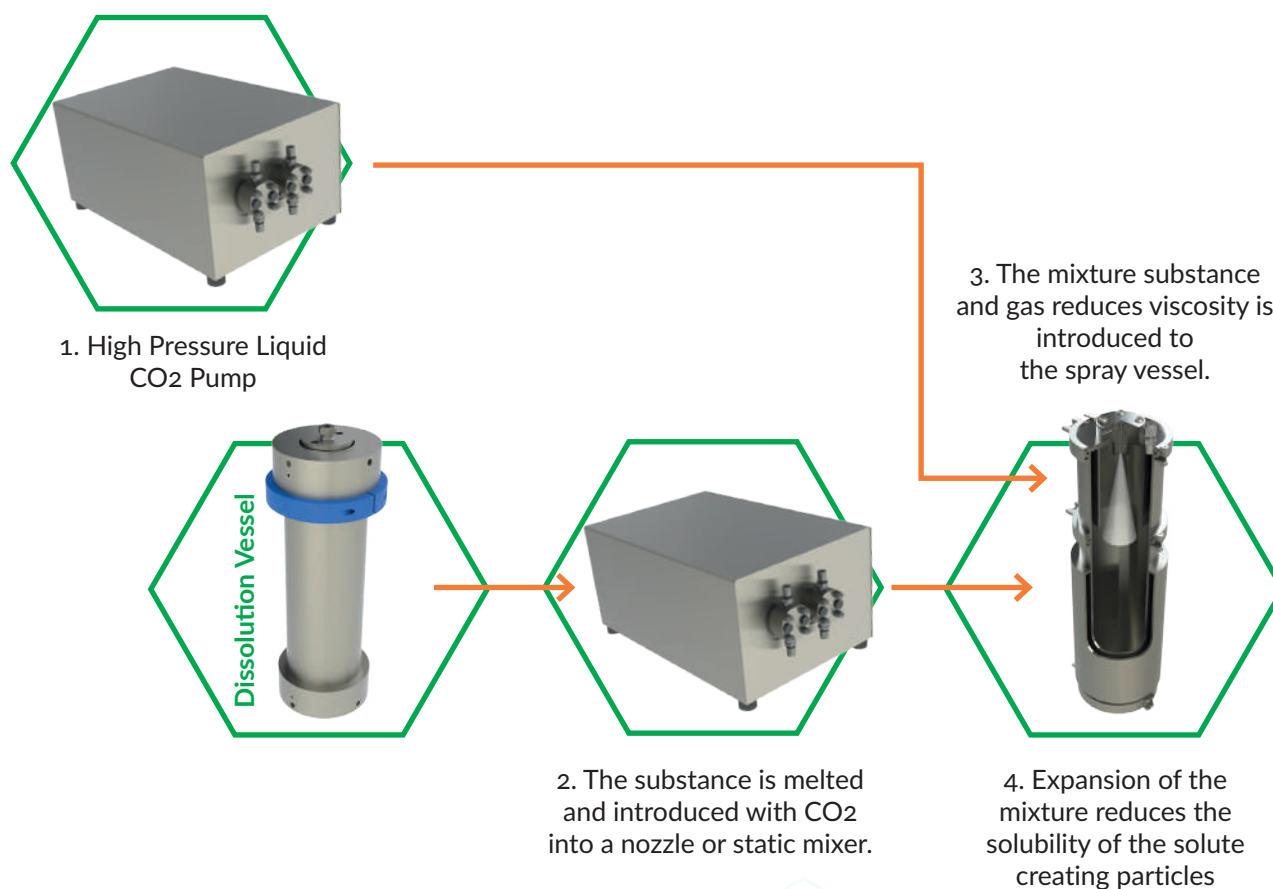


A particle size range of 0.1 μm to 250 μm is produced, mainly of the size of 1-10 μm

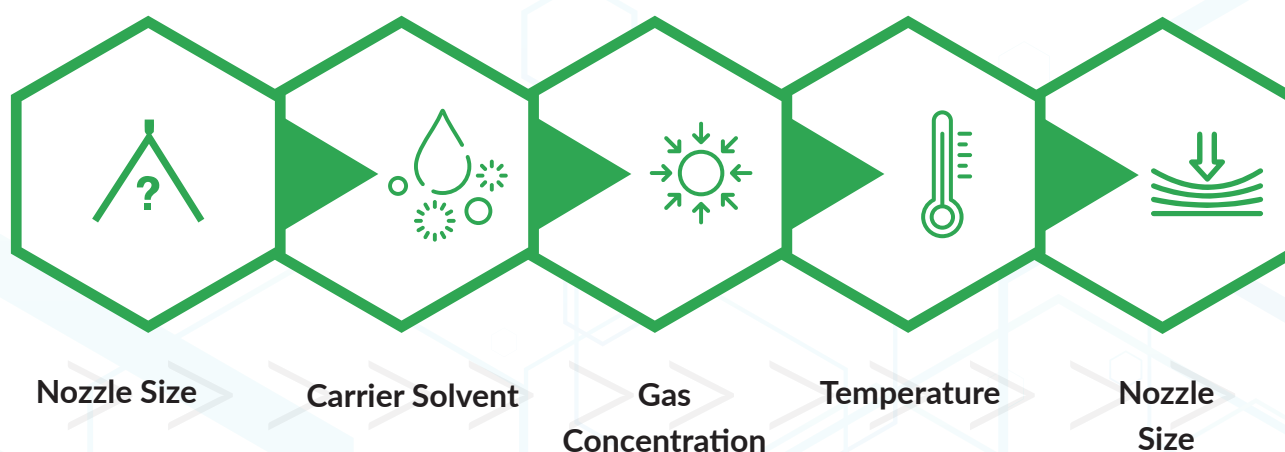


PGSS – Particles from gas saturated solutions

The solubility of compressed gases in liquids is usually high, this resulting mixture changes the ensuing gas and liquid properties. Expansion of this gas saturated solution through a nozzle results high supersaturation forming fine particles.



The crystallinity, particles size can be influenced by



Particle size distribution (150 μm)



12. Core | CCC Applications



Counter-current columns are used for a variety of applications, including separation, purification, and extraction in a range of industries, including pharmaceuticals, food and beverage, and materials science.

It involves the two phases flowing in opposite directions. Components with high solubility in the scCO_2 are carried up the column and compounds with low solubility are collected at the base. The column is made up of a series of packed beds or trays, with each bed or tray serving as a stage in the separation process.

Advantages of using supercritical CO_2 counter-current columns include:

1. High selectivity: Supercritical CO_2 can be tuned to be highly selective for certain compounds, leading to efficient separation and purification.
2. Environmentally friendly: Supercritical CO_2 is a non-toxic and non-flammable solvent, making it a sustainable and environmentally friendly option.
3. Efficient extraction: Supercritical CO_2 can extract compounds at a higher rate than traditional solvents, leading to faster extraction times and higher yields.
4. High purity: Supercritical CO_2 can produce highly pure products due to its ability to selectively extract or separate compounds.

Supercritical CO_2 counter-current columns have a variety of applications and advantages with some common application areas described on the following page.



De-odourisation

Traditionally de-odourisation of edible oils such as soybean oil or palm oil is accomplished through steam distillation. The process generates aqueous waste known as Hydrosol, which contains a mixture of free fatty acids and tocopherols.

The same process can accomplish using CO₂ counter current technology as scCO₂ is effective at removing free fatty acids and the oxidative compounds commonly associated with the odour and off-taste to many edible oils.



De-acidification

De-acidification of free fatty acids from oils can be successfully achieved through physical processing, such as steam distillation or through chemical conversion with sodium hydroxide to form soaps. Both methods produce by-products such as aqueous waste streams that require disposal or impact the oil recovery through emulsification of the oil.

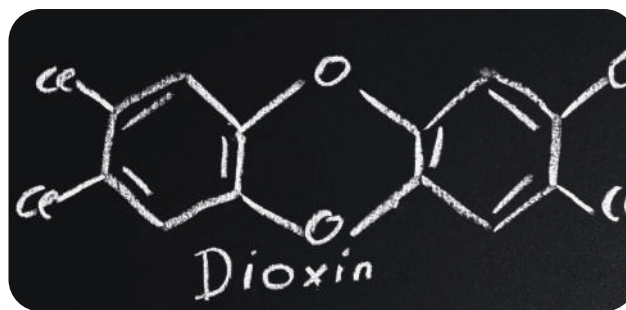
CO₂ counter column can effectively remove these fatty and later processed to form the soap like products.



Vitamin E

Isolation of vitamin E and other Tocopherols from vegetable oils can be accomplished using counter current column technology to isolate these compounds in high yield. It is achieved by manipulating a temperature gradient along the column similar to that used in distillation.

The same technique can be used to process fish oils high in omega-3 poly unsaturated fatty acids such as EPA, DHA or DPA can also be achieved through CO₂ processing through a counter current column.



Detoxification

Processed oils often contain pollutants such as dioxins and heavy metals. CO₂ processing is effective in the detoxification of many unwanted materials in food products especially those who were extracted using CO₂ as the primary method of processing.

However oil can be re-mediated using CO₂ counter current technology to easily remove the harmful dioxins such as PCDD's, PCDF's and DL-PCB's.

13. Core | Counter Current Column

upto 689 bar

Counter Current column is a multi-stage liquid-liquid extraction system. 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
upto 689

Temperature, oC
upto 100

Volume L
2.017

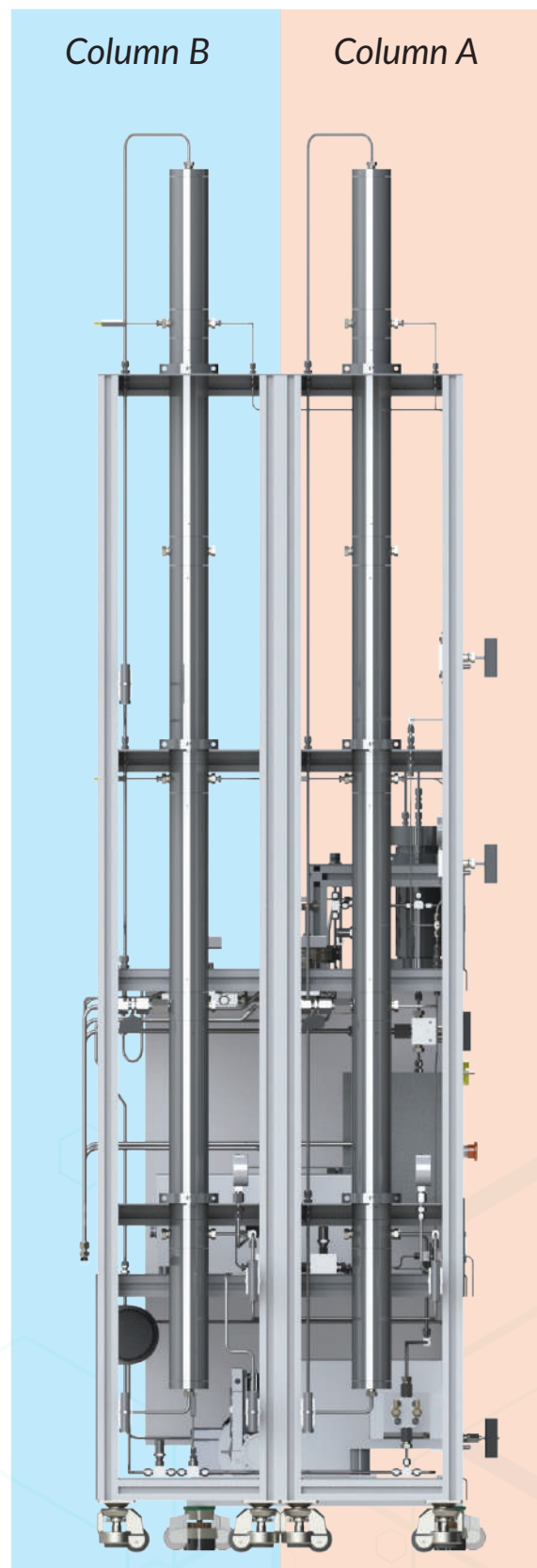
Heated Zones
4

Flow Rate, g/min
upto 1,000



Multi column system

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



For more information: contact@coreseparations.com

Flow Meter
Optional

Automated BPR
Standard

Cyclones
200 bar Std

Control
PLC-PC

Certification
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 on the top and bottom of the column. 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

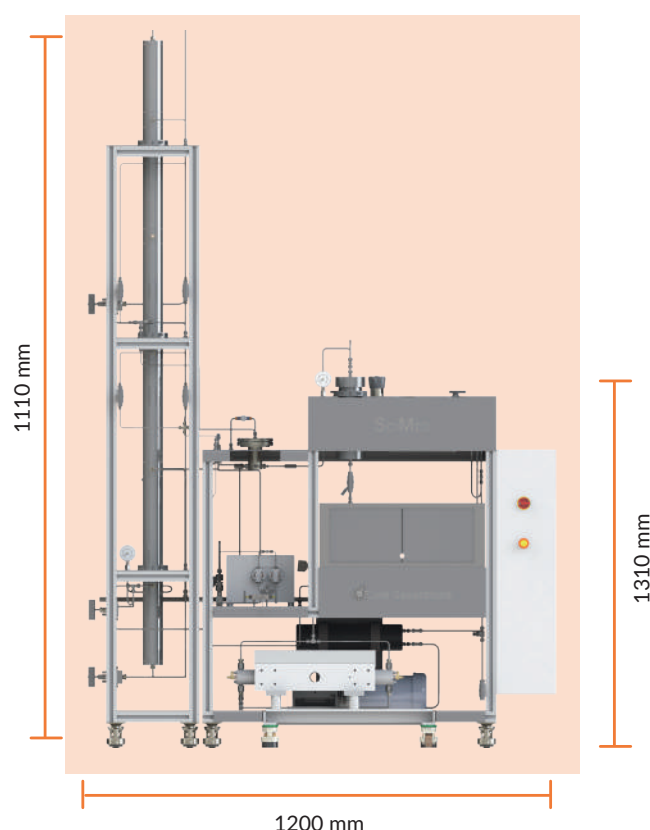
SFX CC2M

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



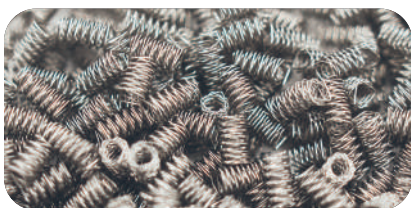
Programmable warning and alarm limits to alert the user that the system conditions are approaching the cut off safety limits.



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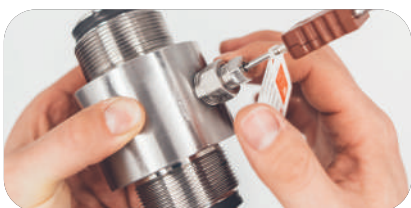
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High Surface Area

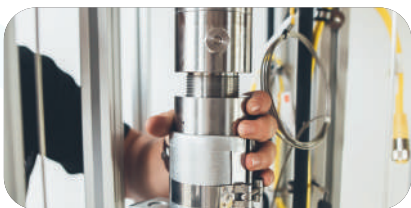
Packed with prismic springs the CO₂ flows over the packing placed within the column. Introduction of the liquid feed wets the surface of the packing which acts to improve mass transfer.

Mass transfer - total movement of mass from one location to another. The selective interaction of the CO₂ 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 separation gradient or be 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 CO₂ densities throughout the column. Zones can be added and removed.

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, allows the separation process to take place. This modular design allows multiple liquid entry points, including the ability to shorten and lengthen the column to allow it to be tailored to a specific process.

04. Core | Co-Solvent

High pressure pump used to introduce the liquid feed into the column for separation.

06. Core | ABPR

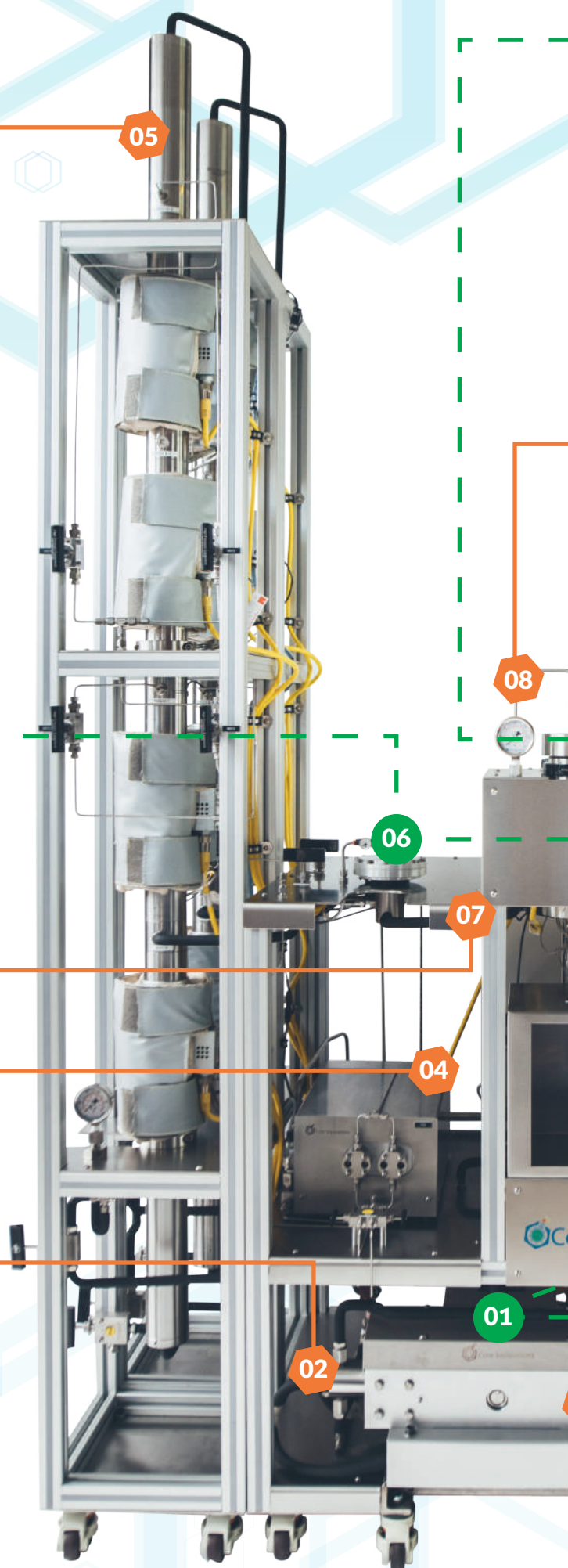
Utilising a electopneumatic back pressure regulator with our APC™ control mechanism we are able to automatically regulate the pressure in our extractions, maintaining pressures +/- 1 bar of the setpoint.

07. Core | Vaporiser

Joule-Thomson effect is observed during a pressure drop 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..

02. Core | Flow Meter

Addition of a flow meter improves delivery accuracy by adjusting the flow to compensate for changes in the CO₂ feed density. Although we control the incoming temperature of the CO₂ a drop in pressure from the CO₂ bottle as we consume the CO₂, can result in a density shift causing the pump to under deliver the CO₂ to the process. The flow meter also offers additional process data to be collected in the system, such as total CO₂ used.



09. Core | **MBPR**

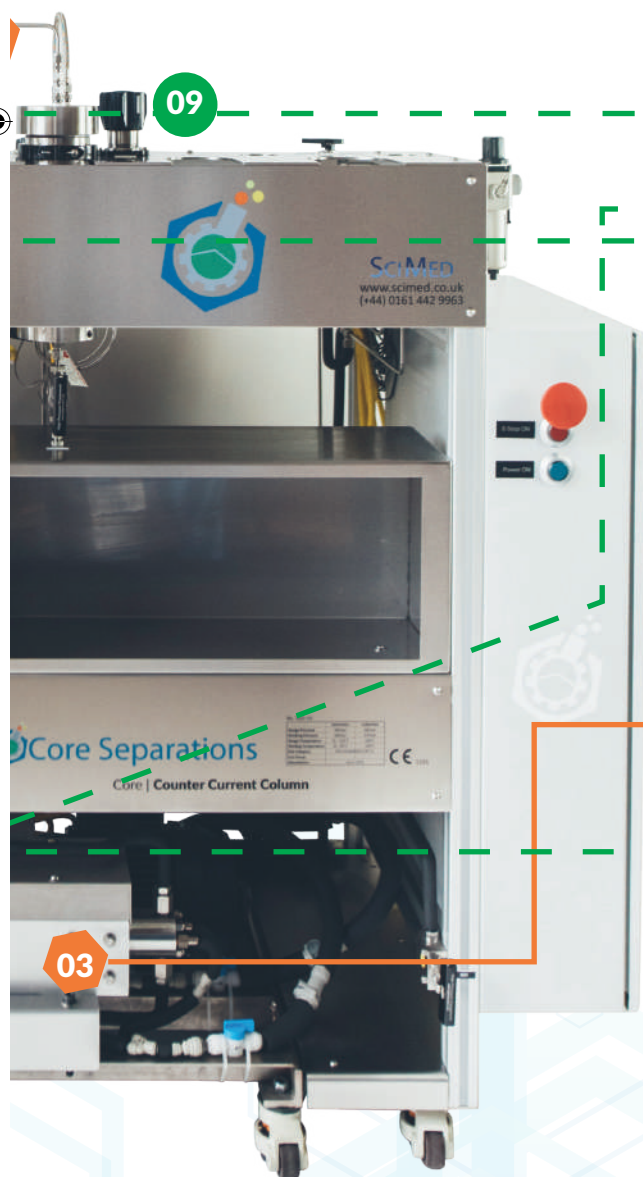
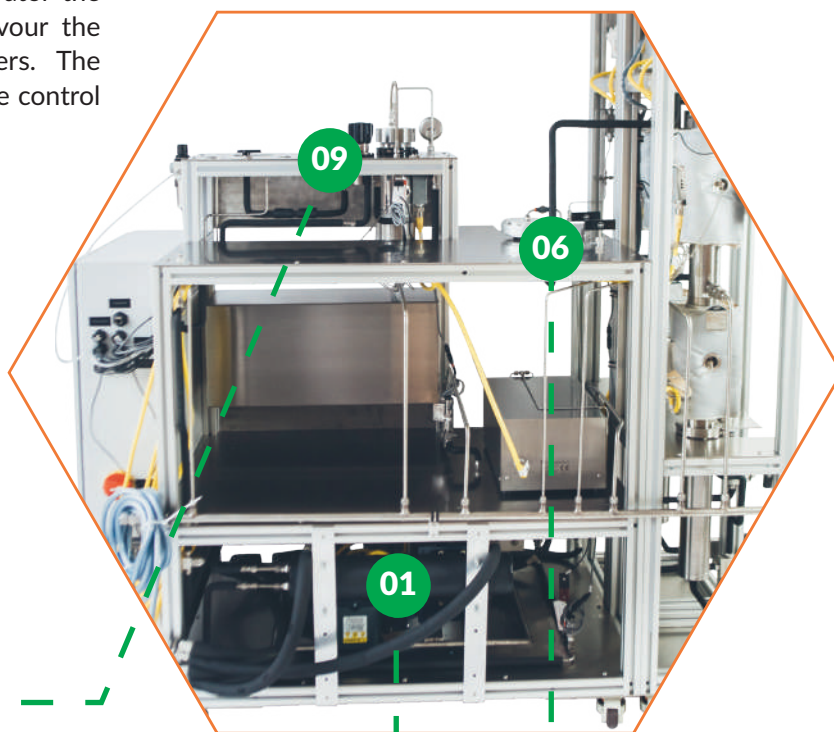
Whether it be a cyclone separator or a cold trap controlling the pressure inside these vessels can aid in collection or in the case of multi cyclone systems result in fractionation of the extraction feed. By modifying the pressure and temperature in each separator the density can be accurately controlled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

08. 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 single pot collection or multi pot fractionation of the lighter fractions.

Part viewed from the front

Part can be viewed from the back



01. Core | **Condenser**

Although we use a liquid CO₂ feed in our extraction systems, its important that the incoming CO₂ remains liquid. The condenser acts to maintain the incoming temperature of the CO₂ ensuring it remains a liquid during the pumping phase. Additional condensers can be added with higher flow rate pumps or with the addition of a recycling unit.

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.



upto
600 bar



100 °C



upto
500g/min

14. Core | Water Applications

Subcritical water extraction (SWE) uses water to extract compounds from various natural products. SWE has several applications and advantages in comparison to traditional solvent extraction techniques.

1. Sustainable: Using water as the solvent, eliminates the use of hazardous organic solvents.
2. High selectivity and efficiency: SWE can selectively extract target compounds and provide high extraction efficiency in a shorter time compared to traditional extraction methods.
3. Cost-effective: SWE is a cost-effective extraction technique since it does not require the use of expensive organic solvents, which can be harmful to the environment and human health.

Some common applications of subcritical water extraction are described opposite.



Algae

Algae produce a variety of phenolic compounds that have antimicrobial, antioxidant, and anti-inflammatory properties, which make them useful in various fields such as medicine, food, and cosmetics. These include phlorotannins which are a specific type of phenolic compound found in brown algae, and bromophenols which are found in red algae.

Using subcritical water these compounds can be collected and purified for use in various applications, such as food additives or nutraceuticals for example.



Berry fruits

Berry fruits such as cranberries, elderberries, blueberries, and grapes are known to be rich sources of bioactive compounds, including Anthocyanin pigments and Polyphenols. Anthocyanin pigments are responsible for the red, blue, and purple colors of many berry fruits. These pigments are potent antioxidants that have been linked to numerous health benefits, including reducing inflammation, improving cardiovascular health, and protecting against cancer.

Subcritical water is an effective method for the extraction of Anthocyanins, producing high yields with minimal degradation.



Bioactive Compounds

Apple pomace and citrus pulp are by-products of the fruit juice industry that are rich in pectin, a complex polysaccharide with numerous functional properties. Pectin is commonly used in the food industry as a gelling agent, thickener, and stabilizer.

Subcritical water extraction (SWE) can be used to extract pectin found in apple pomace and citrus peel, which then can be used in a wide range of applications.



Tea Leaves

Tea leaves contain a variety of bioactive compounds, including caffeine, theobromine, catechins, and flavonoids, which have been associated with various health benefits, such as improved cognitive function, cardiovascular health, and antioxidant activity.

Subcritical water can extract these thermal labile compounds avoiding the use of organic solvents which would then contaminate the final product.

15. 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

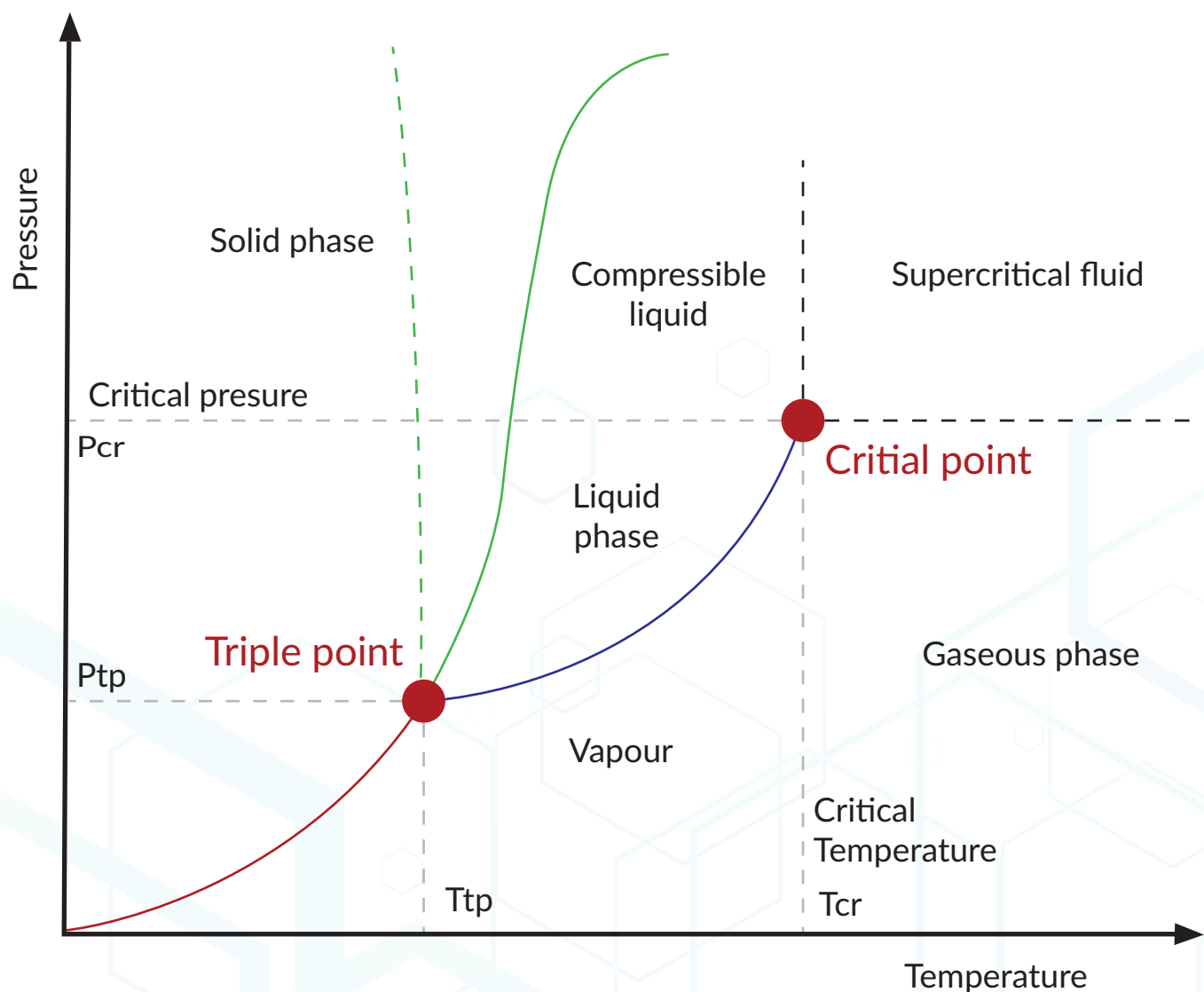
- Polyphenols
- Flavoids
- Sugars
- Gyclosides
- Natural Products



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 these 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 374°C 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 Core | **Water** system utilises Inconel vessel with 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. The water enters the vessel, it is pre-heated to temperatures up to 400 °C via two 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 cold trap located on the right-hand side of the system.

System sizes available

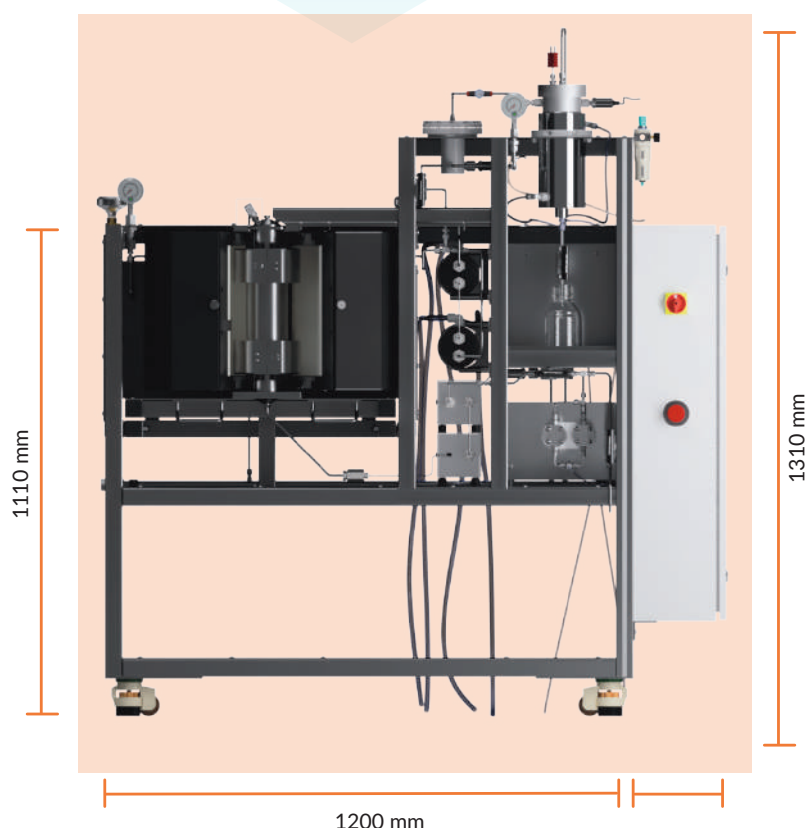
SFXW 500

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



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



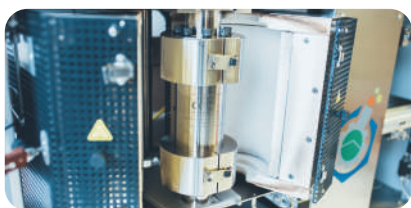
Programmable warning and alarm limits to alert the user that the system conditions are approaching the cut off safety limits.



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 (Adaptive 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 supercritical water could be 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.



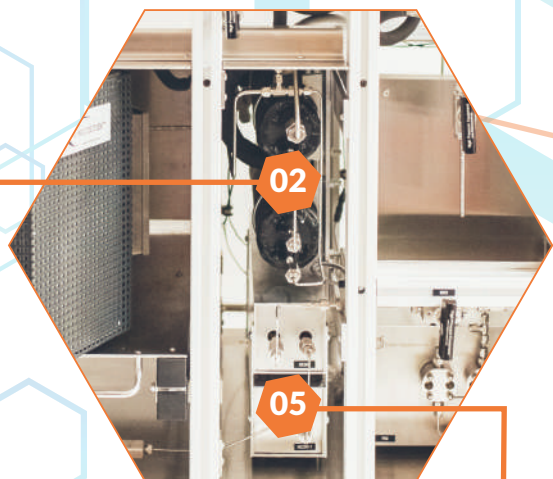
High Pressure: 500 bar

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



05. Core | **Condensers**

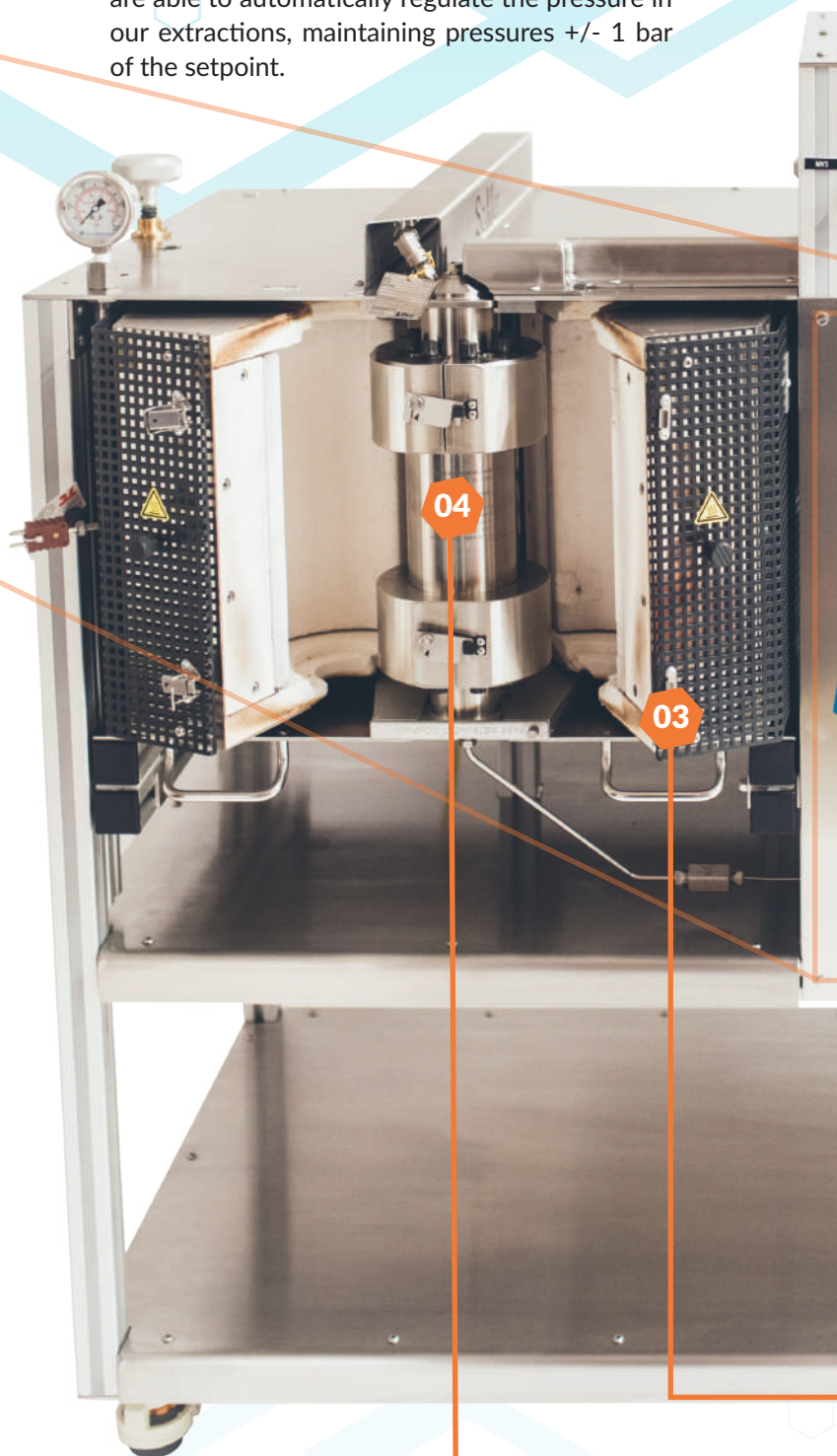
The heat exchangers are located after the vessel and cool the aqueous stream to below 50 °C before entering the ABPR. This improves the life of the soft seals within the ABPR and helps deliver a aqueous stream at a safe temperature for collection.

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.

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.



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.



upto
500 bar



400 °C



upto
50mL/min



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.

16. 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.

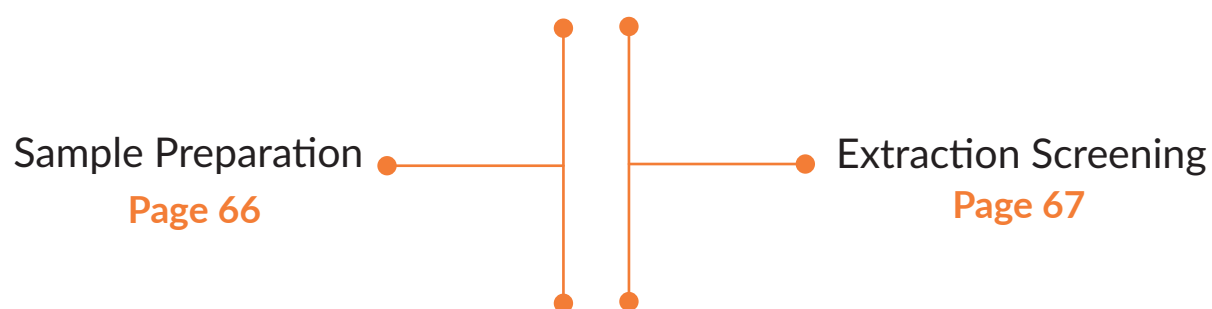
Applications

- Environmental
- Food
- Pharmaceuticals
- Consumer Products
- Polymers





PLE (Pressurised Liquid Extraction)



SFE (Supercritical Fluid Extraction)

Sample Preparation

Sample preparation is a key process in preparing a sample for analysis or testing. The use of supercritical CO₂ can reduce the work-flow required in this time consuming but vital process. Unlike traditional solvents that need to be evaporated when used in sample extraction, CO₂ evaporates as a gas leaving a concentrated extract for analysis.



Soil Analysis

Supercritical CO₂ extraction is a powerful technique for the analysis of toxins and pesticides in soil samples. It offers several benefits and advantages, including high selectivity, efficiency, and safety. As a result, it has become an increasingly popular technique in environmental analysis and monitoring.



Food Analysis

Dioxins and pesticides are toxic compounds that can accumulate in the food chain and pose a risk to human health if consumed in high levels.

Supercritical CO₂ extraction can be used to extract these compounds for analysis to determine their levels and ensure our food meets the required safety standards.



Pharmaceutical Analysis

Supercritical CO₂ can be used in quality control within the pharmaceutical industry. The APIs can be extracted from the tablet matrix, then analyzed using various analytical techniques to determine their purity, potency.

Extraction Screening

Optimising an extraction, when using CO₂ 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.



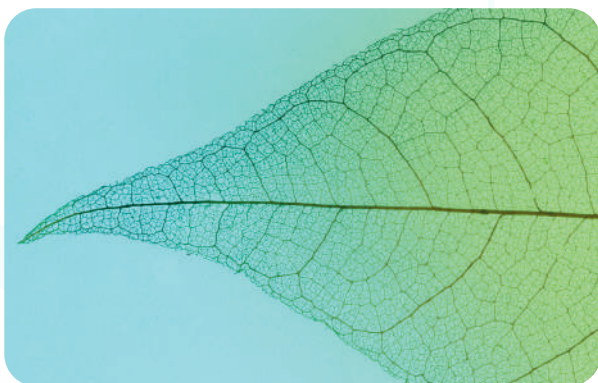
Optimisation Studies

Optimization of supercritical CO₂ conditions, are an important aspect of developing an extraction process for any given application. The extraction time is one of the key parameters that can be optimized to increase the yield of the desired compounds. The ESS can be used to identify the optimal extraction conditions that will maximize the yield of the desired compounds.



Selectivity Screening

The ESS can be used to investigate the effectiveness of supercritical CO₂ in extracting different levels of bioactive compounds from natural products. It can be used to investigate the extraction efficiency of specific conditions on the extraction process, to separate the different molecules of interest.



Plant Evaluation

Evaluating different plant breeds can be important in exploring the varying concentrations of bioactive compounds found in natural products. Using multi-vessel screening available on the ESS allows quick and effective examination of different plant breeds and the concentration of the different bioactive compounds.

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 CO₂ and 10mL/min solvent at pressures up to 689 bar. The system includes multiple heater zones allowing the CO₂ 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 expand the CO₂. The CO₂ pump has an independent flow meter to measure and control the incoming CO₂ and 16 pneumatically actuated valves to control which vessel is selected.

Vessel sizes available

EV10 | EV25 | EV50

Extraction

Number of Extractors 8

Extractor volume
10mL
25mL
50mL

CO₂ flowrate 15g/min

Co-solvent

Flowrate 10mL/min

Max pressure 600 bar

Max temperature 100°C

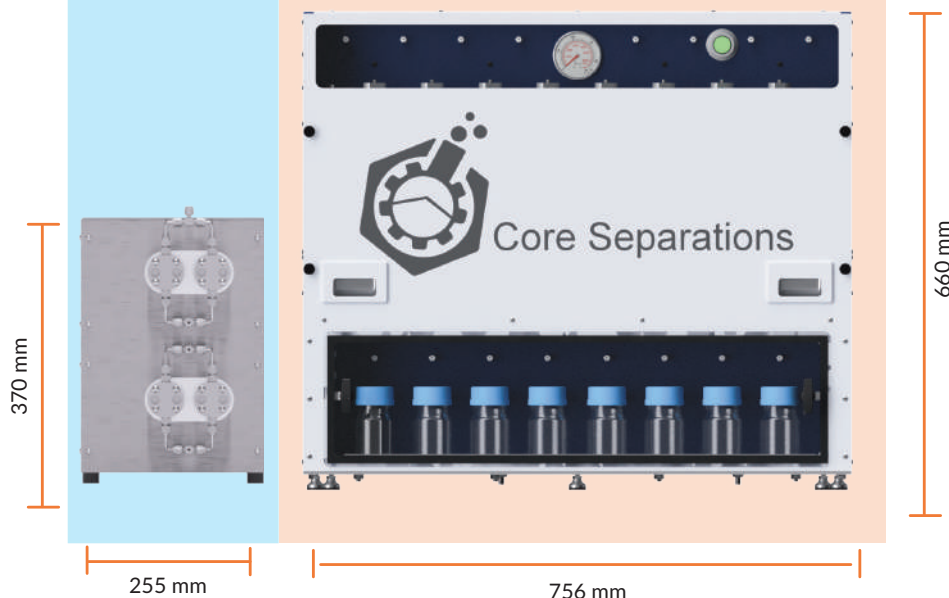
Separation

Number of Collectors 8

Capacity 100mL

Fluid Delivery
Module (FDM)

ESS



Specification



Power requirements

200-240 V (13A)



Pneumatic Air Pressure (bar/psi)

6.9 bar / 100 psi, 1/4" compression inlet



CO₂ Inlet

55 bar, 1/4" compression inlet



Vent Line

3/8" 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 (Adaptive 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 individual extraction to be isolated and collected in its own bottle.

Certification



17. 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.

Compression Zone Level (bar)
40

Fixed PID below this level

Compression Zone PID Output
20

Fixed PID output percentage

Sample Interval
1200

ms

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.

+ Create new recipe

+ Run Recipe

✓ Validate

Core | Recipes

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

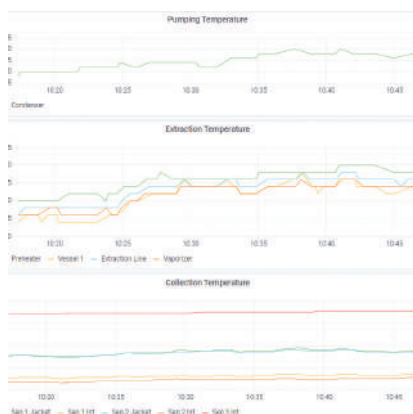
Interface
Web browser

Recipes
Standard

Data collection
Realtime

Data Download
CSV file

User Control
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.

Role

Operator

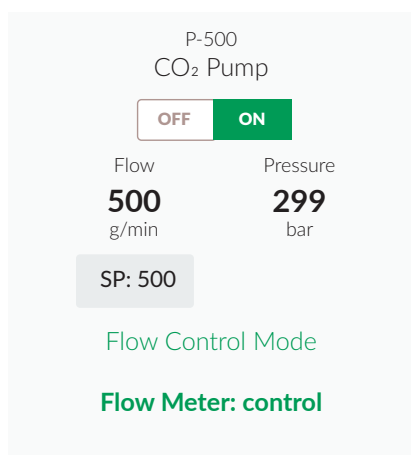
Administrator

Operator

Remote Monitor

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.

ALARM ACTIVE

WARNING

WARNING CLEARED

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 information: contact@coreseparations.com

PID Settings
Adjustable

Modes
**Computed, Flow
meter, Pressure**

ABPR Control
APC™

Alarms
Warning and High

Upgradable
Yes

18. 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@coreseparations.com

Heat exchangers
Re-used

Extraction Vessel
Re-used

Cyclones
Re-used

Valves
Re-used

Chiller
Re-used



Pump
Upgraded

Flow Meter
Replaced

ABPR
Replaced

Control System
Replaced

Pipework
Replaced

19. 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, available in a range of sizes from 10, 25 and 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 information: contact@coresaperations.com



20. 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
689

Temperature, °C
150

Volume, mL
5 - 10,000

Body Material
17-4PH

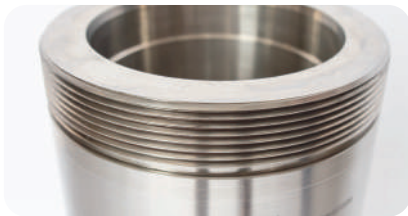
Opening
Double ended

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.

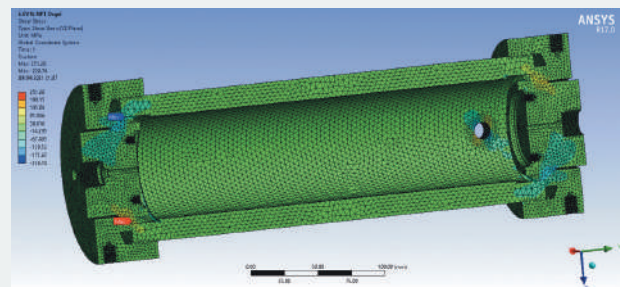


Material of Construction

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. This help inform us of predicted life and inspection cycles of our pressure vessels.



The key to safety is knowledge!

For more information: contact@coreseparations.com

Closure
Threaded

Seal
Energised Sprung

Entry
Toolless

Mount
Split Collar

Certification
ASME, PED, CSA, UKCA

21. Core | Vessels (EVK series)

upto 1100 bar

Building on the EV series vessels, the EVK series pushes the boundaries in CO₂ research offering extraction and reaction vessels that can withstand pressures upto 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
1,100

Temperature, °C
150

Volume, mL
1,000 - Custom

Body Material
17-4PH

Opening
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.

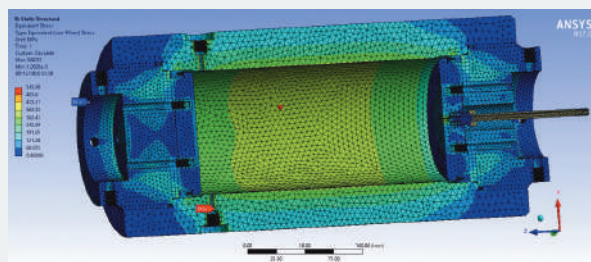


EV Tec Basket

EV-Tec series baskets make loading and unloading the pressure vessels quick and efficient, while also reducing manual handling risks. They 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. This helps inform us of predicted life and inspection cycles of our pressure vessels.



The key to safety is knowledge!

For more information: contact@coreseparations.com

Closure
Threaded

Seal
Energised Sprung

Entry
Toolless

Mount
Split Collar

Certification
ASME, PED, CSA, UKCA

22. Core | Pumps (CL series)

upto 689 bar

Core Separations CL series pumps are ideal for high pressure liquid and CO₂ 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 CO₂



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 reactions 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
689

Flow Rate, g/min
upto 250

Media
CO₂, Solvent

Head Material
316

Number of Heads
2



Core | Features



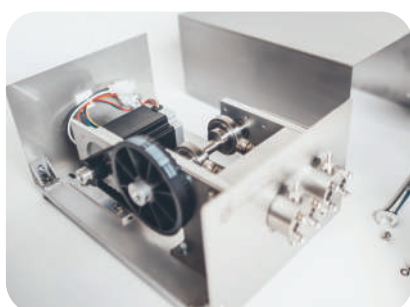
Core | Research

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 (Adaptive Pressure Control). This multilevel PID control achieves superior operational management while maintaining rapid pressure build up.



SCAN ME

For more information: contact@coreseparations.com

Type
Piston

Piston Material
Sapphire

Control
Standalone, System

Mount
Rubber Feet

Certification
ASME, PED, UKCA

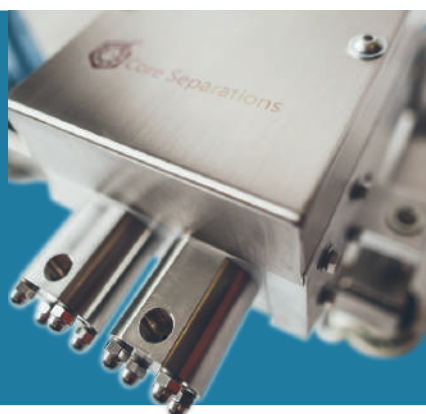


23. Core | Pumps (CI & CU series)

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 CO₂.

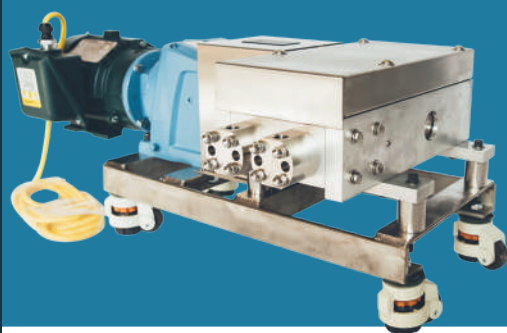
Our Industrial series pumps are highly energy efficient and have a proven long service life for all mechanical components. Combined with particularly low maintenance and operating costs, our pumps are well suited for the conditions required in manufacturing environments.



Core | P500 Pump

Pilot scale manufacturing needs a pump with a robust design 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 upgrade. Suitable for reactors upto 10L.

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



Core | P1K Pump

Using the same core design as our P500 pump, the P1K delivers an 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

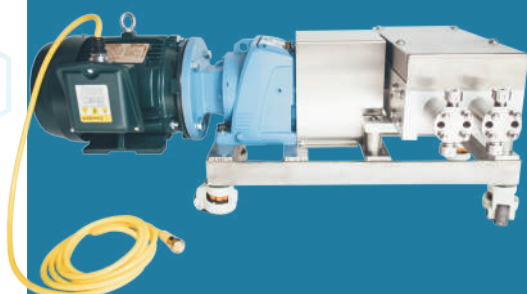
Pressure, bar
upto 1,000

Flow Rate g/min
upto 1,000

Media
CO₂, Solvent

Head Material
316

Number of Heads
2



Core | P251K Pump

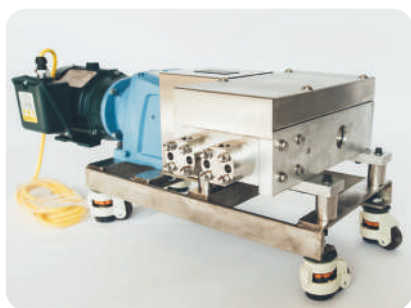
Designed to deliver liquids including CO₂ into extremely high pressure environments upto 1000 bar. Built from the ground up the P251K can deliver 250g/min at 1000 bar utilising a highly efficient Core Separations designed check valve.

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 information: contact@coreseparations.com

Type
Piston

Piston Material
Ceramic

Control
Standalone, System

Mount
Wheels

Certification
ASME, PED, UKCA

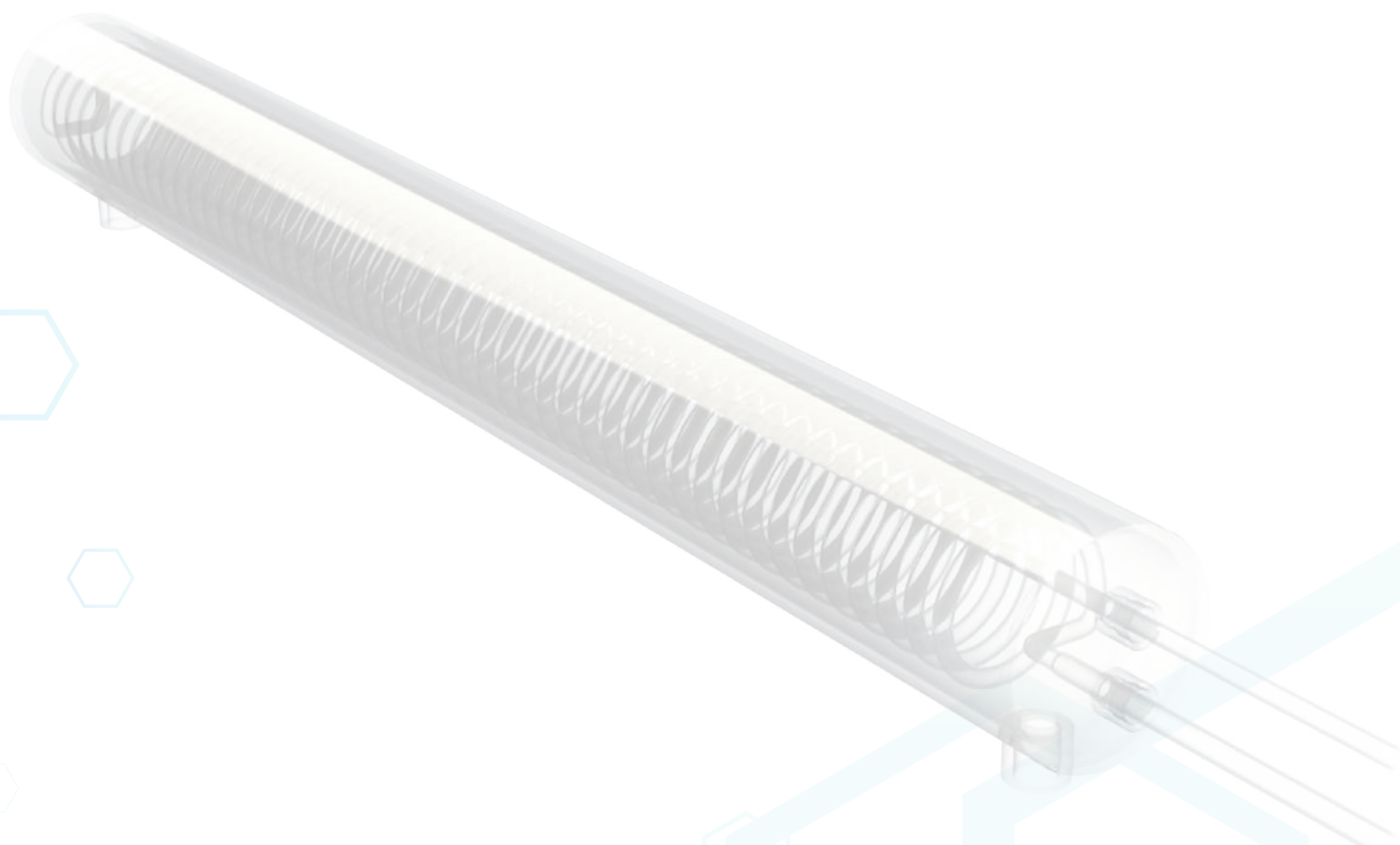


24. Core | Heat Exchangers

upto 1000 bar

Supercritical fluids by their nature require heat to pass the supercritical phase boundary. However to compress CO₂ using our liquid pumps we need to ensure the incoming CO₂ 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 CO₂ 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
upto 1000

Temperature, °C
upto 150

Media
CO₂, Solvent

Type
Tube in Shell

Shell Material
304



Liquid | Heat Exchangers

Part Number	Heating	Tube OD	Tube Length	Surface area	Pressure
LHE403520	Liquid	1/4"	20 ft	0.65 ft ²	353 bar
LHE404920	Liquid	1/4"	20 ft	0.65 ft ²	517 bar
LHE406520	Liquid	1/4"	20 ft	0.65 ft ²	703 bar
LHE603540	Liquid	3/8"	40 ft	1.95 ft ²	227 bar
LHE606540	Liquid	3/8"	40 ft	1.95 ft ²	448 bar

Electric | Heat Exchangers

Part Number	Heating	Tube OD	Tube Length	Surface area	Pressure
HE60T4049-4CE	Electric	1/4"	20 ft	0.65 ft ²	517 bar
HE60T4065-4CE	Electric	1/4"	20 ft	0.65 ft ²	703 bar



For more information: contact@coreseparations.com

Tube Material
316

Tube
Seamless coil

Control
Standalone, System

Certification
ASME, PED, UKCA





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