



SUPERCritical FLUID TECHNOLOGIES, INC.

Supercritical Fluid Extractions, Reactions and High Pressure Chemistry
www.supercriticalfluids.com

SFT-NPX-10 Natural Products Extractor



*Innovative Leadership in Supercritical Fluids
and High Pressure Chemistry*

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SFT-NPX-10 Natural Products Extractor



- Capacity: 5, 10 or 20 Liter Sample Extraction Vessels; Single 5 Liter, Single/Dual 10 Liter or Single 20 Liter Configurations Available
- Optional PLC/HMI Touch Screen Operator Interface Fully Controllable Processing Variables
- Pneumatic Liquid CO₂ Pumping; Waterless Pre-Chiller, Typical Flow Rates from 0.1 to 1.0 kg/min
- 10,000 psi, 689 BAR, 68.9 MPa Operation
- CO₂ Flow Measured by Coriolis Mass Flow Meter
- Single or Optional Dual Collection Separators
- Code Compliant Vessels and Components
- Compact Design for Portability
- Optional Liquid CO₂ and Co-Solvent Fluid Recycle Available

SFT-NPX-10 Processing System

The SFT-NPX-10 Processing System is designed to perform supercritical fluid extractions incorporating a 5 Liter vessel, single or optional dual 10 Liter sample vessels or a single 20 Liter vessel with single or optional dual separators, and integrated interface controls. The system includes features that facilitate the transition from our laboratory scale equipment to pilot and production processing systems.

This system is configured to enable supercritical carbon dioxide (SCCO₂) extraction using a 5 Liter extraction vessel or 10 Liter extraction vessel(s) in a single or dual configuration or a single 20 Liter extraction vessel rated for operation up to 10,000 psi (689 BAR, 68.9 MPa) and 120°C. The system includes either one or two separator vessels, a pneumatic CO₂ pump with an integrated waterless pre-chiller to maximize pumping efficiency, and all associated valves and piping. The system is mounted on a powder coated steel frame. Pressures and temperatures are controlled in the extractor(s) and separator(s) with control valves, electronic heat exchangers, and pump control.

Benefits of Supercritical Fluid Extraction

Using Supercritical CO₂ to perform extractions on botanicals, herbs, spices and other natural product materials has significant benefits over the use of traditional liquid solvents. CO₂ enters the supercritical region at an elevated temperature and pressure, where it is no longer a liquid or gas. It becomes a supercritical fluid. Under these conditions, the fluid possesses many of the same characteristics of a liquid solvent with the added benefit of the high diffusivity of a gas, and pressure tunable solvency power. There is no need to perform a distillation step since upon returning to atmospheric pressure the CO₂ becomes a gas and can be recycled. This means NO residual solvents are in the extract. Additionally, given that the solvency power of the fluid is pressure dependent, it is possible to fractionate and obtain multiple fractions from a single raw material. This is impossible to do with traditional liquid solvent and distillation processing. Supercritical Fluid Technologies also offers training with each system customized to your specific application.

System Operation

The process cycle begins with fresh CO₂ gas from liquid bulk storage. The process stream passes through a coriolis mass flow meter to provide accurate flow measurement that is insensitive to variations in pressure and temperature. The CO₂ stream is delivered at 5°C and 725 psi (5.0 MPa) to a pneumatic air-driven pump (PMP1). CO₂ mass flow is controlled by modulating the air pressure applied to the pump via an electro pneumatic regulator. The process stream is heated to a maximum process temperature of 120°C.

A pressure transducer measures the extraction vessel pressure. The CO₂ flow is controlled through modulation of a micrometering control valve (PCV201). The process stream subsequently flows into the Separator #1.

The system includes a heat exchanger prior to the extractor pressure control valve (PCV201). This heat exchanger is used to warm the process stream up to 120°C, depending on process requirements, prior to flow through PCV201. Under supercritical conditions, these temperatures increase the solubility of extract in the SCCO₂. Following expansion through PCV201, a portion of the extract falls out of solution. The piping from PCV201 to Separator #1 is extremely short so that there is virtually no opportunity for the extract to clog the lines and so that there is high flow velocity upon entry into Separator #1 to facilitate centrifugal separation of the extract solid from the CO₂ gas stream.

After Separator #1, the CO₂ flows through a heat exchanger. The CO₂ next flows through a pressure control valve and into the second separator. The pressure within Separator #2 is maintained with a backpressure regulator (PCV203) at the recycle pressure.

All shutoff valves in the high pressure portion of the system are rated to at least 10,000 psi (689 bar, 68.9 MPa). High pressure tubing is at least 1/4 inch outer diameter and will be rated to 10,000 psi (689 bar, 68.9 MPa).

System Configuration Options

Basic System:

(1) 10 Liter Vessel
10,000 psi, 689 bar, 68.9 MPa
1 kg flow of CO₂
Manual Controls
Single Separator
Coriolis Mass Flow Meter

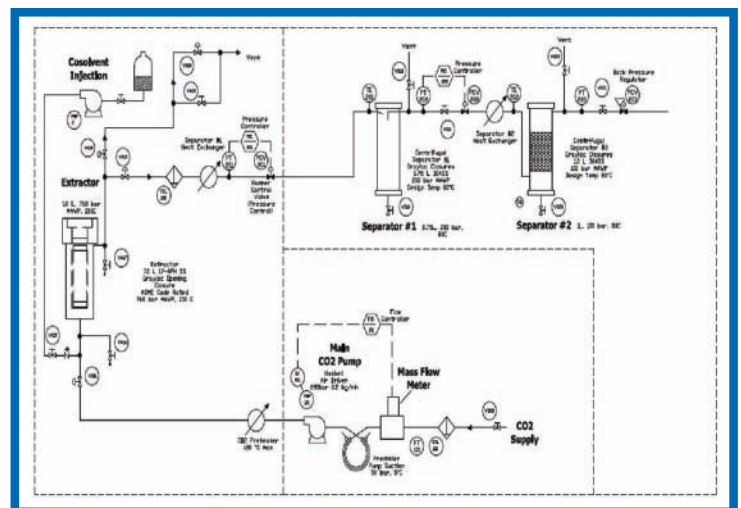
Available Options:

Dual Extractors
Dual Separators
Automated Control Valve

PLC/HMI Controls
Co-Solvent Module
Class 1 Division 2
CO₂ Recycle
Stainless Steel Frame
SCADA Controls
20 Liter Extraction Vessel
5 Liter Extraction Vessel
1 Liter Extraction Vessel
ASME or PED Code Stamps

Optional PLC/HMI Controls

Optional PLC/HMI controlled systems utilize a National Instruments cRIO programmable automation controller to regulate the pressure, flow and temperature process variables. These are the identical controls to those typically found in larger scale commercial production systems. The process conditions in this control system enable direct translation to a large scale processing system. The operator will use a touch screen operator panel to monitor process conditions, observe system status, review process histories, initiate process cycles, and enter process parameters.



SFT-NPX-10 Flow Diagram ▲

SFT-NPX-10 Natural Products Extractor Specifications

Standard Configuration

Maximum Operating Pressure: 10,000 psi (689 bar, 68.9 MPa)

Maximum Operation Temperature: Ambient to 120°C

Flow Rates: Pneumatic air-driven CO₂ pump up to 1.0 kg/min at 10,000 psi (689 bar, 68.9 MPa). Patented electro-pneumatic regulator for accurate CO₂ fluid delivery.

Extraction Vessel(s): Insulated and heated 5 L vessel, 10 L vessel in single or optional dual vessel configuration, or single 20 Liter vessel.

Restrictor Valve(s): Micrometering regulating control valve for extractor

Collection:

Separator #1 volume: 0.75 L with bolted end closure

Separator #1 1.5kW heat exchanger to change the CO₂ temperature for Separator #1

Maximum Separator #1 up to pressure 2,900 psi (200 bar, 20.0 MPa) PTFE U-Cup Seal

Maximum temperature of Operation Separator #1: 80°C

Backpressure control valve for setting pressure in Separator #1

Active regulation of temperature and pressure in Separator #1.

Flow Measurement: Coriolis Mass Flow Meter for measuring CO₂ flow

1.5 kW Electric CO₂ high-efficiency pre-heater/heat exchanger

Configuration Options

Separator #2

Automatic feedback to regulate the liquid CO₂

Separator #2 Volume: 0.75L with bolted end closures

Maximum Separator #2 pressure 2,900 psi (200 bar, 20.0 MPa)

Maximum Separator #2 temperature: 50°C

Regulation of temperature and pressure in Separator #2.

Control Options

Process controls via National Instruments cRIO controller

Process monitoring and logging of all process conditions and process state variables

Touch screen operator with 15 inch diagonal display

Automatic flow control valve

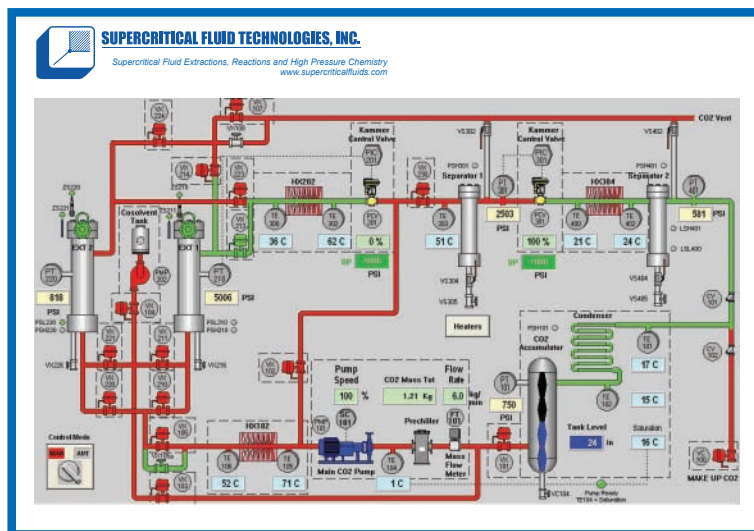
System Requirements

Power Requirements: 3 Phase, 208/240/380/400/480 VAC, 50-60Hz

CO₂ Supply: Liquid CO₂ cylinder with dip tube.

House Air: Dry air, regulated to 110 psi, 80 SCFM

The system is designed in compliance with OSHA 1910.109; NFPA NEC (National Electrical Code; NFPA 70E; ASME codes for pressure vessels, piping and high pressure systems; and Recognized and Generally Accepted Good Engineering Practice



Touch Screen Display, SFT-Pilot SFE Processing System ▲