

EXTRAKT-1 SUPER CRITICAL CO2 MACHINES

SPECIFICATIONS

General Operating Characteristics

Table 53. Table for General Operating Characteristics

ATTRIBUTE	SPECIFICATIONS
Flow Rates range (LPM)	0 to 0.6 LPM
Max Operating Pressure (psi)	5,000 psi
Operating Temperature (°C)	15 to 30°C
Eluent inlet lines	Up to 2
CO2 Solvent inlet lines	1
Sound Pressure	40 db
User Interface	Touch screen HMI panel



Process Utilities Requirements

Table 49. Table for Process Utilities Requirements

TYPE	QUALITY	CAPACITY	PRESSURE	TEMPERATURE
Compressed Air	Compressed Air Class IV 40 µm filtered, oil free, dry	0.33 Nm ³ /h	80 psi	Room
Solvent	Food grade or better 2 µm Filtered, degassed	36 mL/min max	N/A	5°C to 60°C
Carbon Dioxide, Liquid	2 µm Filtered, 850 psi, food grade or better	300-600 mL/min	850 psi inlet	20-30°C
Thermo Fluid	Clean	1 m ³ /h max	6 bar max 0,7 bar @ 1 m ³ /h	2°C to 90 °C



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Environmental Specifications

Table 50. Table for Environmental Specifications

ATTRIBUTE	SPECIFICATIONS
Operating Temperature	5 to 40°C (15 to 30°C is optimal)
Operating Humidity	20 to 80%
Transportation and Storage Temperature	-20 to 60°C
Transportation and Storage Humidity	<60%
Environment	Approved for indoor use
Altitude	Approved for use up to 2000m
Sound Pressure	45-50 db
Pollution Degree	2

Electrical Specifications

Table 51. Table for Electrical Specifications

ATTRIBUTE	SPECIFICATIONS
Models	Up to 3000 mL/min, 10,000 psi Max Pressure
Full Load Amps	46 FLA
Voltage	240 VAC
Phases	Single phase
Frequency	60 Hz
SCCR	1000 kVA
Enclosure Ingress Protection	NEMA 1, Tools required
Electrical Input Connection	Customer shall provide electrical connections according to installation specifications. Twist lock, CS6375, 50A, three pole, 4 wire, 210V
Line Voltages, nominal	Grounded AC
Protection class	Class I
Overvoltage category	II
Pollution degree	2

The size and overcurrent protection of the supply conductors to machine shall be covered by Article 670 of NFPA 70.



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Venting Specifications

Table 52. Table for Venting Specifications

ATTRIBUTE	SPECIFICATIONS
On board venting (front)	Manual damper controlled vent for direct exhaust of collection gasses
Extractor Column venting	Venturi damper controlled onboard vent for direct exhaust of extractor gasses
Venting connection	600-2000 cfm vent fan, earth grounded 2" cmp pipe
Anti-Static Piping	Conductive, Antistatic, carbon steel
Grounding	Earth ground required
Wetted Materials	Carbon Steel, Anti Static Poly Propylene
Chemical Compatibility	Gasses, polar solvents, no acids or bases

Extractor Vessels

Extractor vessels are held at a high temperature and pressure to dissolve oils from biomass. Oils that are locked in the biomass are dissolved in liquid CO₂ as they become solvated as a function of temperature and pressure.

Table 51. Table for Electrical Specifications

ATTRIBUTE	SPECIFICATIONS
Extractor Volumes	5, 10, 20 L
Extractors per System	2
Maximum Allowable Working Pressure (psi)	6800 psi
Wetted Materials	304 SS, Buna-n
Chemical Compatibility	CO ₂ , Organic Solvents, Acids and Bases, plant extracts
Temperature Control Range	25 to 100°C
Compliance	Independently P.E. Stamped according to ASME DIV II VII-2



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Collector Vessels

Extracted oils that are dissolved in the solvent are fluidically conveyed to collector vessels that are held at user defined temperatures and pressures to accomplish selective precipitation of the dissolved product.

Table 55. Table for Collector Vessel Specifications

ATTRIBUTE	SPECIFICATIONS
Collector Volumes	2.5, 5 L
Collectors per System	3
Maximum Allowable Working Pressure (psi)	8500 psi
Wetted Materials	304 SS, Buna-n
Chemical Compatibility	CO ₂ , Organic Solvents, Acids and Bases, plant extracts
Temperature Control Range	25-100°C (600 w)
Cooling	Optional Internal Cooling Coil (1500 watts)
Compliance	Independently P.E. Stamped according to ASME VIII DIV 2

Valves

Table 56. Table for Valve Specifications

ATTRIBUTE	SPECIFICATIONS
Valves	Ball valves, check valves, back pressure regulators
Construction	Stainless Steel, medium pressure fittings throughout
Compliance	ASME VII DIV II
Actuation and Automation	Pneumatic
Wetted Materials	PEEK, PTFE, 304 Stainless Steel
Chemical Compatibility	CO ₂ , Organic Solvents, Acids and Bases, plant extracts
Allowable Temperature Range	up to 100°C
Maximum Pressure	7500-10,000 psi



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Heat Exchangers

Table 57. Table for Heat Exchanger Specifications

ATTRIBUTE	SPECIFICATIONS
Tube in Tube	Tube in tube
Wetted Materials	316 Stainless Steel, medium pressure fittings throughout
Max Pressure	4000 psi at 100°C
Fluid Exchange Media	Water at 5°C or 50% glycol at -5°C
Capability	1200 W
Chemical Compatibility	CO ₂ , Organic Solvents, Acids and Bases, plant extracts
Allowable Temperature Range	-20°C to 150°C

Pumps

Table 58. Table for Pump Specifications

ATTRIBUTE	SPECIFICATIONS
CO ₂ Pump	Chilled heads, Up to 3000 mL/min, 10,000 psi Max Pressure
Cleaning Pump	Optional, up to 150 mL/min, 5000 psi Max Pressure
Process Aid Pump	Optional, up to 150 mL/min, 5000 psi Max Pressure
Co-solvent Pump	Optional, up to 150 mL/min, 5000 psi Max Pressure
Wetted Materials	Sapphire, PTFE, 316 SS
Prechiller	3500 W @ -5°C
Pre filter	40 microns, 316 SS construction, 5000 psi max pressure
Chemical Compatibility	CO ₂ , organic solvents, acids and bases, plant extracts

CO₂ Specification

Table 59. Table for CO₂ Specifications

ATTRIBUTE	SPECIFICATIONS
CO ₂ Minimum Inlet Pressure	750 psi
CO ₂ Purity	Conforming to CFR, EIGA, CGA regulations for food grade 99% Pure CO ₂
CO ₂ Bottle Source	Dip tube required, 60L CGA 320
Cylinder Bundles	Available for up to 16-60L 320 CGA cylinders that are pre plumbed for convenience.
6 Ton Bulk Storage	Available with recirculation pump for GMP installations



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Temperature Control Modules

Table 60. Table for Temperature Control Module Specifications

ATTRIBUTE	SPECIFICATIONS
Pre Heater	Max Temp, 140°C, K type thermocouple, PID Control Algorithm, Wetted Materials: 316 SS, 10000 PSI MWAP, NEMA 1 Enclosure, Direct wire Max pressure: 10,000 PSI
Vessel Heaters	316 Stainless Steel, medium Max Temp, 100°C, K type thermocouple, PID Control Algorithm, insulated blanket heaters pressure fittings throughout
Collector Heaters	Max Temp, 100°C, K type thermocouple, PID Control Algorithm, insulated blanket heaters
Post Heater	Max Temp, 140°C, K type thermocouple, PID Control Algorithm, Wetted Materials: 316 SS, 10000 PSI MWAP, NEMA 1 Enclosure, Direct wire Max pressure: 10,000 PSI
Zones	Up to 16 zones, independent control

Insulation

Table 61. Table for Insulation Specifications

ATTRIBUTE	SPECIFICATIONS
Fire Rating	Certificate, 200°C max
Materials	3170 Grey Silicone Cloth
R Value	5 Gage Insulation, 10

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Safety

Table 62. Table for Safety Specifications

ATTRIBUTE	SPECIFICATIONS
Rupture Discs	Zook burst discs, calibrated, ASME VIII Div II compliant, Max Pressure is 6850 psi, Certificate Attached to Disc
Temperature Switch	Preheater, Post heater MAX TEMP 140 pC, Certificate Available Collector, Extractors MAX TEMP 100°C, Certificate Available
E-stop Switch	Switch disengages main contactor
CO ₂ Gas Detector	Built in alarm, turns off pump and closes valves at 9000 ppm, Certificate Available
Interlocks	Marked with safety warnings
Pressure Transducers	Post pump, Extractor, Collector 1,3; Turns off pump when overpressure (>5800 psi) condition is detected.
Isolation Valves	Manual

Containment System

Table 63. Table for Containment System Specifications

ATTRIBUTE	SPECIFICATIONS
Max Pressure	MAWP 300 psi
Poppet Valve	200 psi max
Back Pressure Regulator	200 psi max
Wetted Materials	Buna-N, 316 SS
Surface Finish	16 micro in or better
Temperature Range	-50°C to 100°C
Flexible connection hose	3000 psi max pressure
Seal Material	Buna-n

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Recycler

Table 64. Table for Recycler Specifications

ATTRIBUTE	SPECIFICATIONS
Max Pressure	1000 psi, MAWP, CRN Number Available
Rupture Disc	1000 psi, Certificate
Filter Elements	200 micron 100 micron
Heat Exchanger	2400 W
External Chiller	3500 W, Certificate
Wetted Materials	Buna-N, 316 SS
Temperature Range	-50°C to 100°C
Flexible connection hose	3000 psi max pressure
Seal Material	Buna-n

Customer Interface

Table 65. Table for Customer Interface

ITEM	DESCRIPTION	VISUAL
CO ₂ Feed	1/8" compression fitting type Swagelok® Follow WI-006 and manufacturer's documentation for making and breaking connections.	
Compressed Gas	ColorConnex Push-To-Connect female Green Coupler, ARO Type B 1/4 in. FNPT	
Ventilation Interface	Customer shall provide a vent fan that will provide a minimum of 1000 CFM and vent fan conduit that is antistatic and can interface with a 2" EMT Pipe as per the requirements listed in the installation section.	
Electrical Interface	Customer shall provide electrical connections according to installation specifications. Twist lock, CS6375, 50A, three pole, 4 wire, 250V	

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Other Characteristics

Table 66. Table for Other Characteristics

ATTRIBUTE	SPECIFICATIONS
Tubing internal roughness	< 0.8 μm Ra (32 $\mu\text{-inches}$ Ra)
Valves internal roughness	< 2.4 μm Ra (94 $\mu\text{-inches}$ Ra)
Material wetted parts	Stainless Steel 316, Stainless Steel 304, Quartz, PTFE, PFA, PEEK, Urethane
Frame	Aluminum, anodized Bonded joints
Electrical cabinet	Painted Steel
Electrical design	Designed for general purpose area
Air Quality	Class 1V or better

Automation

Architecture of the Control

Table 67. Table for Architecture of the Control

ARCHITECTURE OF THE CONTROL	
ATTRIBUTE	SPECIFICATIONS
Operator Interface	A touch screen graphical user interface is used for the operator interface and historical data logging through the automation software. This automation software provides automated and safe operation of the solvent pumping module.
PLC Controller	A Programmable Logic Controller (Click PLC from Koyo) ensures real-time operation, high availability (reliability) and a high degree of safety. The communication between the PLC and the operator interface is based on Ethernet protocol.
Electrical cabinet	It is a box which contains all controls and electrical components necessary for proper operation of the system (power supplies, fuses, PLC I/O cards, PLC controller).
Telemetry Option	Remote monitoring and datalogging software allows remote troubleshooting, service, software and firmware updates.

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Description of the Software

Table 68. Table for Description of the Software

DESCRIPTION OF THE SOFTWARE	
ATTRIBUTE	SPECIFICATIONS
User Access	The User Access Module is used to define access rights of the users for the protection of the system. The password and Username strategy are managed by the operating system.
Datalogging Module	The Datalogging Module is used for logging and viewing the data acquired during the system operation.
Graphics	It allows to trend relevant process parameters such as CO ₂ signals, flowrate, pressure drop, temperature, etc. It also allows the user to compare data from various cycles within a run.
Method Editor	The Recipe Editor module is used to create easily and quickly the base parameters of the method (Recipe Identification, Recipe Duration, Valve Configuration).
Manual Mode	The Manual Module is typically used for the priming and testing.
Sequence Mode	The Sequence Mode runs extraction in an attended mode as defined in the Method. Methods may be linked. For example, the user can run five cycles of a given separation method and then run one cycle of a regeneration method and then run again five cycles of the separation method.
Alarms	The alarm data and event data are stored as an event in the batch record. This data can be recalled from batch management module.
Reserved Parameters	This module has restricted user access. It contains all critical parameters, which could affect safety, validation or operation of the unit.

Automation Interface

Table 69. Table for Automation Interface

ACTION	TYPE
Pump Power off and process stop	Digital input dry contact (DI)
Full functional remote access	Ethernet, WIFI, Customer Computer
Status of the (RUN or STOP)	Status of the (RUN or STOP)

Weight & Dimensions

Table 70. Table for Weight and Dimensions

WEIGHT	DIMENSIONS
1500 lbs	35 in x 72 in x 89 in