SuperC
SuperCritical CO2 Extraction System

⚠WARNING:

For your own safety, never operate unit until all assembly steps are complete and until you have read and understood the entire operator's manual.

Safety Instructions

This manual contains information that you should know and understand. Understanding this information is for your SAFETY and to PREVENT EQUIPMENT PROBLEMS. To help recognize this information, observe the following symbols.

Safety Signal Words

! DANGER indicates an imminently hazardous situation which, if not avoided, WILL result in death or serious injury.

**! WARNING indicates a potentially hazardous situation, which if not avoided,
COULD result in death or serious injury.**

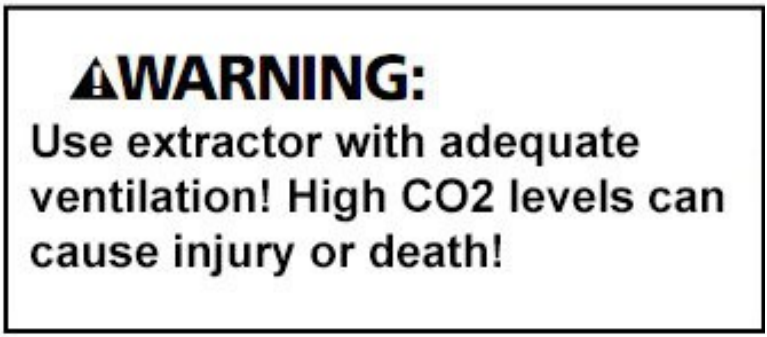
**! CAUTION indicates a potentially hazardous situation, which if not avoided,
MAY result in minor or moderate injury.**

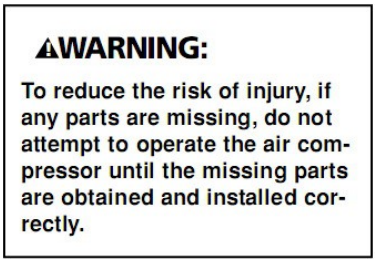
NOTICE indicates important information, which if not followed, may cause damage to equipment.

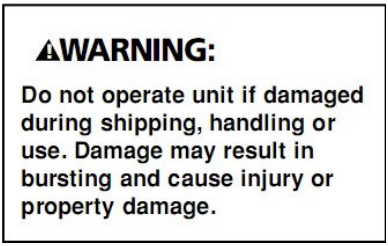
NOTICE:
! CAUTION:
! WARNING:
! DANGER:

Intended Use

This extractor is designed to extract oil from plant material using only CO2 gas. It requires a CO2 bulk tank feed at approximately 850 psi to the input on top of the unit.







First Time Setup Quick Start

The SuperC as shipped does not have the CO2 feed line installed.

1: Find the fill line provided in the Styrofoam box and screw it into the threaded hole in the top of the SuperC. There is Teflon sealing tape pre-installed on the hose fitting. Use a wrench to fully tighten.

2. Make sure unit is unplugged and remove front cover by unscrewing the four side bolts.

3. Lubricate the pistons by dabbing a few drops of the oil you intend to extract on the piston shafts using a brush. If source oil is not available use appropriate vegetable oil for lubrication.

4: Reinstall front cover before use.

5. Find the extractor body with the aluminum knob on top. Lightly lubricate the o-rings. Install the extractor body in the square air block on the top of the unit. The steel pin forces proper alignment.

6. Rest the chamber tube in the heater cradle and screw all the way onto the extractor body. The chamber should already have the end cap screwed in.

7. Use the quick disconnect fitting to attach feed hose to the far end of the chamber tube.

8. Slide the silicone hose on the end of the brass fitting under the extractor body.

9. Place end of silicone hose in the flask provided.

10. Close the vent knob on top of the unit.

11. Open CO2 tank valve.

Unit is ready to start.

Running the SuperC

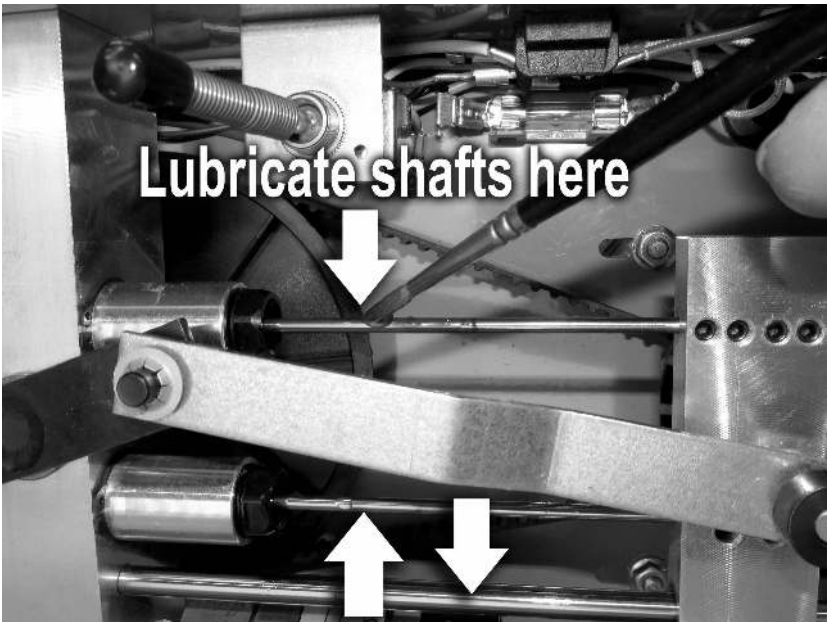
Plug in the SuperC to an electrical outlet supplying 110 volts AC and push the black switch **all the way to the right** to start extractor. The switch arm will spring back to center. It is only designed for momentary contact to the right to start the extractor. This is much like a car ignition switch. The switch arm is on the spring and will feel compliant to the touch.

The SuperC will start running. If air is leaking out the vial vent, tighten the bleed valve knob on top of the unit. Monitor pressure build-up on the gauge. The SuperC has an electronic shut off pressure switch set to 4500 psi. See adjustment section to adjust shut off pressure.

The pressure will build up to the desired psi. When the proper pressure has been achieved, open the vent knob SLOWLY to start venting off CO2 into the vial. Adjust the vent rate so the pressure holds at the desired psi. This will require periodic adjustment during the run and should be closely monitored.

Lubrication

Follow the warnings in this manual and on the SuperC to unplug all air lines and power from the unit before removing front cover. The four screws on the sides hold the cover in place. Your SuperC uses oil impregnated bushings which should not need lubrication.



To lubricate both air pistons use **the oil you intend to extract for lubrication or equivalent vegetable oil**. Disassembly of the pistons is not required. Simply put a dab of oil on the exposed piston shafts as shown in the picture using a brush or swab. Once the unit is turned on, the oil will get pulled into the cylinder as the piston moves in and out. See our website videos on the Support page at OCOlabs.com

AC Motor

The Dayton AC motor is 1/2 horsepower and runs off standard 110 volt household current. It should be plugged into a grounded 20 amp receptacle. The motor has built-in overload protection and will shut off

⚠WARNING:

If not properly grounded, this tool can cause an electrical shock, particularly when used in damp locations, in proximity of plumbing, or out of doors.

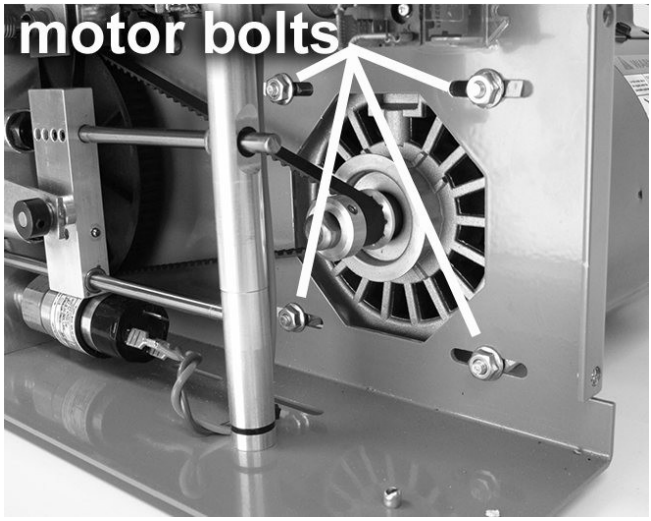
⚠WARNING:

The motor must be allowed to cool down before start-up is possible. The motor will automatically restart without warning if left plugged into electrical outlet, and the motor is turned on. Do not leave motor plugged in during cool down

if overheated. The motor will start automatically when cooled off, so be sure to unplug unit if overheating occurs.

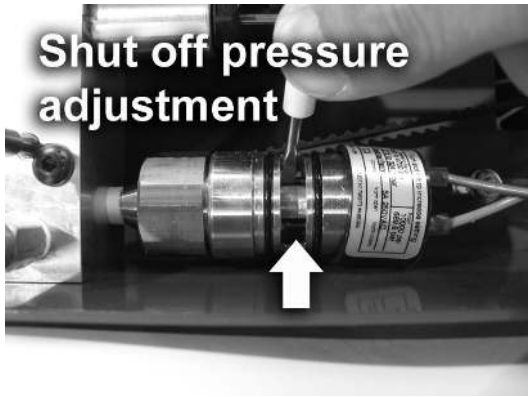
Belt Tension Adjustment

The SuperC comes with a quiet cog belt drive. Loosen the motor bolt screws and slide the motor to tension the belt. The belt should be tight enough to 'twang'. More tension is better than not enough.



⚠WARNING:
Release all pressure and disconnect power before making any repair or adjustment.

Shut Off Pressure Adjustment



The electronic pressure switch in the SuperC has an adjustable shut off between 300- 4500 psi. To adjust the shut off, slide the plastic collar back over the wires to expose the brass adjustment tube inside the switch. Use a small flat blade screw driver in the slots to turn the brass piece. Rotate the screw driver up to increase pressure; down (counterclockwise) to decrease pressure. Return the plastic collar over the opening before starting.

Burst Disk Overload Protection

The SuperC is equipped with a burst disk that can be found behind the main air block. If the pressure exceeds aproximately 7500 psi, the copper seal in this device will blow out and vent the system. This burst disk is industry standard and must be replaced after a venting incident. Use the same pressure rated burst disk for replacement. Replacements are available from our webstore: OCOlabs.com under the ‘Order’ tab and then under ‘Spare Parts’.

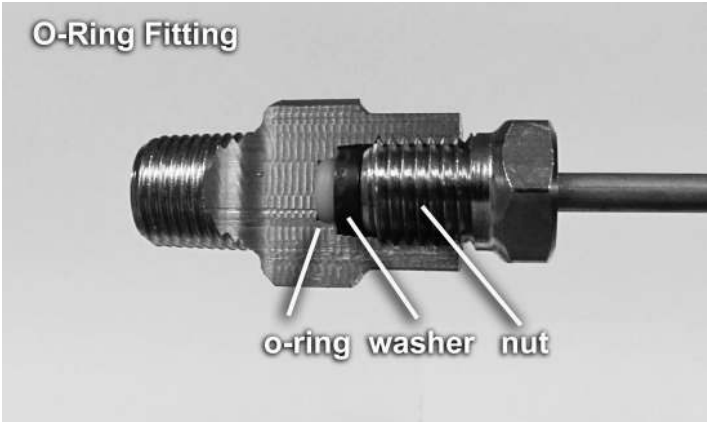
O-Rings and Back Check Valves

There are only 7 o-rings which are active seals in the extractor. These o-rings are accessed by removing the cylinders. These o-rings should only be replaced after watching the rebuild videos on the website at OCOlabs.com.

⚠WARNING:
Burst disk must be replaced with unit pressure rated to the same specification as the one removed.

O-Ring Air Line Fittings

A nice feature on the SuperC is our own custom o-ring fittings on the air lines. They are made to be user serviceable by replacing the o-rings if they start to leak. There is a permanent ferrule clamped on the air line. Next comes a black steel washer that is removable. Do not leave it off. Next is the white urethane o-ring which is the same one used for the lower piston. The nut does not contribute to the sealing so do not over tighten.



⚠WARNING:

Do not spray flammable materials in vicinity of open flame or near ignition sources including the compressor unit.

⚠WARNING:

For your own safety do not try and run the air compressor while troubleshooting.

Heat Buildup

Under normal running conditions the parts inside the SuperC can reach temperatures in excess of 150 degrees Fahrenheit. Handling these parts immediately after shutdown can cause severe burns. Never spray the SuperC with any flammable material or solvents. Always use the SuperC in an area with adequate ventilation.

How to Maintain the SuperC

Lubrication

The SuperC Extractor requires manual lubrication before every extraction cycle. To do this you simply remove the front cover and dab a spot of oil on the pistons with a brush. See Lubrication elsewhere in this manual.

Rebuild Cylinders

After about 70 to 100 hours of run time the o-rings will likely need replacing. A spare set of o-rings is provided with the unit and maintenance kits with o-rings are available in our online store. The SuperC is made to be user serviceable. Removing the snap rings and air lines from the cylinders allows them to slide out. Once the nut holding the spacers and o-rings are removed, the o-rings can be replaced and the unit reassembled. The SuperC can be rebuilt many,

many times. See our How To videos which walk you through the whole process.

Warranty

There is a 90-day parts and labor warranty to the original purchaser from date of purchase. The customer is required to contact us for an RMA before sending the unit back to us at their expense. We will repair or replace the defective parts and ship the unit back. Technical Support is handled online at OCOlabs.com under the SuperC forum. Most questions are answered the same day.

The warranty applies only to the original purchaser at retail and may not be transferred.

OCOlabs, Inc. MAKES NO WARRANTIES, REPRESENTATIONS OR PROMISES AS TO THE QUALITY OR PERFORMANCE OF ITS CO2 EXTRACTORS OTHER THAN THOSE SPECIFICALLY STATED. OCOlabs, Inc. MAKES NO WARRANTIES OR REPRESENTATIONS, EXPRESS OR IMPLIED, INCLUDING AS NOTED BELOW.

ADDITIONAL LIMITATIONS

To the extent permitted by applicable law, all implied warranties, including warranties of MERCHANTABILITY or FITNESS FOR A PARTICULAR PURPOSE, are disclaimed. Any implied warranties, including warranties of merchantability or fitness for a particular purpose, that cannot be disclaimed under state law are limited to three years from the date of purchase. OCOlabs Inc. is not responsible for direct, indirect, incidental, special or consequential damages. Some states do not allow limitations on how long an implied warranty lasts and/or do not allow the exclusion or limitation of incidental or consequential damages, so the above limitations may not apply to you. This warranty gives you specific legal rights, and you may also have other rights, which vary from state to state.

Part II: The Extraction Process

⚠WARNING:
Use extractor with adequate ventilation! High CO_2 levels can cause injury or death!

Introduction

CO_2 at temperatures and pressures above 90F and 1000 psi enters a supercritical state. While in this state it has several novel characteristics. It is denser than water, but floats like air. It also becomes a solvent that can dissolve many different oils. The dissolved oil becomes part of the supercritical fluid. When the temperature and pressure falls below the critical value, the CO_2 thereby leaving supercritical state, cause the oil to precipitate out of the gaseous CO_2.

The main factors influencing extraction with CO_2 are heat and pressure. Pressure is the most significant factor. For any individual type of oil, there is an ideal range of pressure and temperature. Departing from the ideal will reduce extraction percentage and increase extraction times. It is typical to expect about 2/3rds the extraction percentages over other solvents like hexane. Hexane and similar solvents are much broader based in their ability to dissolve extraneous components like waxes and chlorophyll, accounting for the remaining 1/3.

Note that there is a characteristic “dead zone” around 2000 psi which should be avoided for best results.

CO2 Tank

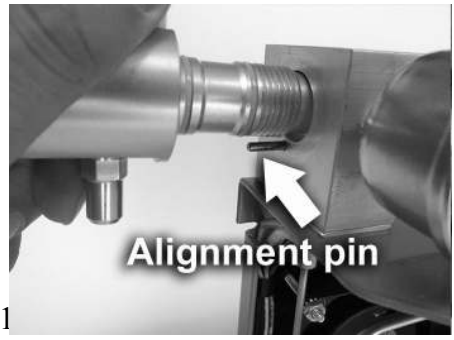
The SuperC requires a CO2 feed at approximately 800 psi. This can be obtained from a standard food grade CO2 tank at room temperature. The system will use approximately a pound of CO2 per hour so the right size tank for your expected use should be purchased. Using the supplied hose, screw one end tightly into the port on the top of the SuperC. The other end has the brass nut to fix on the tank. Check for leaks using ONLY soapy water.

Chamber Assembly

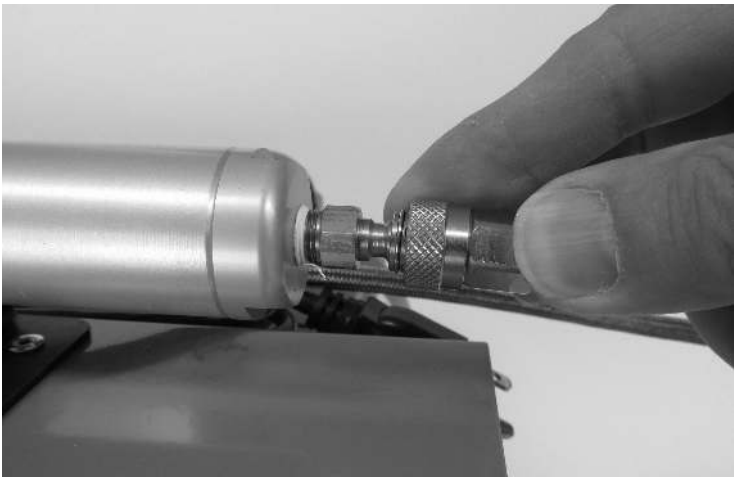
There are three major components to the extractor chamber: the extractor body (shown below); the extraction chamber itself, which is the long tube; and the end cap. These three parts are easily removable and should be kept clean with soap and water. Supercritical CO2 will dissolve all lubricating oils, so the extractor is shipped dry. The end user should use lubricating oil on all the o-rings that are compatible with the final product since some will end up in the final product. Most users will opt to use the same oil they are trying to extract for lubrication.

Apply a light coat of lubricating oil to the o-rings on the extractor body and the end cap. Slide the extractor body into the mounting block on the top of the housing. Take care to mate the alignment pin in the hole on the extractor body. Once fully seated, the alignment pin locks the regulator seat assembly in place so the user should not attempt to unscrew it while on the machine.

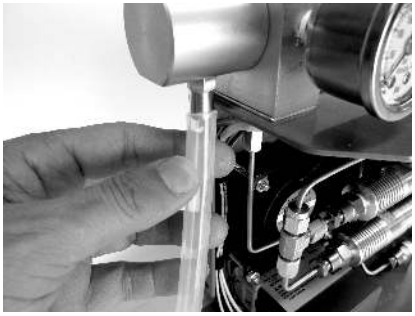
Once the extractor body is fully assembled, screw the end cap into one end of the chamber tube. Next slide the chamber tube through the black safety ring in along the heater bar and screw it all the way onto the threads of the extractor body.

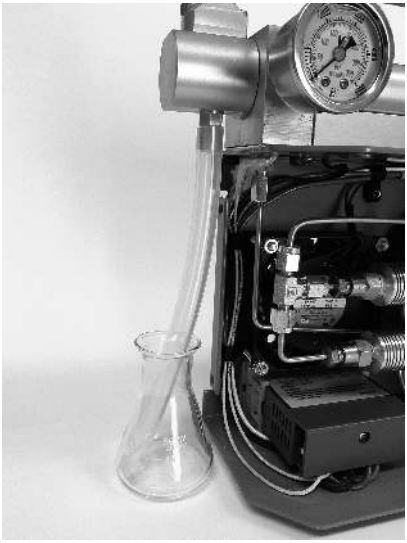


Attach the high pressure hose to the fitting on the end cap. Make sure the locking ring is seated all the way before use. Screw the knob on top of the extractor body clockwise until snug to seal up the vent.



Catch Vial Setup





Once you have installed the extraction chamber, slide the silicone hose on the end as shown in picture.

Next place the open end of the hose in the supplied flask on the table as shown. For testing, place a small amount of water covering up the end of the hose in the flask. You will see bubbles in the flask if the vent is not shut off.

Lubrication

The piston o-rings in the compressor must be lubricated before each use. Unplug the unit from the wall, disconnect the hose from the CO2 tank and unscrew the vent knob on top of the extractor body. Make sure there is no pressure left anywhere in the system. Only then is it safe to remove the front cover. Use a cotton swab or brush to dab lubricating oil on the piston rods while they are all the way out of the cylinders. See picture in Part I. The crankshaft can be rotated by hand if the pistons are not in the right position. Replace the front cover before running the unit. Failure to properly lubricate the pistons before each extraction will severely limit o-ring life!

Start Up

To start your SuperC make sure all hoses are properly attached and sealed. Turn the knob on top of the extractor body clockwise to turn off the vent valve. Turn on the CO2 tank valve and CO2 should flow into the feed hose. If your pistons are all the way out from doing the lubrication, CO2 will flow into your chamber and the pressure can be read on the gauge. If CO2 is entering the chamber it should build up to about 800 psi before you turn on the unit. If bubbles are coming out the end of the hose in the flask further tighten the vent knob.

Push the power switch to the center and you will hear the cooling fan come on and the heater will start warming the chamber. Let the chamber heat soak for about 15-20 minutes before starting any extractions. To start the compressor you must push the switch ALL THE WAY TO THE RIGHT. It will then spring back to center just like starting a car. Your chamber should now start slowly building pressure.

Setting the Temperature Controller

The temperature controller is on the back of the unit. The temperature is displayed in Celsius. It comes factory preset to 65C which is about 150 Fahrenheit. The controller temperature must be set higher than the target chamber temperature due to heat loss from the heater bar to the chamber. The factory setting of 65C will heat the chamber to approximately 110-115F which is a good starting point for most extractions. Do not run the heater without the chamber in place.

Doing so exposes the hot heater element which can and will burn you if you touch it.

To adjust the temperature set point:

1. Push and hold the ‘S’ button. The display will change to ‘F1’
2. Continue to hold the ‘S’ button and press the up arrow. The display will change to the set temperature.
3. Push the up or down arrow to set the desired temperature. Release the ‘S’ button.
4. Quickly push the on/off button once to lock in the set temperature.
5. Check the set temperature by pushing the up arrow once.

Coming Up to Pressure

As the chamber fills, you will notice a steady climb in pressure until around 1000 psi when it will appear to stop filling. This is normal. The CO2 is entering a liquid phase and not building pressure. After several minutes the pressure will start climbing again and you will be moving into the supercritical range. Depending on the target oil, you will want to run the system somewhere between 1000 and 3500 psi.

YOU MUST WATCH THE GAUGE as the pressure climbs and as it gets near your target pressure. You must manually crack open the vent valve and start to release CO2. If this is a test run, you will now see CO2 bubbling out the end of the hose in the flask. The rate of pressure increase will slow down or start dropping if you open the vent valve too far. Manually adjust the vent valve until you reach the right pressure and are venting enough CO2 to hold steady at that pressure. Depending on your conditions and source material the air may not vent from the chamber smoothly.

Collecting the Extract

Now that the system is venting properly and holding pressure it will start extracting oil from the material in the chamber. The oil-laden CO2 will vent out the silicone hose and accumulate in the flask. CO2 ice crystals will often build up in the flask which is okay. The ice holds the oil and will eventually melt, releasing the oil into the bottom of the flask. If the flask becomes too full of ice, shut down the unit and wait for the ice to melt. Additional flasks can be swapped out during the run and are available from OCO Labs. CO2 will not vent smoothly and you will hear the unit cough as oil and ice pass through the vent valve.

⚠WARNING:
CO_2 ice can cause frostbite in seconds. Do NOT handle CO_2 ice without proper protection

Extractions typically run for 45-100 minutes. The majority of the oil comes out early and tapers off later in the run. The user must experiment with pressure, heat and run time to optimize their extraction percentage. Under all circumstances less material is extracted using CO_2 than other methods. This is due to the targeting effect of the CO_2 for particular oils, and CO_2 does not extract waxes and chlorophylls that contribute dead weight to other extraction methods.

Shut Down

Once the end of the run has been reached, first shut off the CO_2 tank valve while the compressor is running. This will drain the pressure from the hose. At the same time you can continue to allow the vent valve to drain the chamber and reduce the pressure. As the pressure comes down you can open the vent valve further to facilitate fully depressurizing the chamber. Once the chamber is empty, shut off the compressor and remove the hose from the end cap to verify that there is no pressure left. If the hose does not want to come off there is still pressure in the system. Never unscrew the chamber or end cap unless the hose has been removed first. If there is excessive force to unscrew the chamber or end cap there is still pressure in the system. MAKE SURE ALL PRESSURE IS DRAINED FROM THE SYSTEM BEFORE DISASSEMBLY.

If your extraction was successful, you should have oil collected in the bottom of the flask. Remove the silicone hose, and squeeze out any remaining oil in the hose. Make sure to laboratory test all extractions for suitability before use.

Chamber Packing

Packing the chamber with material is an art in itself. If the material is packed too tightly, the CO2 will not be able to reach it and you will get low extraction percentage. If packed too loosely the CO2 will not 'touch' the material and will pass through the larger channels directly to the vent. Plant cells are sealed structures that the CO2 has to diffuse into and back out of. This adds time to the extraction process. Grinding of dried material is recommended. The size of the ground particles is important. The smaller they are the more plant cells are cracked open allowing easy access for the CO2. If they are too small they will pack too tightly and not see the CO2. In general, particles that would fall through a window screen are approximately the right size. Experiment with different particle sizes and packing densities for best results.

To properly pack the chamber screw the end cap into one end of the empty chamber. Add material to the open end and use a rod to tamp down the material every few inches. You will have to experiment with how hard to pack your particular material. Add material until you are up to ***but not over*** the threads. Now unscrew the end cap and screw it in the opposite end. The open end now screws onto the chamber. Using this method the material is already up against the extractor end when the chamber comes up to pressure.

Oil and plant materials baked in a chamber tend to stick inside the tube. Over packing the material will lead to hardened lumps inside the chamber which must be worked out with a probe. Clean your chamber, end cap and threads after every use to ensure continued sealing of your o-rings.

Cleaning

Keep your parts CLEAN! Oil residues interfere with mating parts, clog air passages and create o-ring leaks. There is a filter at the end of the chamber to prevent particles from entering into the vent mechanism. This filter should be removed and cleaned periodically so it flows air easily.

⚠WARNING:
A clogged filter will shatter from excessive pressure if not cleaned regularly

The chamber and extractor body can be cleaned with soapy water by hand or in a dishwasher. Do NOT use a wire brush in the chamber as it will scrape aluminum off the walls. Use a nylon brush or paper towel plug pressed through the tube.

Leaks

If your chamber will not fill past 800 psi, turn off the compressor and CO2 tank valve. Watch the gauge over 5-10 minutes and see if the pressure drops. If it does, you have a leak. Check that the vent valve is tightly sealed by holding the end of the silicone tube under water. If that is sealed then there is a leak in the system somewhere.

⚠WARNING:
Use only soapy water to find leaks!

Using any type of ammonia product will eat into the aluminum. Ammonia is like acid to aluminum and can weaken pressure vessels causing deadly explosions.

Hints

Terpenes which contain most of the flavor and aroma are best extracted around 1500 psi with chamber temperatures from 110 to 120 degrees Fahrenheit. There is a dead zone around 2000 psi which should be avoided. Working at this pressure will severely reduce the

extraction percentage of all oils. 2500-2800 psi and 130F is a good start for the heavier oils.

Obtaining maximum percentages may require running the same batch at a series of temperatures and pressures. Measuring the outside of the chamber with a non-contact temperature probe is highly recommended.

For maximum yield after the first run, unscrew and reverse the chamber so the CO2 flows through in the opposite direction. This will expose the material that was 'hidden' in the chamber to fresh CO2.

The user should understand that this instrument requires research and knowledge to find the best combinations of pressure, temperature, and extraction time for any given plant material. Keeping careful records of the source material starting weight and extraction weight will allow dialing in on the most efficient settings. The scientific literature under "supercritical CO2" has journal articles showing extraction results and most efficient parameters for virtually every commercial plant species.