



Manual Centrifuges - Installation and Operation

Please read before installation or first time usage

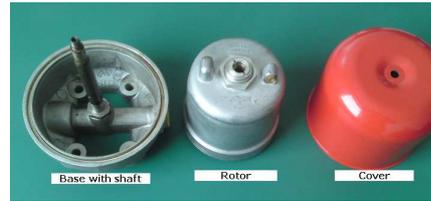
Content:

Introduction – Safety Aspects – Common Problems Troubleshooting – Schematic of installation– Centrifuge construction details – Installation of pressure regulation– Cleaning of Rotor – Cleaning of waste vegetable oils – Simple analysis of water content in waste vegetable oil – Summary safety aspects



Some Basics – Introduction

**PLEASE ALSO READ SAFETY ASPECTS
ON LAST PAGE!!!**



Particles

A Centrifuge will remove heavier-than-oil particles with the so called G-force sending them to the rotor wall, but it will find it more difficult to separate any particles if the main body of oil is heavily contaminated with material of the same specific gravity, in this case the oil will require more than one pass, or for the oil to be filtered to a better standard before pumping into the centrifuge, the cleaner the main body of oil is, or gets, the faster the rate of separation will be. The INVERT 50 centrifuge has one of the highest G-forces in the market! It turns up to 9000 rpms at 7bar (100 PSI); the nozzles are "inverted" at the top of the rotor contrary to most other centrifuges having the nozzles at the bottom.

ADVANTAGE: higher capacity of dirt accumulation in rotor, better water retention in rotor even when shutting down the centrifuge and no particle recirculation into tank with cleaned oil

Liquids

A centrifuge will remove heavier-than-oil liquids by the same means as it removes particles, but it will not remove "miscible" liquids, for example liquids that have the same "Specific Gravity" as the oil, or contaminants that are bonded to the oil molecules chemically. It is worth noting particularly with liquids that the maximum capacity of the centrifuge rotor cap (where dirt is held) is approximately 500 Grams, if you pump a lot of water, glycerol, or animal fat through the centrifuge then it will become full very quickly and this will prevent further separation

Safety Aspects:

In principle we have to distinguish between 2 operation levels:

1. With personnel being present
2. Without personnel being present

In the latter case we recommend a higher safety level i.e. with pressure safety valves and a sensor for sudden pressure drop installed

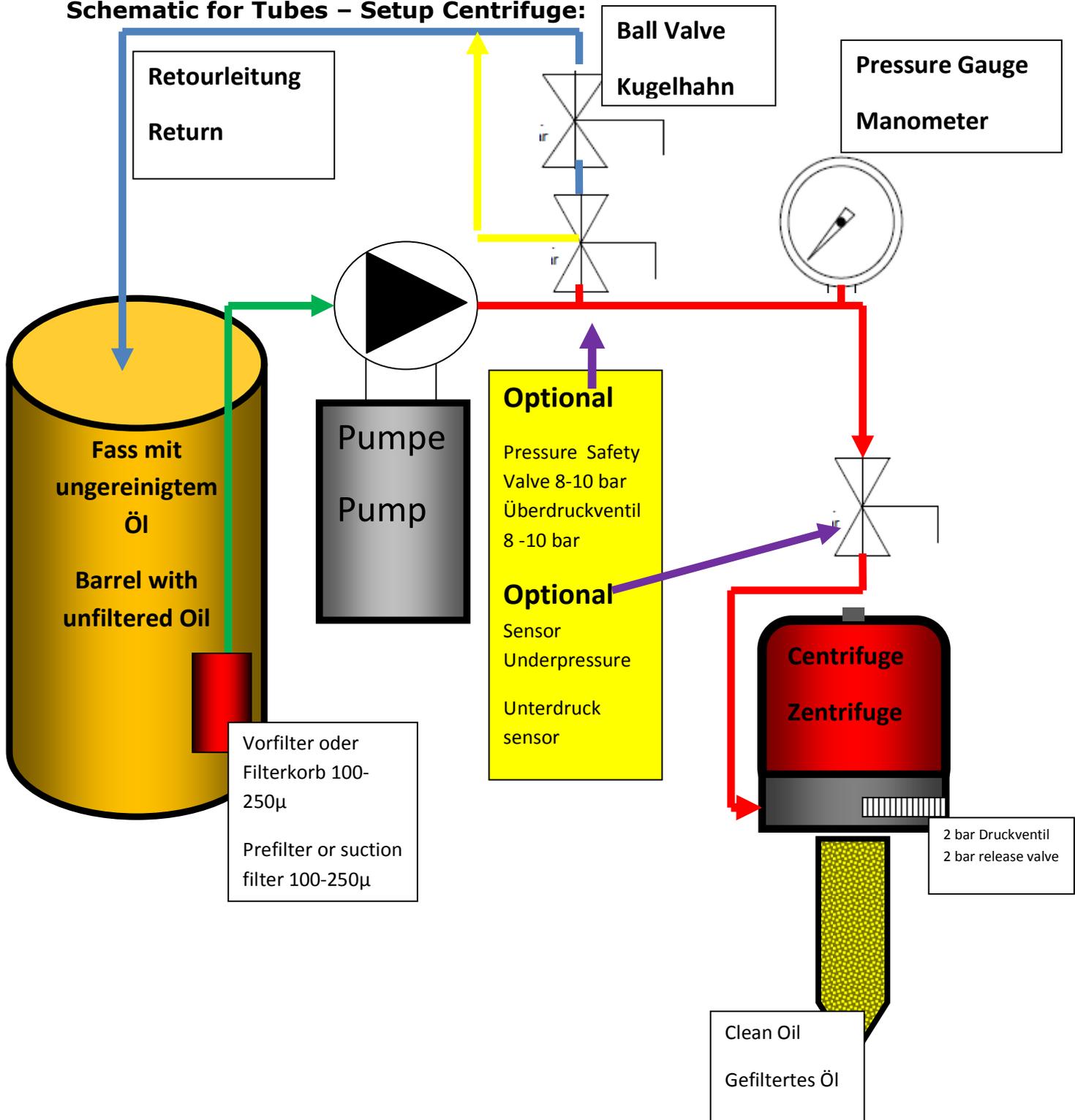
The most common mistakes not to be made!

Too much air	The bubbles in the oil stop the rotor from turning properly
Excess Animal Fat or Water when filtering WVO (Waste Veg.Oil)	The rotor will be full too soon and make the centrifuge stop working
Excess in large particles	If you do not pre filter the oil to 250 μ , your pump will suffer, the nozzles will get clogged and the centrifuge stops
Oil is too cold	If you do not heat the oil to appr. 40-50°C the separation forces are not sufficient - insufficient filtration
Oil is too warm	No problem per se for the centrifuge however a problem for your pump that may overheat and the thermal cut out may interrupt the current - wait for appr. 30 minutes and restart
Too much pressure (Max.7 bar 100 PSI = 9000 rpm)	Do not use more than 7 Bar (100 PSI) this will destroy the gaskets in the rotor and the centrifuge leaks

Troubleshooting:

Pressure increases above 7 bar after setting and some time of operation	The rotor and or the nozzles are clogged, immediate cleaning, danger of burst pipes-tubes due to over pressure
Rotor does not rotate - Nozzles blocked	unscrew nozzles from the top of the rotor and clean them with diesel
Rotor does not rotate after cleaning nozzles Entry valve is blocked which normally opens at 2 bar(100 PSI)	disassemble carefully all the components (spring, washer, piston, sealing ring) clean with pressurized air and reassemble
Rotor only rotates at low speed Insufficient pressure, leaking of seals in the rotor housing, rotor too full with dirt.	Readjust pressure of pump observe pressure gauge, tighten rotor housing better, replace seals, if bushes damaged replace rotor, clean rotor
Vibration our strange sound Rotor cap not correctly seated or top nut loose Arrow Marks (if present) are not Aligned Rotor Shaft excessively worn Rotor Bushes worn	STOP CENTRIFUGE IMMEDIATELY DANGER OF DAMAGES Retighten rotor cap, retighten nuts, rearrange correctly the arrow marks, replace rotor shaft, replace rotor
No dirt collection in rotor rotor not turning at sufficient speed	See above points for solution

Schematic for Tubes – Setup Centrifuge:





The construction of the centrifuge



Entry valve shaft
(opens at 2 bar)

nozzles seals

rotor

Pump(1st barrel)
Centrifuge (2nd barrel)

IMPORTANT: Mounting of Pressure Regulation :



By opening and closing the ball valve(yellow or red lever in illustrations) the return to the container(barrel) will take more or less flow - as a results the pressure entering the centrifuge can gradually be adjusted to a Maximum of 7 bar, the rotor starts to turn at appr.2 bar **Please also read last pages for safety**

Mounting on the centrifuge or on the pump:



Cleaning of Rotor



Opened rotor for cleaning



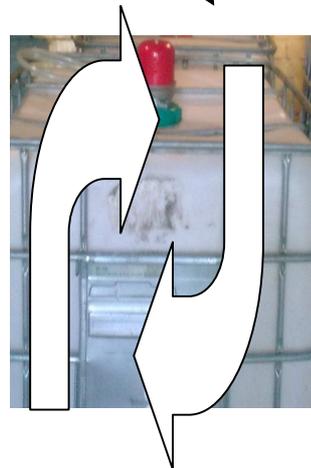
Observe match of arrow marks for reassembly!!!!!!!!!!!!

How to purify oil:



1. Pour the oil into a preferably conical HDPE tank (reactor tank) in a room at 20°C (do not heat the tank as this causes convection and mixing currents) allow the oil to settle over a few days. You may also use other tanks with a flat bottom. Use either a filter bag 200 μ or a rough 500 μ sieve – in the second case you can use a suction filter
2. Via a tap in the bottom of the (conical) tank, drain off all settled waste solids and liquids and discard them completely

3. Filter it through a 200 micron washable filter bag or similar filter at the same time you pour-pump the oil into a second tank or use a suction filter see illustration below
4. Heat the oil in a separate tank-barrel (50-200ltr), to 45°C Celcius or above (we use a 200l metal drum with a band heater).
5. Pump oil into the centrifuge, remember that during the start-up and shut down period, the centrifuge may pass unfiltered waste oil. Ensure the oil going in is free of air bubbles, and the centrifuge can drain freely from the bottom, maintain 7 bar (100PSI) pressure throughout the operation, leave centrifuge to circulate the oil for as long as it takes to gain the purity you desire
6. Pump the oil from one barrel to another – or let it circulate through the centrifuge using only one barrel for several passes.



Usage of a 250 μ suction filter to protect pump and nozzles in centrifuge



Water in WVO: The Invert 50 Centrifuge is a very effective tool to remove water from WVO after the initial separation by decanting – (water is removed from the bottom of the container), even if only the top section of WVO is taken there can be some water left in the WVO.

The PAN TEST:

A quick, unscientific and non-quantitative test to check for the presence of water in WVO.

False positives can be obtained if the pan is too hot or if solvents are mixed in the WVO. False negative results are possible if the sample contains suspended water that has high concentrations of salt/sugar/acids.

Procedure

Smear WVO across a COLD frying pan (cast iron preferred) as a temp check with your finger. Heat the pan on high temp until the smear begins to really smoke then pour in the sample WVO, how much? Enough for appr. 10 mmm (1/4"-3/8") thickness covering the bottom

Do not pour in a sample with any visible water. If water droplets are visible no testing is needed, there is water present in your sample. Visible droplets of water will spatter hot oil out of the pan and may cause burns or a fire. Look closely at the bottom of the pan where the oil meets it. Are there very small bubbles forming? This indicates water is present in the WVO. The number of bubbles is a rough indicator of how much water is present. A practical laboratory result with WVO for acceptable water levels

Sample	Observation in Pan	Results of Analisis via Karl Fischer ASTM D6304 (couloumetric)
WVO, after passing 100 mesh screen	lots of bubbles	708ppm water
WVO one pass centrifuge at 40°C (appr.120°F)	no bubbles	545ppm water
WVO heated, mist washed -six passes centrifuge at 40-80°C(120-180F)	no bubbles	478ppm water

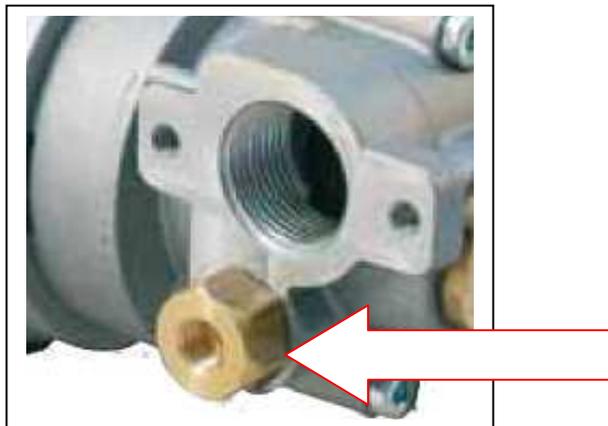
Conclusion: Pan tests can only detect water levels of 700ppm or higher!

Safety Aspects:

- Please always wear **goggles and gloves** when working with oils, it is a small investment for your health
- **Oil pressure versus oil temperature:** Please note that cold oil will create a higher pressure than warm oil, so we strongly advise you to keep the oil at constant temperatures and especially if you are absent during the filtration process you work with pressure safety valves as outlined below.

Please do not work the pump or the centrifuge with cold oils below 30°C

- **Pressure regulation:** if you buy our pump you can adjust the pressure to a maximum of 7.5 bar please see illustration below: you can adjust the pressure by closing the pressure regulator – ball valve until the pressure meter shows 7.5 bar, then you start opening below nut until the pressure starts to drop, fix the nut in this position



- **Pressure safety valve:** in case you are absent over a longer period during the filtration process we advise you add a safety valve opening at 8-10 bar to your system, please see below illustration:



This will avoid any burst pipes or seals in Rotor in case the nozzles of the rotor are clogged.

- **Low pressure Sensor:** Should the centrifuge be used without personnel being present, we advise you install a sensor that switches off the gear-pump in case of burst pipes or hoses
- Should you mount the pump without fixing it tight not to permit any vibration and you wish to use a tube, a vibration compensation must be installed between the pump and the fixed pipe.