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HIGH VELOCITY EVAPORATORS
HiVE25 MANUAL
VERSION 1.2

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Guidelines Essential for the Continued Performance of High Velocity Evaporators Wiped Film Evaporators

OBJECTIVE The guidelines outlined in this document describe both improper operations and recommended operations. Following these guidelines will ensure the continued proper operation of the wiped film equipment as well as the ancillary equipment attached.

-  Never use anything other than distilled or highly purified water when filling internal condenser and heating/cooling circulator loop (unless going below 0°C or over 100°C which is not recommended).
-  Do not engage main vacuum until the cold trap is either freshly cleaned or has been brought down to temperature (below -50°C).
-  Never turn main body heat jacket on until the system has had a vacuum pulled on it and vacuum gauge reads system pressure below (9×10^{-1} torr or 900 micron).
-  Do not clean the machine with anything other than 200 proof food grade ethyl alcohol or food grade oil.
-  Never leave material in feed tank after a run for longer than 24 hours.
-  Please use caution in handling machine while heat jacket is on and emitting heat.
-  Always wear safety glasses or eye protection when operating the machine.

High Velocity Evaporators Wiped Film Evaporator Startup Procedure

OBJECTIVE This guide will teach the proper startup procedure for all High Velocity Evaporators wiped film evaporators.



1. Upon Initial start up, load cold trap with dry ice, and slowly fill with solvent (Acetone/Iso/Ethyl Alcohol); adding cold dry ice to warm solvents will release CO₂ gas explosively which will cause solvent to erupt from the cold trap. This will happen until Solvent bath properly cools down. Alternatively, an immersion chiller can be used by simply placing the probe into the cold trap, using a handheld temperature reading let Solvent Bath cool down to below -70°C before starting the vacuum pump. After an initial run of system the leftover solvent can either be pumped out of the trap well (recommended) and the trap can be filled again in the same manner as explained above. Solvent can be left in the trap well in between runs and used again, but use caution when adding dry ice to warm solvent as explained previously.
2. Assure all flasks are mounted correctly and produce a good seal including cold trap flask as well as distillate and waste flask. Tighten all valves to atmosphere including Service valves on flasks, Feed tank valve and any additional valves added as accessories to machine. Open any valves between vacuum and machine.
3. Turn on the vacuum and allow system to purge of atmosphere until internal pressure reading on vacuum gauge reads a pressure level in the 10⁻² (10-90 micron) level. If the vacuum gauge doesn't show a drop in pressure to those levels please assure that steps 1 and 2 are completed properly as well as ensuring all flask joints are properly sealed.
4. Switch on circulating heater/Chiller attached to internal Condenser and set to desired temperature for run. (typically, between 50-85°C)
5. Turn on temperature control for all heated accessories (heat bands, feed tank, joints that are heat taped etc.). Turn on Temperature control to main body heat jacket and change temperature to 140°C and allow to heat up. Wait for 140°C has been reached and stabilized then proceed to raise the temperature again to the desired operating

temperature using increments of no more than 100°C. Allow main body temperature has been reached and stabilized for run.

6. Start motor to begin spinning internal blades and slowly ramp up blade speed to desired speed for run (typically start around 40%).
7. Once all controls reach their desired steady states start your process. If material isn't flowing into machine properly please allow material in feed tank to heat up to a more viscous consistency and this will allow proper flow (typically 70-120°C).

High Velocity Evaporators Wiped Film Evaporator **Shut Down Procedure**

OBJECTIVE This guide will teach the proper shut down procedure for all High Velocity Evaporators wiped film evaporator systems.

1. Completely shut valve on feed tank, allowing material left in feed tank machine side stem to drain off into machine, switch off feed tank heat jacket. Please allow 5 minutes for material inside machine to fully complete its path through the machine after this is done.
2. Shut down temperature control on main body jacket by setting the temperature to 80°C. Once the main body has reached 80°C switch power switch to the off position.
3. Reduce speed on motor control unit until it reaches the 0 position and turn motor control to off.
4. Turn off all heating controls to accessories.
5. Turn any valves between vacuum and machine body to the closed position and shut down vacuum pump. At this point if you need to remove material from either distillate or waste flasks you may allow atmosphere to enter the system via the service ports on either flask and remove them. If you have no need to remove the flasks at this point you have 2 options:
 - a. If a valve is installed between the machine and the vacuum pump and it has been moved to the closed position, you may leave machine in this state indefinitely.
 - b. If no valve is installed between machine and vacuum pump, you must allow atmosphere to enter the machine via the service port until it reaches room



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pressure (10⁹ or 9000 Micron) on vacuum gauge. After the system has reached atmospheric pressure, you may leave the machine as it is indefinitely.

6. Cold trap can be left to reduce in temperature naturally if dry ice was used (Bath solvent can be left and used over again). If an immersion chiller was used then that should be switched to the off position and cold trap can be allowed to cool down naturally. If cold trap collection flask has condensed liquid in it from the run, empty it now and replace with empty flask.
7. Check vacuum pump oil after vacuum pump has cooled down to ensure continued optimum pump performance. Do this by removing a small amount of oil into a clear container and inspect oil. If oil is significantly fowled in smell or color replace with fresh vacuum pump oil for next run.
8. Switch internal condenser recirculating chiller/Heater to the off position.
9. Machine is fully shut down.

Standard Modes of Operation

OBJECTIVE This document outlines the most standard modes that an HVE wiped film evaporator can be operated. The modes described can be used to achieve quality output material on initial purification or to further improve the performance of oils requiring remediation. Please be aware that these operations can only improve input oils to a quality consistent with the input product and some of the methods can in fact be limited by preprocessing errors as well as quality.

Wiped Film Stripping Configuration

- Remove the hybrid still condenser unit from the main body.
 - Remove the water chiller/heater quick disconnects from the internal hybrid condenser section located at the bottom of the machine (Be aware a small amount of condenser fluid [typically water] may come out upon removal but the DESO style connectors will prevent full drain from both sides).
- Remove the 4 ISO C-clamps around the perimeter of the bottom ISO flange of the main body. Carefully remove the Internal condenser being sure to drop it straight down and out of the machine with as little angle as possible in order to protect the internal blade cage. Place Condenser on the included condenser rack and relocated to designated cleaning area and clean the assembly. Retain the centering ring and Viton O-ring that was located between the main body and condenser.



- Affix the provided Stripping bowl to the bottom of the wiper body with at least 4 ISO clamps and the retained Viton O-ring and centering ring assembly. Attach an appropriate size flask to the single KF25 fitting on the bottom of the stripping bowl using either of the KF25 to

35/25 O-ring ball converter. It is recommended to use the 28/15 accessory with the 8mm valve on the accessory port of the flask used if using one of the included HVE 12-liter double neck flasks. Using the accessory valve instead of the stopper will allow you to bleed air into the system to evacuate any heavy gas that may have built up in the attached flask.

- Now the machine is ready to be run as an HVE wiped film stripping evaporator. The purpose of this is to increase the efficacy and efficiency of removing the higher volatility fractions present in your oil. Evaporated substances will be condensed and collected in the cold trap and stripped material will collect in the flask attached to the single output.
- Keep in mind that the temperatures and pressures recommended are only for reference and could be different depending on input material being stripped.
- **Wall Temperature suggestion**
 - Solvent stripping: 30-70°C
 - Stripping plant oils: 100-140°C

Pressure recommendation

(Note; Pressures lower than recommended increase the risk of evaporating target fractions as you approach higher temperatures for plant oils.)

(1 to 5) x 10⁻¹ Torr or (100 to 500) Micron

A recommended style of running would be to set target temperature and use flow rate to control pressure. The more material entering the machine the higher the pressure is driven due to increased input gas load from evaporation. "Ride the pressure" Like this until you pass all material through the machine.

“Internal” Stripping or “Reverse Cutting”

Internal stripping (Reverse cutting) is a methodology that strips relatively volatile compounds and heavier plant oils that don't strip readily running the machine in stripping configuration (material dependent).

In this configuration, the hybrid still condenser is left attached to the system so that the “Waste” side will now be the side your good material will come out of. The good side or distillate side will now collect your unwanted fractions. A smaller flask than normal may be attached to the condenser side when performing this function as the bulk of your material will come out the “waste” side. You will be removing the light volatile residue via the internal condenser taking advantage of the shorter vapor path between the still body and the center condenser.

- Hybrid still (Condenser) installed
- Wall Temperature suggestion: 120-140°C
- Internal Condenser circulating heater/chiller suggestion: 5°C.

Cut

- The primary purpose for the cut step is to separate the major cannabinoid fraction from the heavier components typically dark colors will still be present in the oil.
- Hybrid still installed
- Wall Temperature suggestion: 160-200°C.
- Internal Condenser circulating heater/chiller suggestion: 50-80°C.

Polish

- The purpose of a polish step is to increase the quality of the already cut oil. Benefits of this process include increased color quality as well as increased potency (This is typically the last step).
- Temperature suggestion: 155-180°C.
- Internal Condenser circulating heater/chiller suggestion: 50-80°C.

6-Inch and 3-Inch wipe film evaporator Regular maintenance.

OBJECTIVE This guide will show you how to perform maintenance procedures in order to keep your processing equipment running longer and with great performance. This will include cleaning and maintenance of the vacuum pump, wipe film evaporator and Cold trap.

Regular Maintenance

1. Check vacuum pump oil after each run to ensure the oil is not fouled.
2. Remove any distillates collected in flask attached to cold trap.
3. Clean machine regularly in order to ensure clean runs in the future and reduce cross contamination from previous material. *cleaning procedures will be listed below
4. Clean any built-up material inside and outside of feed tank.

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5. Empty and clean flask on cold trap daily. Every 3 months clean the inside of cold trap. * Refer to cleaning procedures below unmount the main cold trap body and clean the inside with warm 200 proof ethyl alcohol. After cleaning the cold trap and draining it of all alcohol remount and leave all entrances and exits open for 30 mins to allow to dry internally. After fully dried reconnect all hoses and bottom collection flask.
6. Every 2 months swap out blue charcoal filters on vacuum exhaust.
7. Check water level on the condenser group heating/cooling water circulator and top off if necessary (Only use filtered or distilled water with the circulator)

Cleaning Procedures

MACHINE MAIN BODY CLEANING (All parts are to be cleaned with 200 proof food grade ethyl alcohol) Please make sure to clean the machine only after the main body and internal condenser group are both completely cooled.

1. Remove all flasks from the machine and unmount the stainless steel KF-25 to Ball mount parts and clean them inside and out (Be careful not to lose the O-rings installed on the stainless-steel balls.
2. Remove retaining bolts on condenser group and carefully remove, be mindful of the water lines if left attached. Once removed, clean the entire condenser group and place in safe position.
3. Unmount and remove feed tank from machine and place in safe position.
4. Unplug motor control unit from main motor via locking connector.
5. Remove retaining bolts mounting motor/feedthrough group and lift the entire blade assembly up and out of the machine (be careful not to let the blades fall out of the retainers as you remove it). Please blade retainer and motor group in a safe position and clean retainer and the blades. Check blades for significant wear and tear such as large portions removed or blade sections ground to nothing or torn off, lastly ensure blades aren't warped significant.
6. Clean the inside of the main body of machine from either above or below to facilitate full reach inside machine body.
7. Remount blades into retainer by slowly lowering blade housing group into body until feedthrough mounting plate sits on top of centering ring gasket. Remount clamps and tighten at least 4 C-clamps in a cross pattern.
8. Slowly insert condenser group into the bottom of the machine until the bottom plate hits and mounts onto the centering ring. Mind the condenser on the blade housing group when mounting condenser group. Secure the condenser group to the main body using at least 4 C-clamps.
9. Clean flasks and remount, ready for next run.

COLD TRAP CLEANING PROCEDURE

1. Unmount cold trap distillate collection flask and clean, setting aside to remount later.
2. Unmount cold trap vacuum gauge if mounted to cold trap and replace with KF25 blank.
3. Unmount all bellows or ports to main machine and recap with KF blanks.
4. Unmount cold trap from machine frame carefully and pour acetone into chemical disposal collection bin.
5. Place cold trap on table with ice fill reservoir facing down on the table. Use a funnel to pour 750ml (25oz) 200 proof food grade alcohol into bottom KF25 port and seal with KF25 blank. Shake cold trap to agitate solution inside for a minimum of 3 minutes; make sure to also tip up and down attempting to allow the alcohol to clean entire inside of cold trap. Laying the cold trap down on a table and rolling it back and forth will also assist in cleaning as well. After completing a sufficient amount of agitation, you can then drain the ethyl alcohol either into a chemical disposal bin or into a storage container and stored for additional cleanings if not fouled completely.
6. Remount cold trap to frame as well as all KF fittings to proper joints and tighten sufficiently.
7. Remount distillate collection flask and vacuum gauge if the gauge is attached to an accessory port on cold trap.

Machine Specifications

DIMENSIONS

Depth-27 Inches (685.8mm)
Width-45 inches (1143mm)
Height-84 Inches (2133.6mm)
Body total Interior diameter – 6.3 Inches (160mm)

MATERIALS

(All Welding done to ASME section IX standards)

Frame- 6105-T5, Clear Anodized Aluminum
Frame Fasteners- Grade 2 hardened Zinc Plated Steel
Mounting Brackets for main body- 304 stainless steel bolted to 6105-T5 Aluminum
Main Body-316 medical grade 304L stainless steel
Flanges-304 Stainless steel
O-Rings-Viton Fluoroelastomer
Material Feed Tank- Tempered Borosilicate Glass
Feed Tank feed screw-PTFE with Fluoroelastomer O-ring
Rotating elements-Virgin solid white PTFE
Main Feedthrough- 14-4PH Stainless steel impregnated with proprietary Ferrofluid blend

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VOLTAGE/CURRENTS

Motor Drive Control Unit (Tethered to Main motor)-

Maximum rotational Speed 250 RPM @ 25 in.-lb. (2.824620625 Newton meters)

120V Default plug type: 5-15P needs 5-15R receptacle

1.5A

180W

Main Body Heater

240V Default plug type: L6-30P needs L6-30R receptacle

26.66A (Variable) 30 amp circuit breaker recommended

6400W (Complete range)

Equipment Necessary for Operation

(The following specifications are only for reference and depends on the equipment selected for specific use cases)

Laboratory Recirculating Water Chiller/Heater

This piece of equipment is used to run the hybrid condenser pre-installed in the HiVE25

Recommended: A Heater up to 200°C with chiller capability of at least 500W at 20°C

Example Power Requirements: 1800W at 120V or 240V

Vacuum

This piece of equipment is used to pull a vacuum on the system in order to accommodate lower temperature distillations in an oxygen-free environment.

Recommended: At least 15CFM pumping speed with low pressure rating of 3×10^{-4} torr

*Example Power Requirements: Up to 5000W with roots blower upgrade on 240V,
Or standard 120 V vacuum pump up to 25CFM 1800W*