SEREC
CORPORATION

Airless™ Vacuum Cleaning Systems

Serec Airless™ Vacuum Cleaning Systems

- Serec Airless™ Cleaning Systems are distillable solvent cleaning systems where the process occurs in a vacuum chamber for the ultimate in efficiency, performance and environmental responsibility.
- Serec Airless™ units can address applications of all sizes.
- Serec Airless™ units provide the lowest utility consumption, highest repeatability, lowest environmental impact and lowest operational cost of ***any*** cleaning process.
- Serec Airless™ systems accommodate virtually all common distillable chemistry cleaning agents.

Serec Applications & Benefits

Applications

- Aerospace
- Tube Cleaning
- Bearings
- Castings
- Dewaxing
- Electronic Assemblies
- Machined Parts
- Medical
- Optics & Photonics
- Powdered / Sintered Metals
- Screw Machined Parts
- Semiconductors

Benefits

- Clean Dry Parts
- Near Zero Emissions
- Closed Loop Design
- Exceeds EPA / OSHA Regulations
- Saves Solvent
- Easy To Maintain
- Multi Solvent Compatibility
- Low Utility Consumption

Serec Airless™ Processing Options

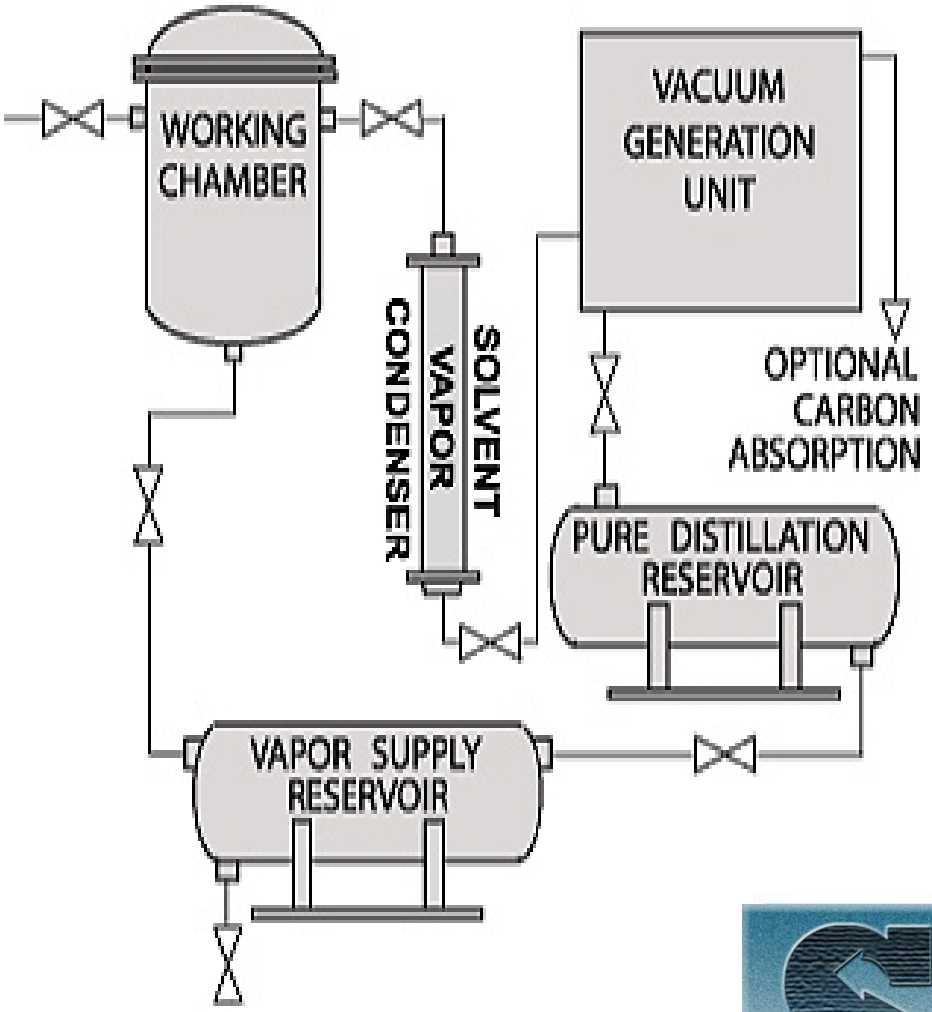
- Ultrasonic cavitation
- 360^{O} spray impingement
- Filtration
- Multiple process chambers
- Integrated automation
- Part rotation or tumbling within process chamber
- Auxiliary distillation
- Integrated chiller & boiler (*available as required*)

Serec Airless™ Compatible Solvents

- HFCs (DuPont Vertrel)
- HFEs (3M Novec Fluids)
- n-propyl bromide
- HCFCs (AK-225)
- Chlorinated solvents (trichloroethylene, perchloroethylene, methylene chloride)
- Azeotropes & blends
- Hydrocarbons
- Isopropyl alcohol
- Combustible & flammable solvents

Serec Airless™ Process Description

1. Loading of the parts
2. Decompression, (air removal)
3. Warm solvent soak (static, recirculating cleaning)
4. Warm solvent ultrasonic cleaning (optional)
5. Cold solvent soak (static, recirculating rinsing)
6. Cold solvent ultrasonic cleaning (optional)
7. Vapor cleaning
8. Vacuum drying & vapor removal
9. Scavenging (final air purge)
10. Unloading of the parts



Serec Airless™ Configurations

- Horizontal Loading (front loader)

- Vertical Loading (top loader)

More Airless™ Configurations

- Multiple process chambers

- Very large or custom size/shape process chambers available

More Airless™ Configurations

- Horizontal "Pizza Oven" chamber

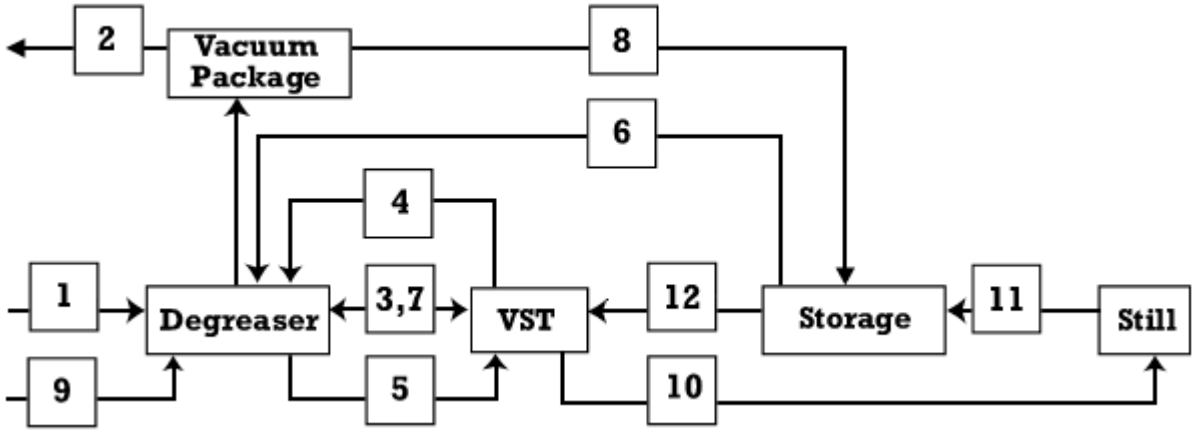
- Tube cleaner

ACS1212 Cabinet Model

- Cost effective
- 1 cubic foot top loader
- Totally vacuum sealed
- Co-solvent capable
- Built- in distillation
- SCAQMD permitable
- Small footprint
- Ideal for cleanrooms

ACS1212 Cabinet Model

Serec Process Flow



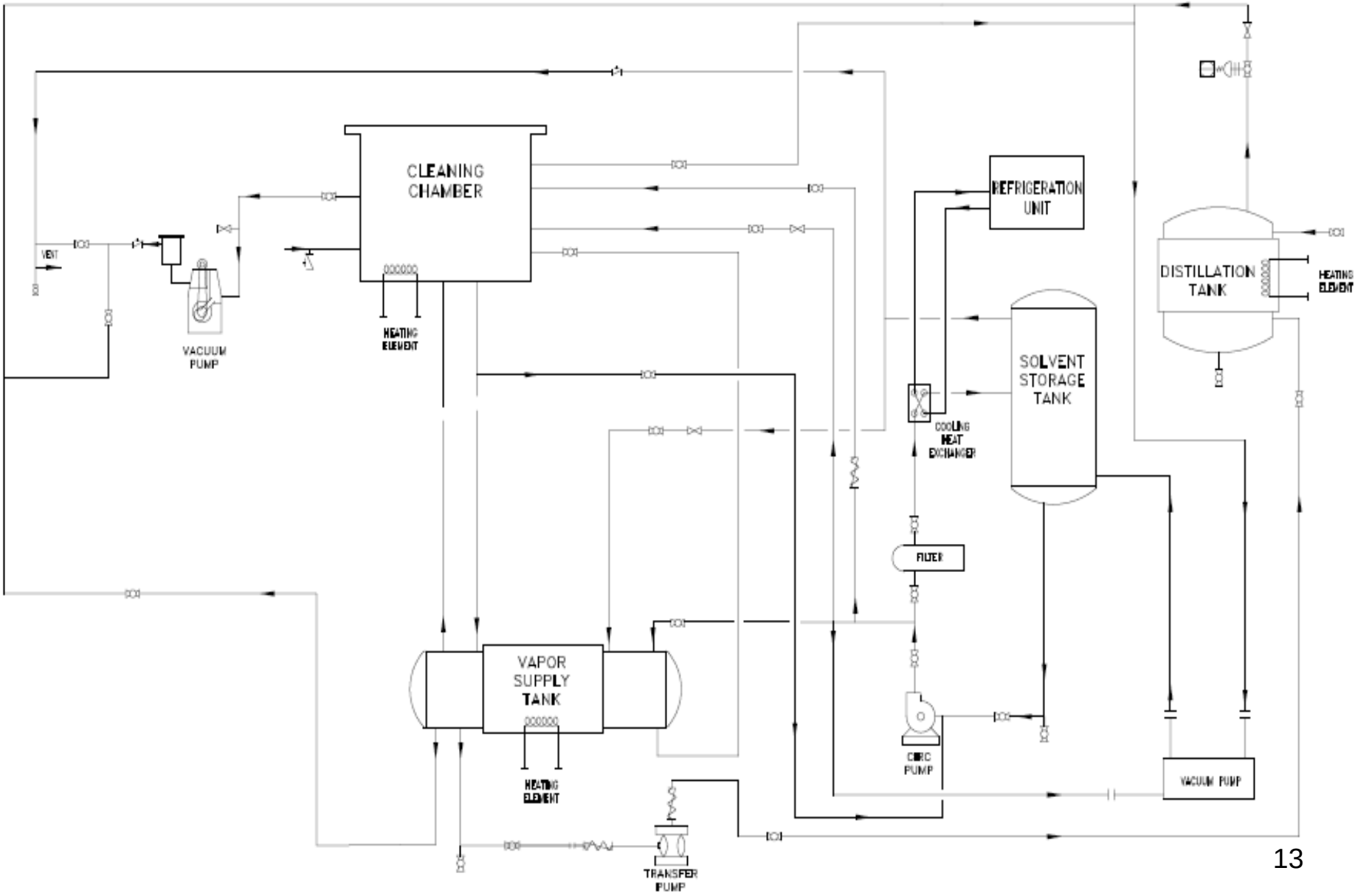
Cleaning Process

1.Load parts chamber and close lid.
2. Evacuate air from process chamber to one torr and out of the unit using the vacuum package.
3. Equalize pressure between the degreasing chamber and the vapor supply tank.
4.Fill the degreaser with solvent from the vapor supply tank (VST) (submerge parts) and soak. May apply recirculation soak/flushing. Ultrasonic energy may be applied to enhance cleaning. (Optional). Also, basket rotation may be applied. (Optional)
5.Drain cleaning chamber and return solvent to the vapor supply tank. Note, steps 4 and 5 can be repeated as desired.(Optional)
6.Spray pure cold solvent from the storage tank. (Optional) Note, excess solvent is collected in the vapor supply tank.
7.Vapor degrease\heat parts with vapor from the vapor supply tank. Note, excess solvent is collected in the vapor supply tank.
8.Vacuum dry chamber and parts to one torr using the vacuum package.
9.Return chamber back to atmospheric pressure.

Distillation Process

1.Contaminated solvent from the vapor supply tank is transferred to the distillation vessel on an as need basis.
2.Solvent is distilled and collected in the storage tank during the cleaning process cycle when the vacuum package is available. Distilled solvent is required to replenish the vapor supply level and supply pure solvent spray for the on coming cleaning cycle.
3.Removed contaminated solvent from the vapor supply tank is replenished by pure distilled solvent from the storage tank to maintain high solvent purity levels in the vapor supply tank.

ACS1212 Process Flow



Series 2200 Airless™

- Cost effective
- 3 cubic foot top loader
- Totally vacuum sealed
- Co-solvent capable
- Built- in distillation
- SCAQMD permitable
- Small footprint

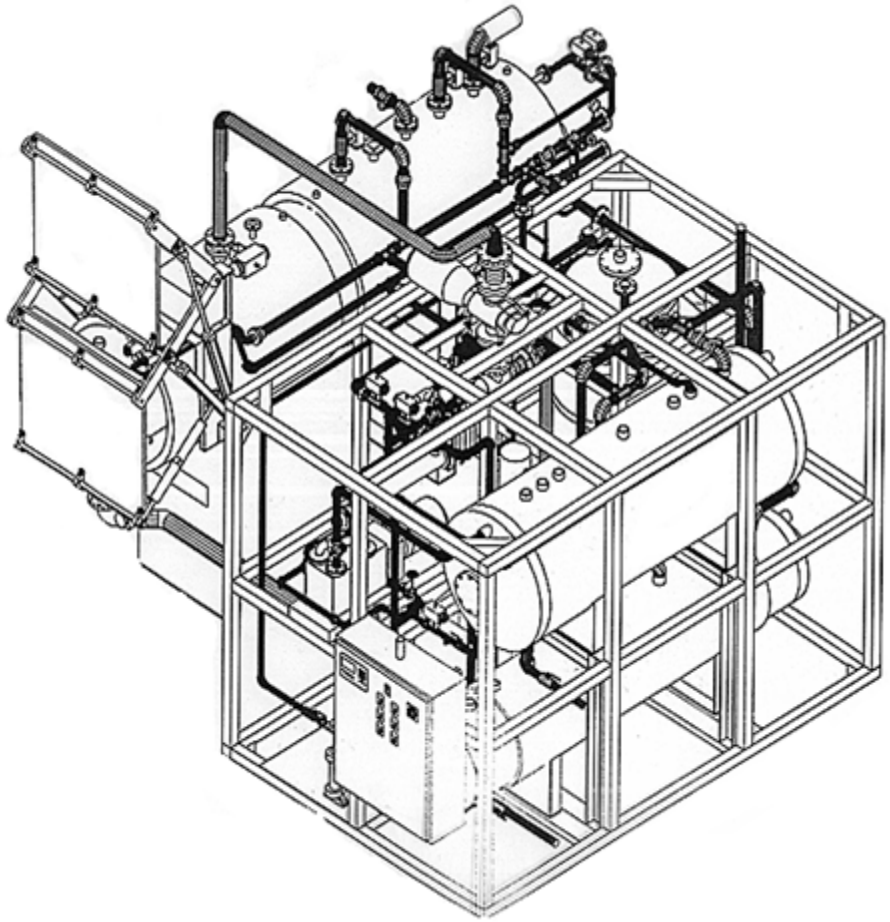
Series 1000 Airless™

- Very cost effective
- 10” x 12” top-loading chamber
- Totally vacuum sealed
- Co-solvent capable
- Built- in distillation
- SCAQMD permitable
- Very small footprint
- Minimal utility / facility requirements

Aerospace Cleaning System

Typical Industrial Cleaner Configuration

- Typical cycle time = 20 minutes (or less)
- Working chamber = 24”D X 24”L (or 24 inches^3)
- Footprint = 96” by 72” by 66”
- Approximate emissions for trichloroethylene are 18 to 20 lbs. per 1000 cycles
- Requires chilled water at 12 GPM with a ΔT of 20^{O}F (in @ 45^{O}F, out @ 65^{O}F)
- Requires 150,000 BTU/Hour @ 15 PSIG steam. (*apx 48 kW steam*)
- Requires 15 kW electrical



Benefits Of Vacuum Technology

- **Solvent Emission Reduction**
  Initially the air in the cleaning chamber is evacuated so that the solvent and the air are not interfaced with each other to eliminate the solvent emissions.

- **De-gassing the Solvent**
  When the solvent is placed under vacuum, the air dissolved in the solvent is eliminated to enhance the ultrasonic power — this means cleaner parts.

- **Drying the Parts Completely**
  In the vacuum drying process, the vacuum created in the cleaning chamber depresses the boiling point of the solvent: becoming 75% of its boiling point at atmospheric pressure. The higher the vacuum, the lower the solvent boiling point. The heat capacity of the parts helps boil the solvent and the evaporated vapor is recaptured and recycled in the system.

Open Top vs. Airless™

Conventional "Open-Top" Vapor Degreaser	Serec Airless™ Cleaning System
Start-up loss	Negligible start-up loss
Workload movement loss (Piston effect)	No workload movement loss (Solvent exchange method)
Workload shock (Workload thermal mass)	No workload shock (No vapor zone to collapse)
Diffusion & evaporation loss	No diffusion & evaporation loss
Drag-out loss	No Drag-out loss
Ventilation loss	No ventilation loss (Closed-loop and self-contained)
Faster solvent deterioration	Longer solvent life (Minimum solvent and air interface)
Possible operator errors	No operator errors (Fully automated)
Acceptable cleaning performance	Superior cleaning performance (superior vapor distribution due to the elimination of air in the cleaning process via vacuum technology: specifically for complex part geometries)

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