VACUUM PROCESSING SYSTEMS

Presents

Vacuum Cycle Nucleation ™

- History
- How Works
- Cleaning Videos
- Extraction
- Scale -Up

Presenter

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Vacuum Cycle Nucleation (VCN)

Vacuum Cycling Nucleation (VCN) for internal cleaning of parts:

•VCN works inside tight offsets. On the initial vacuum air is removed from the internals of the part.

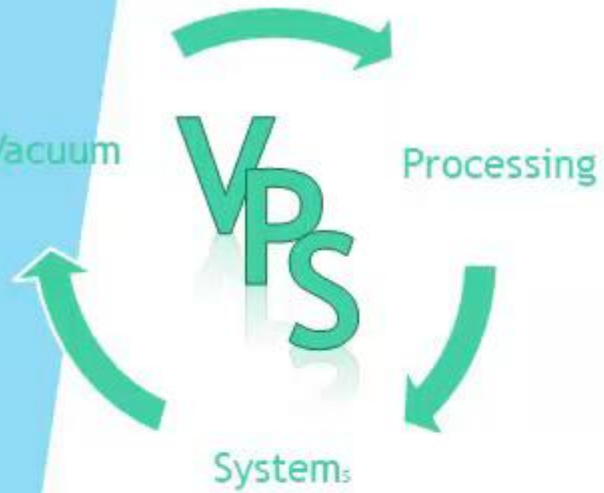
•On the initial pressure cycle fluid is forced into the void spaces within the part.

•On the subsequent vacuum cycles vapor bubbles grow inside the part and force fluid from the internals of the part.

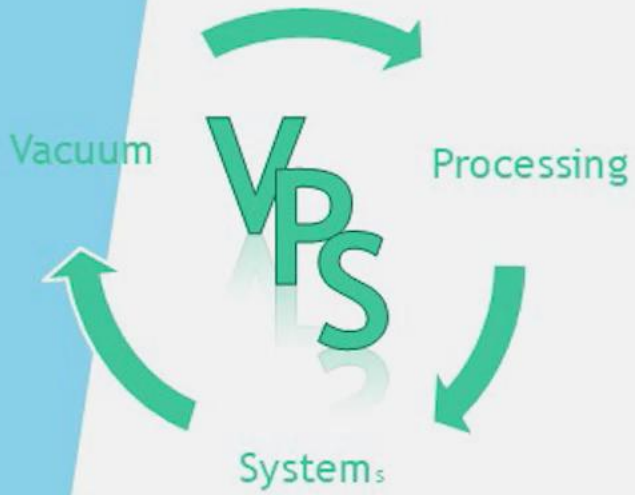
•Reactant chemicals, soluble material, particles and surfactant micelles are purged from the part during this cycle.

•On the subsequent pressure cycles fluid reenters the part's internals bringing fresh treatment chemicals.

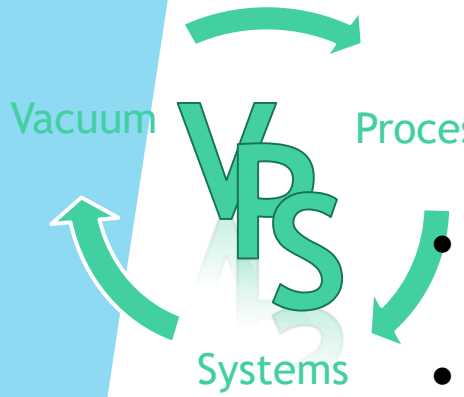
•Cycling continues until the part is fully processed.



VACUUM PROCESSING SYSTEMS PRESENTS VACUUM CYCLE NUCLEATION (VCN) HOW IT WORKS



VACUUM CYCLE NUCLEATION (VCN) IN A SOLVENT



Vacuum Cycle Nucleation™ (VCN)

Features/Benefits

- VCN works from the inside out
  - Energy is directed directly to the internal part surface
- Vacuum/Pressure cycles refresh cleaning fluid every 2-3 seconds
  - VCN works fast no need to what while contaminants “diffuse” from the surface
- Small lumens and porous surfaces are easily wetted and cleaned
  - Eliminates manual flushing , jetting , high pressure methods
- VCN is non-damaging
  - Pressure is equal on all part surfaces
  - Eliminates need for tumbling
- VCN can work with low concentrations of cleaning (aqueous) chemistry
  - Cost Savings
- VCN insures complete rinsing
- VCN systems provide rapid vacuum drying
  - Savings in time and energy expense
- Single chamber processing
  - Eliminates mechanical material handling device
  - Brings the fluids to the parts, not the part to separate tanks
  - Small footprint

- **High Capacity**
- Our systems can add extra heat to a system requiring rapid heat up time of heavy loads. We generally design for cleaning times between 10 and 30 minutes.

- **Solvent VCN Systems**
- Solvent VCN systems combine the capabilities of an Airless degreaser with the power of the VCN process.
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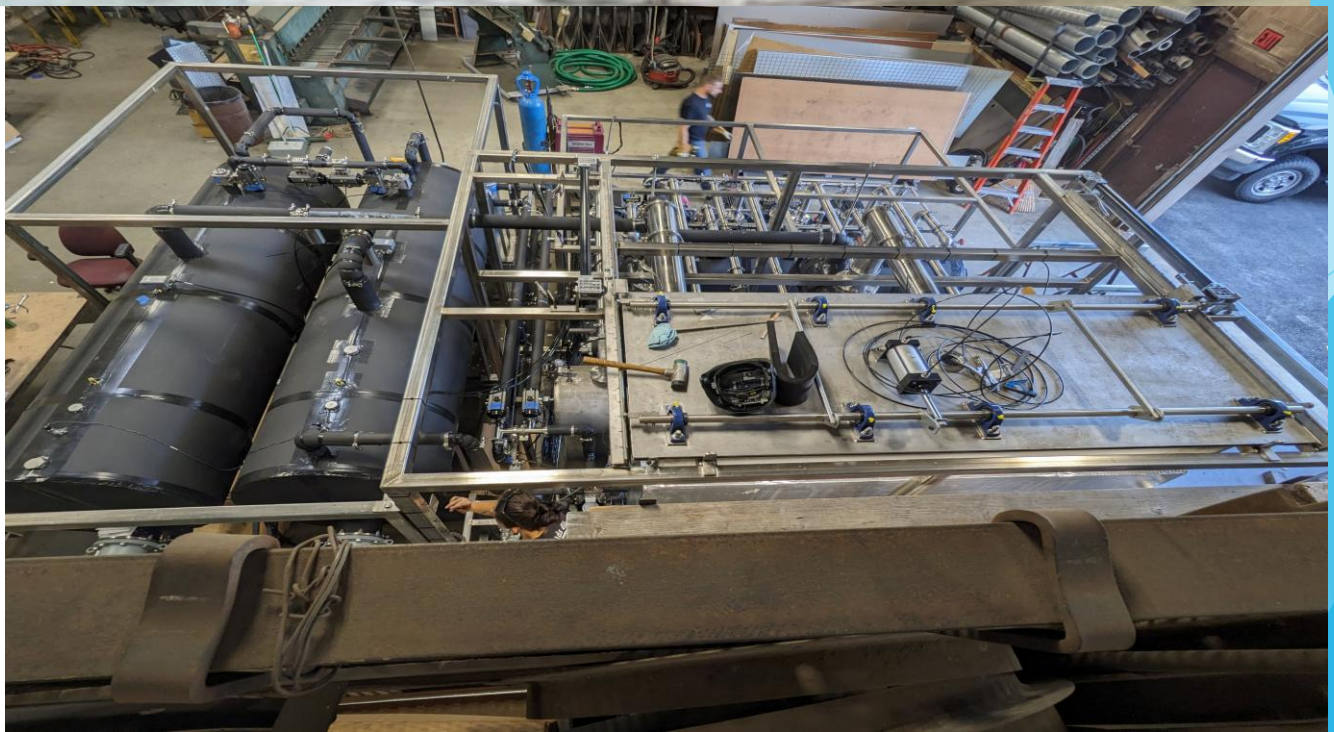
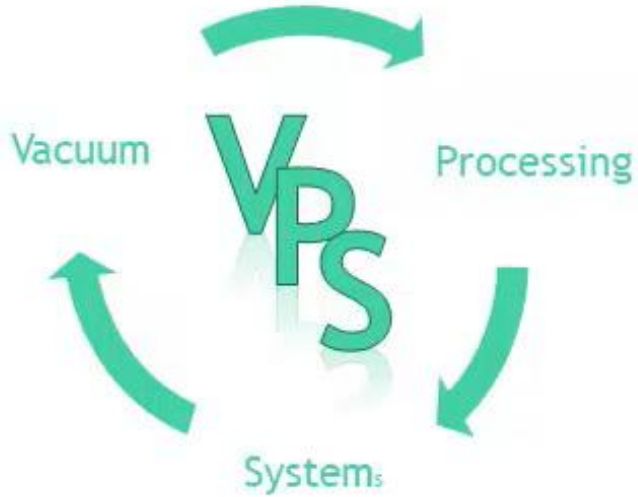
- **Low Emissions**
- Our Vacuum Vapor Degreasing System are completely closed looped systems. Emissions can escape only when opening the chamber. Because of this, our Vacuum Vapor Degreasing Systems have practically zero emissions.

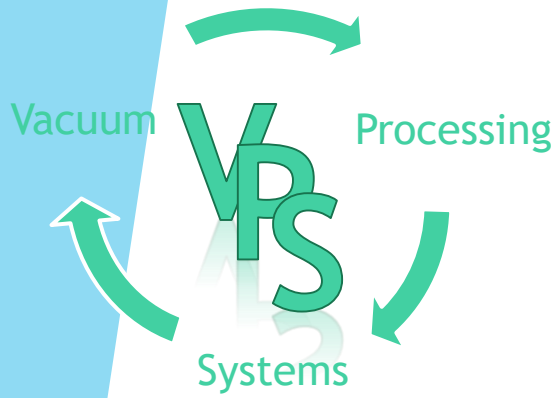
- **Tube Cleaning Equipment**
- No more manifolding or multistep processes. Adding VCN processing to our Airless Degreasers removes oils, grease and chips automatically







VACUUM PROCESSING SYSTEMS PRESENTS VCN RAPID CLEANING OF LARGE PARTS



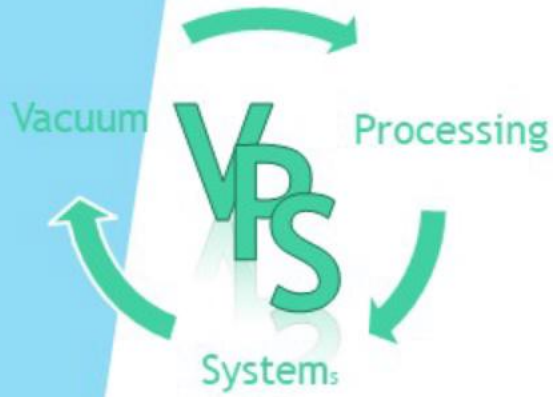
HOW VCN CLEANS SMALL LUMENS

Vapor Formation

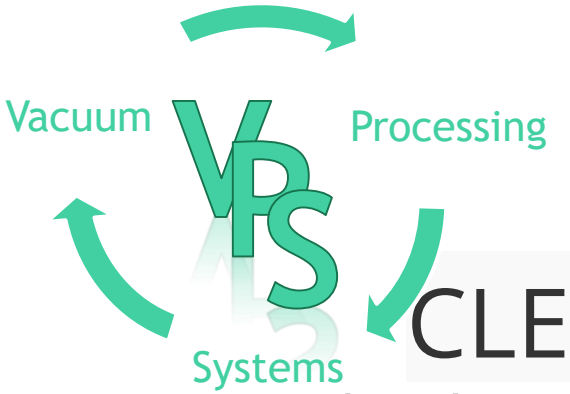
Water in an enclosed container will exert a pressure equivalent to the waters vapor pressure. The space above the liquid level is filled with water vapor. When a vacuum is pulled on the chamber, vapor is removed from the chamber. The vapor space now needs to be replenished with vapor. The water forms vapor bubbles that replenishes the vapor space.

Nucleation

Boiling liquids need nucleation points to begin vapor formation. Vapor therefore begins forming on parts within the chamber. The best nucleation points are in crevices and tight areas where a high solid surface to liquid volume can be found. The interior of small lumen tubes is an ideal location for vapor bubble formation. The vapor bubbles begin to form throughout the lumens and liquid is forced from the interior creating fluid motion within the tube. Stopping vacuum reverses the process and fresh fluid enters the tube. This process is cycled until the tube is cleaned.



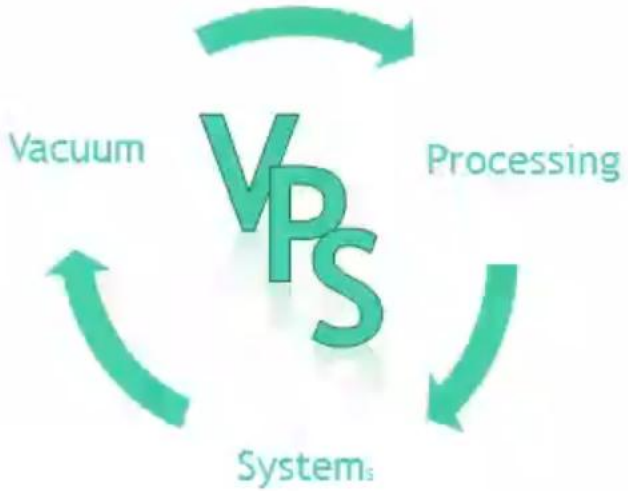
VACUUM PROCESSING SYSTEMS PRESENTS VACUUM CYCLE NUCLEATION (VCN) CLEANING OF SMALL TUBES



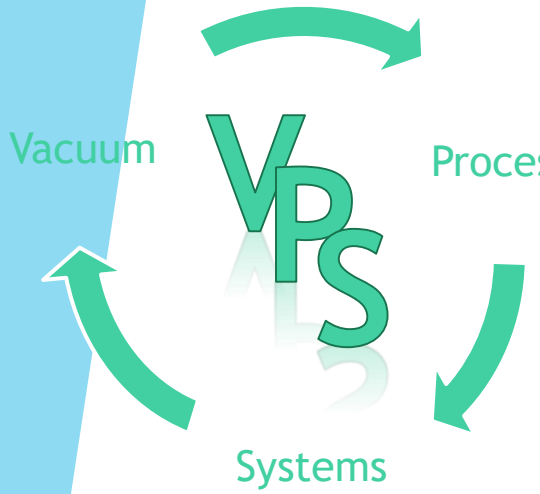
CLEANING IN ENTRAPPED AREAS

Like the initial vapor bubble formation in a boiling pot of water, VCN bubbles like to form in tight areas like the crevices in the pot where water begins to boil. Vapor bubbles expel fluid and contaminant from the area and collapsing bubbles draws in fresh fluid. The pressure change during the vacuum cycle is felt by the fluid throughout the chamber.

Like the pressure your back brakes feels instantaneously when you apply the brakes in a car, the fluid even inside solid channels or tubes form vapor when the pressure is reduced and even the smallest space can become an escape route for contaminated fluid at the cleaning site. When the vacuum is paused, fresh fluid can now reenter the target areas, and the cleaning process continues.



VACUUM PROCESSING SYSTEMS PRESENTS

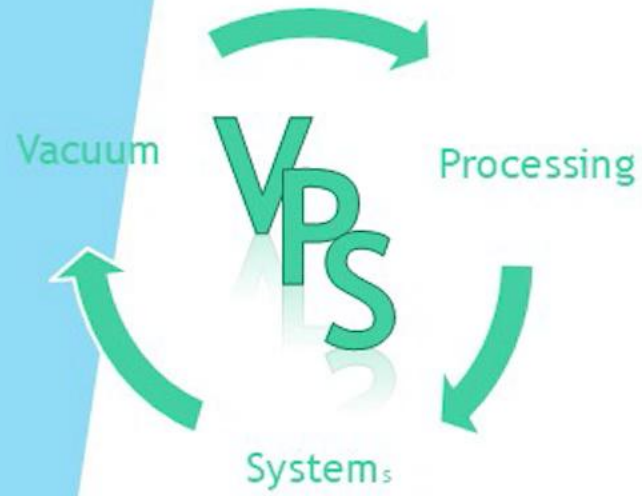


LARGE MODULE SYSTEMS

GENERALLY, SYSTEMS LARGER THAN 350 LITERS ARE CONSTRUCTED IN THREE MODULES INCLUDING A CHAMBER MODULE, VACUUM MODULE AND A SUPPLY TANK MODULE.

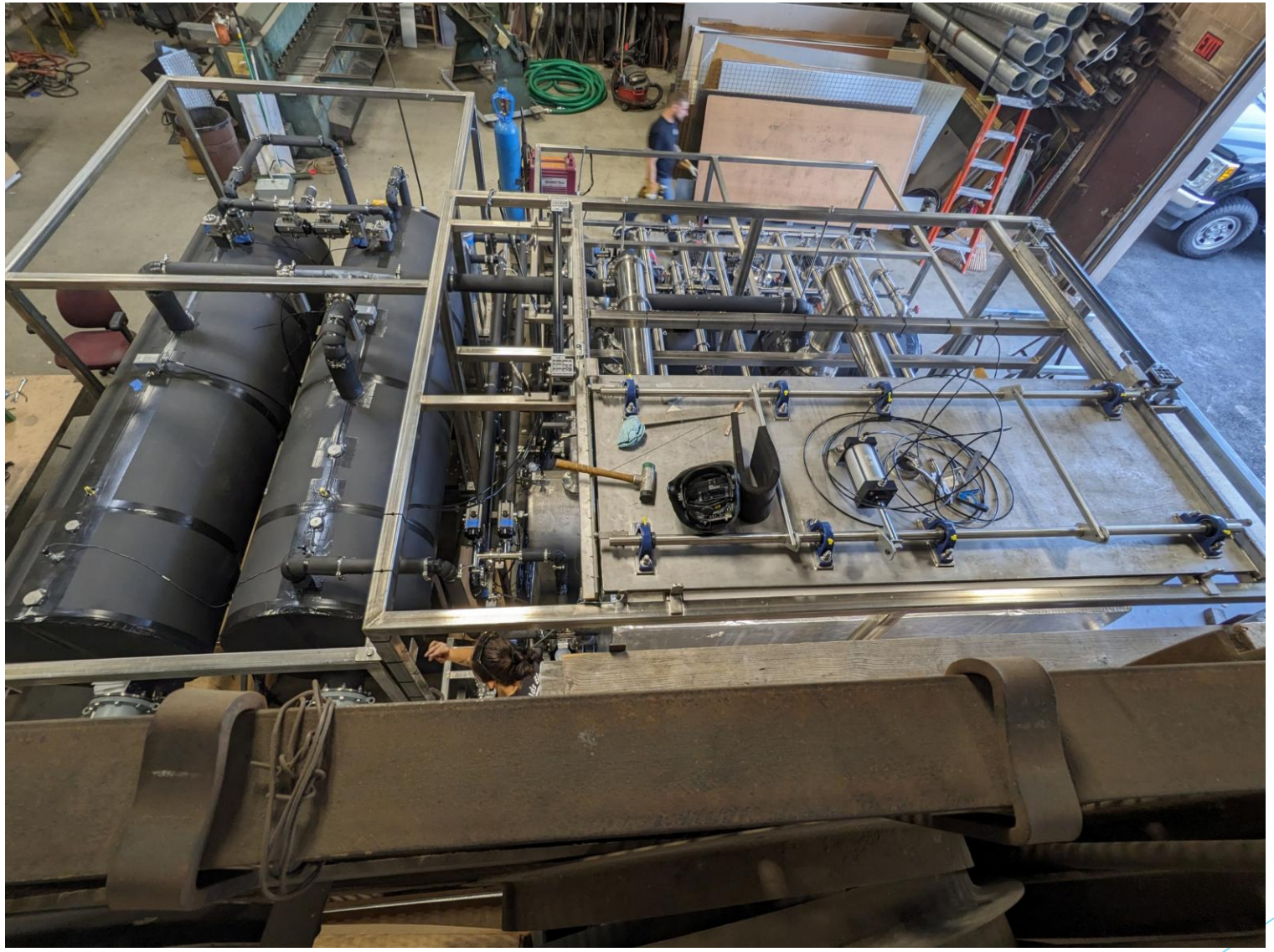
LARGER AQUEOUS SYSTEMS MAY USE MULTIPLE VACUUM PUMPS TO SUPPLY THE NECESSARY VACUUM.

TO DATE, SYSTEMS USING UP TO FIVE VACUUM PUMPS HAVE BEEN CONSTUCTED. THIS DESIGN DISTRIBUTES THE WORK OF THE PUMP ACROSS THE TOTAL CYCLE WHERE ONE PUMP MAY HANDLE THE CHAMBER EVACUATION, ONE PUMP IS USED FOR VAPOR RECOVERY, ONE PUMP IS USED FOR VACUUM DRYING AND ALL THE PUMPS PRODUCE THE VAPOR FOR THE VCN PROCESS.

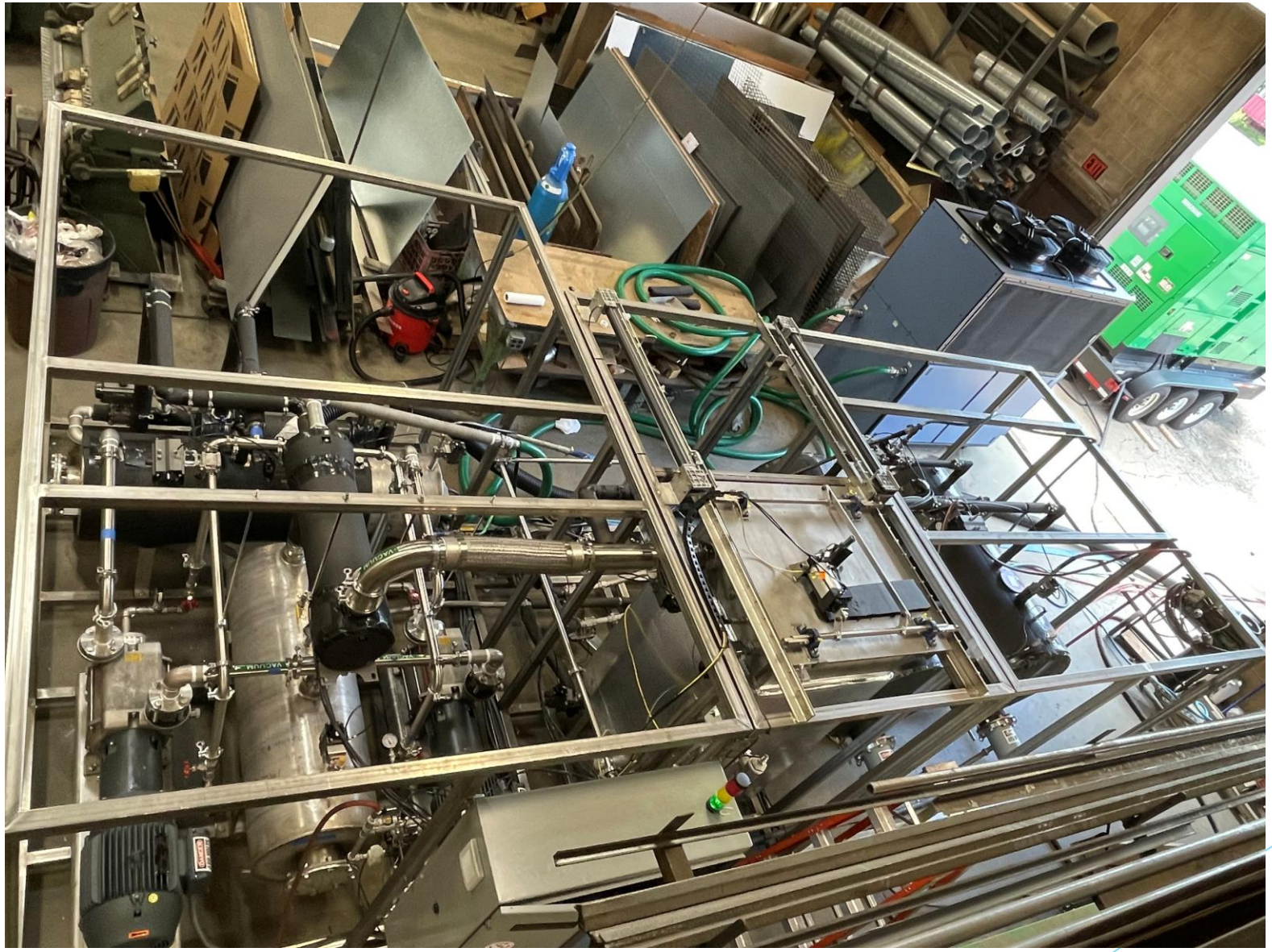


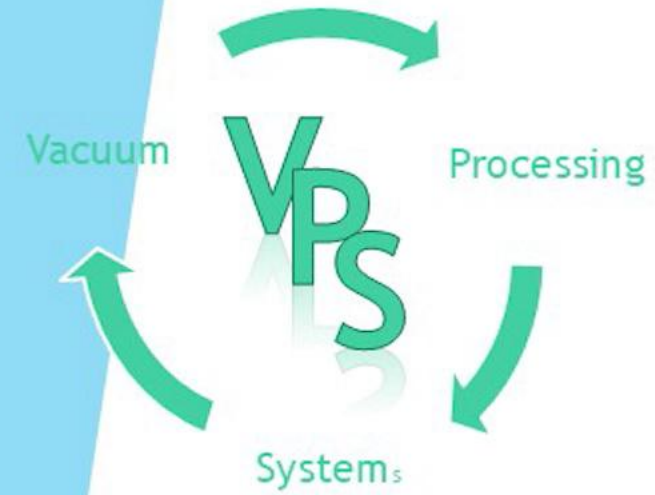
VACUUM PROCESSING SYSTEMS PRESENTS VACUUM CYCLE NUCLEATION (VCN) SCALEUP TO AEROSPACE UNITS

LARGER SYSTEMS FOR AEROSPACE



LARGER SYSTEMS FOR AEROSPACE





VACUUM PROCESSING SYSTEMS PRESENTS CONSTRUCTION OF LARGE UNITS

ADDITIVE MANUFACTURING IN AEROSPACE INDUSTRY

POWDER REMOVAL FROM 3D PRINTED PARTS USING THE VACUUM CYCLING NUCLEATION (VCN) PROCESS

NASA PRESENTLY HAS A VCN UNIT IN HUNTSVILLE ALABAMA THAT REMOVES POWDER FROM MANY OF THEIR 3D PRINTED PARTS. THEY HAVE A TECHNICAL TRANSFER PROGRAM AND WILL WELCOME ANY AEROSPACE OR NASA PARTNER TO TEST CLEAN THEIR PARTS IN THEIR UNIT AND WILL EVEN SCAN THE PART FOR ANY REMAINING POWDER.

THE UNIT IS 18” SQUARE BY 54” HIGH AND CAN HANDLE UP TO A 16”W x 16”L X 24”H BUILD PLATE.

IF YOU ARE INTERESTED IN TESTING SOME PARTS, PLEASE SEE OUR CONTACT INFORMATION ON THE LAST SLIDE AND WE CAN PUT YOU IN CONTACT WITH THE NASA STAFF RUNNING THE PROGRAM.

CONTACT US FOR MORE INFORMATION

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or

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