



Vacuum Debind And Sinter In One Cycle, One Furnace, For Ultimate Component Purity While Maintaining Rapid Manufacturing Throughput

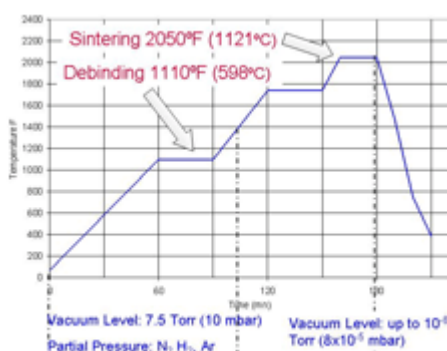


The **VFS** Model VDS incorporates a unique dual vacuum pump design that combines two steps – debinding and sintering – into one cycle, one furnace, without contamination of the components, furnace chamber, or hot zone.

During the debinding process, all binders must be completely removed from components, and contaminants that could foul the furnace or pumping system must be evacuated. These contaminants will affect furnace performance and quality during the sintering process. The design of the VFS Model VDS (Vacuum Debind/Sinter) solves this problem by utilizing not one, but two vacuum pumping lines.

One vacuum pumping line removes binders and carries them out through the bottom of the furnace. The pumping line incorporates an optically dense, water cooled baffle trap with a removable insert for ease of maintenance. The design utilizes an additional water cooled trap also with removable (replaceable) filter inserts in front of the vacuum booster to collect residual binder material.

If high vacuum is required, a second vacuum pumping line is connected to the high vacuum diffusion pump's main poppet valve. After the binder removal portion of the cycle, the high vacuum pump is available for the sintering process. The sintering process can also be run with process gas if required.



Process Description

Sintering is a process required for many different parts and applications, including powder metal parts and metal injected molding (MIM) components, 3-D metal printing components of various types, and beading applications including abrasives. The parts are then heated to the binding agent's vaporization temperature. The temperature is held at this level until all outgassing of the binding agent is complete. Debinding segment control is provided through the application of a suitable partial gas pressure that is above the vapor pressure temperature of the other elements in the alloy base material. The partial pressure is normally between 1 and 10 Torr.

The temperature is then increased up to the sintering temperature of

the base alloy and maintained to ensure that solid state diffusion of the part occurs. The furnace and parts are then cooled. Depending upon the application of component metallurgical requirements, cooling rates can be controlled to meet hardness and material density requirements. The chart show above is an example of a typical debinding/sintering cycle, which includes the use of a partial pressure gas during the debinding phase, and rapid gas quenching to meet specific material hardness requirements.

Customer Benefits

Vacuum debinding and sintering in one process cycle not only saves heat treaters time and money, but also results in superior and more consistent part quality. The main benefits of the VFS vacuum debinding and sintering furnace system are:

- Quicker processing turnaround. This one-cycle technology permits virtually unlimited design flexibility.
- Higher process quality (vacuum versus atmospheric).
- Minimization of contaminants to the furnace and components.
- Production of clean and bright components – a requirement of the medical industry.
- Furnace reliability and component repeatability. Maintenance "friendly" for cleaning and contaminant removal.



Sintering Part Applications

Several industries rely on sintered parts and components including:

- Medical parts, particularly implants
- Automotive – Power transmissions, gears & sprockets, camshafts, diesel particulate filter and valve seats
- Tools – Screwdrivers, drills, cutting/grinding tools

Standard Furnace Features

The VFS vacuum debinding and sintering furnace is packed with features for fast and effective applications. These include:

- Choice of graphite or metallic hot zone
- Operation at temperatures of up to 3000°F (1648°C)
- Vacuum levels to 10⁻⁶ Torr (8x10⁻⁵ mbar)
- Partial pressure with argon, nitrogen or hydrogen
- Partial pressure range of 50 to 1000 microns (to 650 Torr, 866 mbar, with Argon/Nitrogen)
- Fast cooling of up to 2 bar
- Binder removal system
- Burn-off system provided for safe handling of any flammable by-products

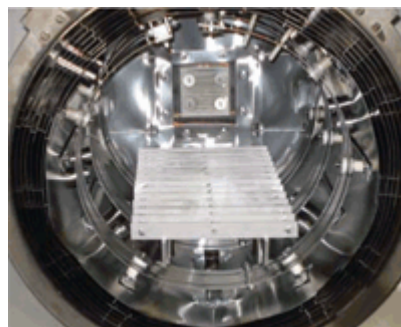
Standard Work Zone Size

- 10" (254mm) high x 10" (254mm) wide x 18" (457mm) deep
 - Up to 300 lbs (136 kg)
- 36" (914mm) high x 36" (914mm) wide x 48" (1219mm) deep
 - Up to 3,500 lbs (1,590 kg)

Special sizes available on request.



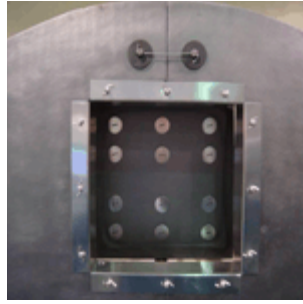
Graphite Hot Zone



Metallic Hot Zone



Water-cooled binder trap assembly

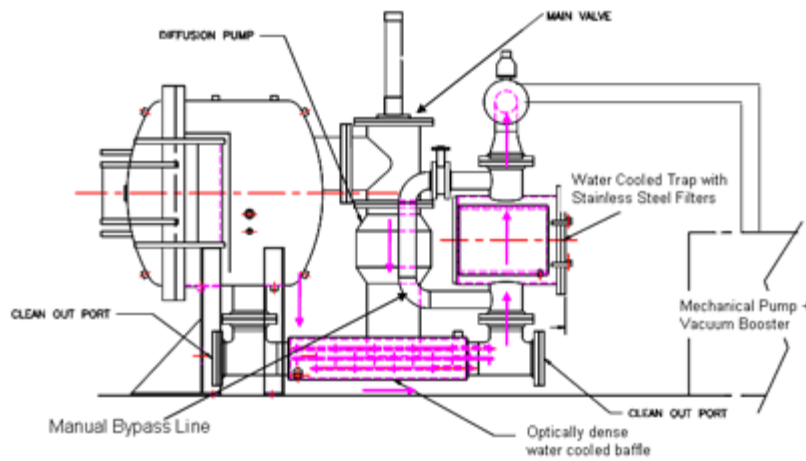


Pumping ports in hot zone stay closed during debinding and sintering



Binder collection trap

VDS Furnace Configuration



Compuvac® Control System

Our advanced user friendly Compuvac® Control System allows you the flexibility to perform many functions including:

- Process variable monitoring
- Alarm display and annunciation
- Recipe development and storage for repeatable results
- In-process recipe editing programmable heating and cooling events
- Preventative maintenance and diagnostics
- DIGITRIM® heat zone control
- Real-time and historical trending
- Process cycle reporting

