VACUUM IMPREGNATION METHODS

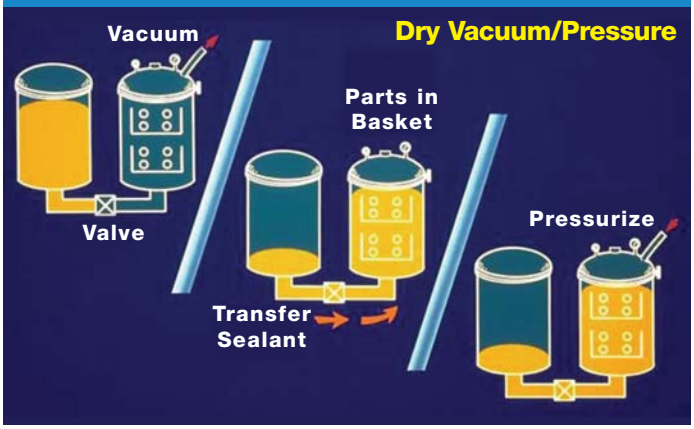
A variety of processing methods may be used to impregnate parts. The method selected depends on the sealant and the requirements of the parts.

Fundamentally, vacuum impregnation sealing of porosity addresses a pair of fluid mechanics problems. The laws of fluid mechanics govern the flow problem of removing the air from the pores and the flow problem of filling the pores with liquid sealant. The entire process can be reduced to four basic steps:

Process Steps:

1. Remove the air from the pores.
2. Fill the pores with liquid sealant.
3. Wash excess sealant from outer surfaces of the parts (without removing sealant from the pores).
4. Cure the sealant within the pores.

Each of the following impregnation process methods accomplishes these steps, but in slightly different ways.



• DRY VACUUM/PRESSURE (DVP)

This is the most complex vacuum impregnation method. The cycle requires two tanks, one which holds the sealant, and one in which the parts are processed.

Process Steps:

1. Place parts in process basket and load into process tank.
2. Draw vacuum in process tank to remove air from pores of parts. (Dry vacuum)
3. Transfer sealant from storage tank to process tank and submerge parts, still under vacuum.
4. Release vacuum and pressurize process tank with compressed air. Pressure helps to drive the sealant into the pores.
5. Release pressure and transfer sealant back to storage tank.
6. Remove parts. Wash and complete other process steps.

DVP processing was traditionally used with old-tech high-viscosity sealants. The DVP method is now sometimes specified with modern sealants where porosity is very small and sealing requirements are unusually rigid. The advantage of the dry vacuum is that there is no liquid present to interfere with degassing the pores. In a typical impregnation tank with a liquid level of 30 inches, the presence of the liquid column of sealant can reduce effective vacuum at the bottom of the tank by almost 8 percent. Use of dry vacuum eliminates that small variable. The pressure step is helpful in forcing the sealant into the pores. This is most important where the porosity is extremely small.

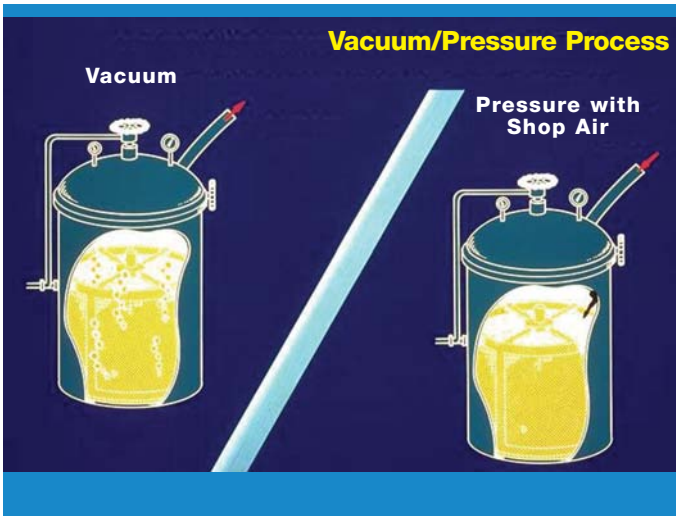
• WET VACUUM/PRESSURE (VP)

This process method requires only one tank. Parts are submerged in the sealant, which remains in the process tank at all times. The vacuum is applied to parts and sealant together, followed by pressurization with air. This process retains the pressure step, but does not use the dry vacuum. This is often an effective compromise, as the dry vacuum is less beneficial than the pressure step. The equipment is greatly simplified and the process will run faster.

Process Steps:

1. Place parts in process basket and load into process tank.
2. Draw vacuum in process tank to remove air from pores of parts.
3. Release vacuum and pressurize tank with air.
4. Release pressure.
5. Remove parts. Wash and complete other process steps.

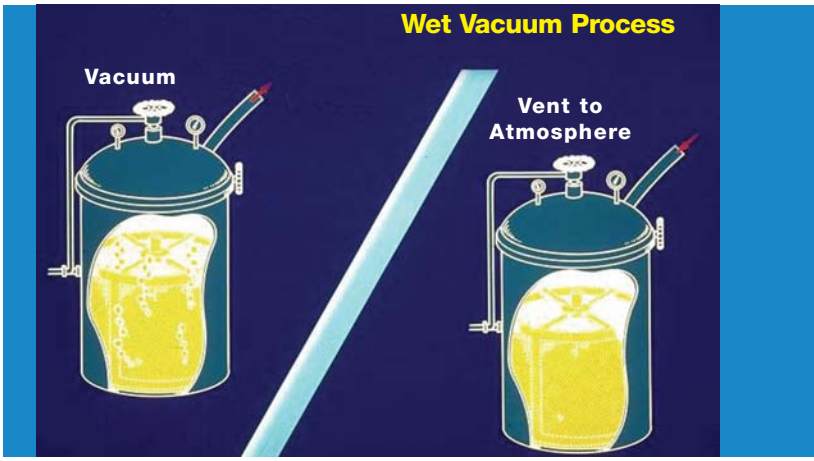
VP processing is more common for production processing of castings with very fine porosity and for high density PM parts.



• WET VACUUM (V)

This is the simplest and fastest of the vacuum impregnation methods. It is similar to the VP method, except that the tank is not pressurized. Instead, the tank is simply vented to atmosphere after establishing the vacuum. Penetration of the resin into the parts takes place at atmospheric pressure. The resin flows in to fill the vacuum created inside the porosity of the parts.

Wet vacuum impregnation is the most widely used application method by far. The simplicity and rapid processing, along with lower equipment cost, make this the method of choice in many impregnation system installations.



Process Steps:

1. Place parts in baskets and load into process tank.
2. Draw vacuum in process tank to remove air from pores of parts.
3. Release vacuum and vent tank to atmospheric pressure.
4. Allow parts to soak briefly while sealant penetrates.
5. Remove parts. Wash and complete other process steps.

• PRESSURE IMPREGNATION

This specialized method of applying impregnating sealants generally is used to treat parts individually and can be a very effective way to seal porosity in some situations. Typically, the parts are not placed inside a tank. Instead, each part is fixtured so it can be filled internally with the liquid sealant. The sealant is then pressurized, usually with compressed air, to force it to flow through any porosity leaks. The part is then drained, washed and processed further as in a tank method.

Process Steps:

1. Position part in fixture and close all open ports.
2. Fill part with liquid sealant.
3. Pressurize to force sealant through any leaking pores.
4. Release pressure and drain liquid sealant from part.
5. Remove part from fixture. Wash and complete other process steps.

Pressure impregnation in a highly automated system requires only seconds to process each part. Specially assembled set-ups can be useful when the part is too large to fit into a vacuum process tank, or when there are a large number of large parts where vacuum impregnation in a tank system would be costly.

PROCESSING DETAILS FOR HOT WATER CURING

Processing is similar for Loctite® Resinol® 90C™, Loctite® Resinol® 88C™, or Loctite® Resinol® 90R™.

Process Steps:

1. Impregnate parts using any of the process methods described in section titled “Vacuum Impregnation Methods”.
2. Use the Loctite® centrifuge to spin the basket of parts before removal from the impregnation tank. This removes most of the surface resin from the parts, returning that resin to the original bath. This step is very important for part clean-up. The sealant removed by the spinner returns to the bath, minimizing sealant usage. This is the most effective method available for removing excess sealant with no risk of damage to the parts. Since this is done inside the impregnation tank, very little time is required.
3. Using the Loctite® oscillator, lower the basket into the wash tank to clean the parts. Washing takes place in plain water with constant overflow, using the oscillator to agitate the parts in the water.
4. Place the basket of parts into the hot water cure tank and allow sufficient soaking time for the sealant to cure within the parts. The sealant will cure in four to 10 minutes at 90˚C (194˚F), but time must be allowed for the parts to reach that temperature throughout. Twenty minutes of soak time in the hot water tank is usually sufficient. Note: Parts must be allowed to cool after removal from the hot water. They can be leak tested as soon as they are cool. A corrosion inhibitor can be added to the hot water tank to provide protection for parts that might rust or corrode easily.

Processing Details for Hot-Water Curing

Wet Vacuum Wash Hot Water Cure