## 17 Cubic Foot Debind/Sinter Batch Furnace With "Laminar Gas Flow" For MIM Parts

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## Abstract

This presentation deals with a large debind and sinter batch furnace which rivals the output of continuous furnaces. The versatility of a batch furnace coupled with the benefits of "laminar gas flow" is being compared to the operation and output of continuous furnaces. Laminar gas flow provides complete debinding, it ensures temperature uniformity during debind and sinter, it eliminates evaporation of key constituents of the part, it provides versatility and flexibility in producing the largest variety of PIM/MIM parts, and it eliminates a separate thermal debind step. All of these benefits prove that laminar gas flow is able to improve all properties of the part and reduces cycle time and utility consumption even in very large batch furnaces.

## Introduction

In the manufacturing of pressed and sintered parts (PM) the volume of parts produced dictates the use of continuous furnaces. In metal injection molding (MIM) the question is still asked batch furnace or continuous furnace. In MIM there is also no correct answer because it depends on the need of the customer performing the sintering operation. If you need to produce many different parts using different materials, the batch furnace has the greater flexibility to allow you to do so, but if you are using the same material to produce all your parts or your parts may go through the same cycle and you can run the furnace 24 hours 7 days a week, then continuous furnace is said to be the way to go. The introduction of the 17 cu.ft. batch furnace provides another option to those looking for a small continuous furnace.

## **Continuous Furnaces**

There are three basic types of continuous furnaces:

- Belt furnaces, where a continuous belt is driven through the furnace and returns below the furnace. These are the workhorses of the PM industry, but the standard metal belts used in PM do not stand up to the temperatures used in MIM. Ceramic belt furnaces are available, but these are restrictive regarding the amount of load they can carry and are not popular in MIM.
- Pusher furnaces, where a thick ceramic plate is pushed into the furnace at a fixed time interval, and as one plate is pushed into the furnace another comes out at the cooling end. This technology was first introduced for high temperature sintering in PM and has been modified to remove secondary binders in MIM. This technology comes from the US and these furnaces are more popular in the US. Figure 1a shows a schematic diagram of a pusher furnace and Figure 1b shows the picture of a similar pusher furnace.
- The walking beam furnace moves the entire load inside the continuous furnace by a certain increment by using a beam to lift the entire row of trays in the furnace and bring it down after it has moved the fixed distance. This technology too has been modified from the high temperature sintering of PM. Walking beam furnaces are made in Europe and are more popular there. Figure 2a shows a schematic diagram of a walking beam furnace and figure 2b shows a picture of a similar walking beam furnace.