

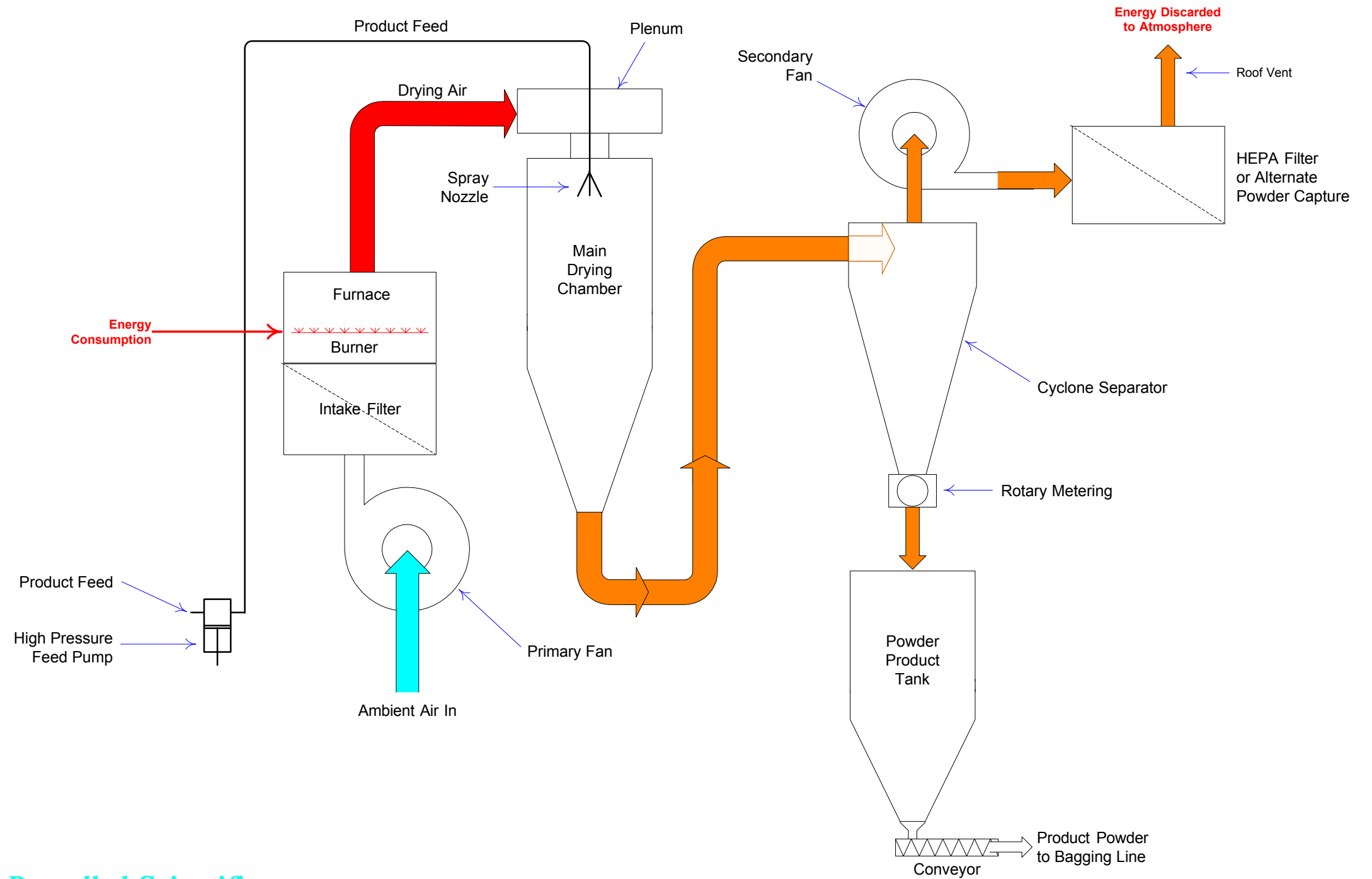
Conventional Open Loop  
Fuel Fired Spray Dryer  
*Quick Overview*

Furnace

Drying Chamber

Cyclone Separator

Powder Capture



Conventional Fuel Fired  
Spray Dryer Operation  
*Furnace*

The primary fan draws drying air through filter, to the furnace.

Hot drying air travels to the main drying chamber.

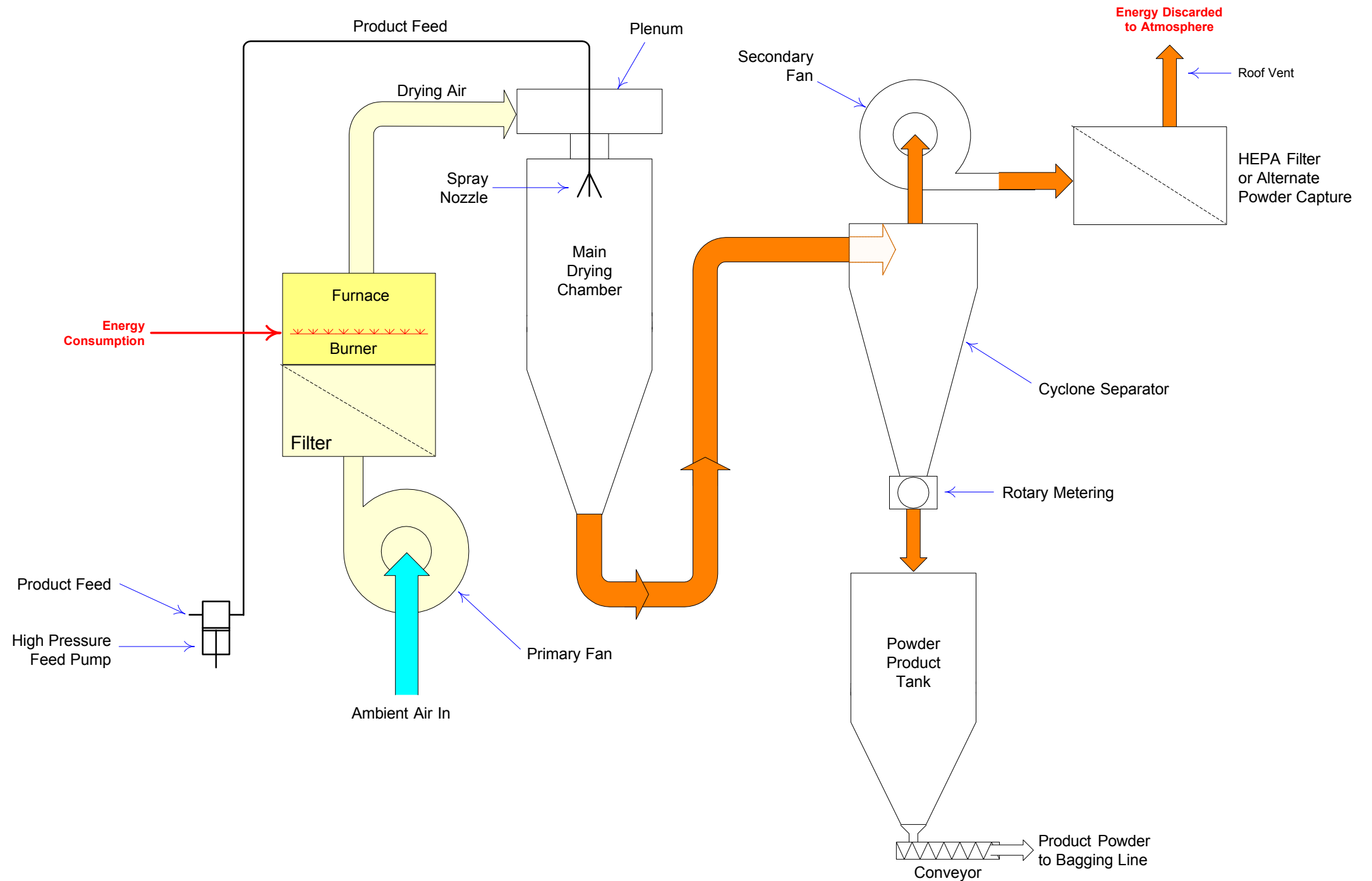
*Convection drying is driven by the humidity of the drying air.*

*This air must be very dry, on the order of 2% rH.*

*Conventional dryers heat the incoming ambient air to reduce its humidity.*

*In order to achieve sufficiently low rH%, conventional dryers typically run at 400 ° ~ 500 ° F, presenting significant product degradation issues.*

*For a 10K Lb / Hr class spray dryer, typical furnace energy consumption is 15 ~ 20 Million BTU per hour.*



Conventional Fuel Fired  
Spray Dryer Operation  
*Drying Chamber*

The feed pump transfers liquid product to be dried, e.g. milk or whey, to the spray nozzle, typically under high pressure.

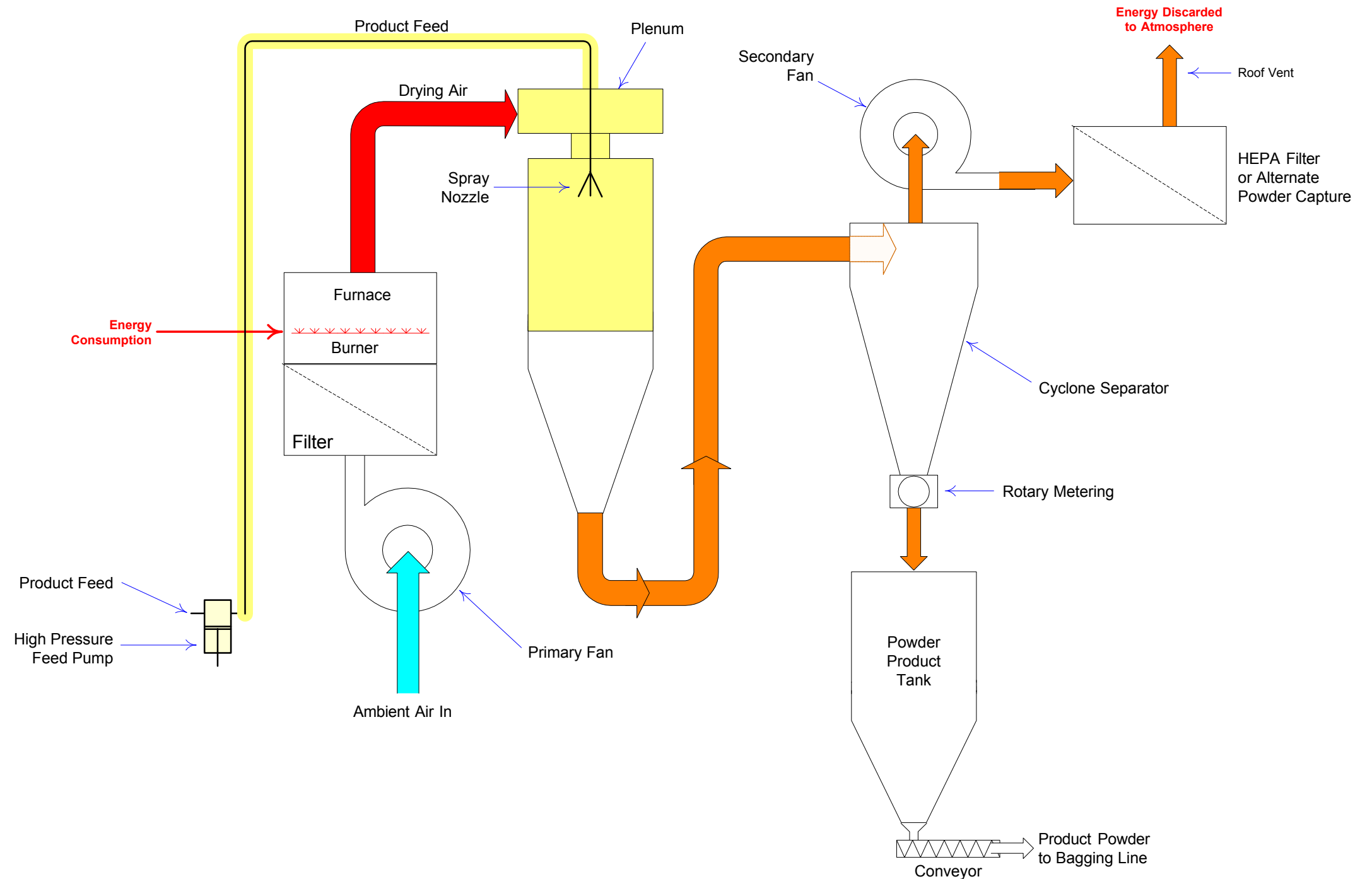
Liquid product exits the spray nozzle as a very fine mist or fog of nearly microscopic droplets.

When the droplets contact the hot drying air, they dry in milliseconds.

They become powder before they contact the inside surface of the drying chamber.

*The hot drying air passes through the drying chamber only once.*

*Much of this drying air bypasses the product entirely, and exits without doing useful work.*



Conventional Fuel Fired  
Spray Dryer Operation  
*Cyclone Separator*

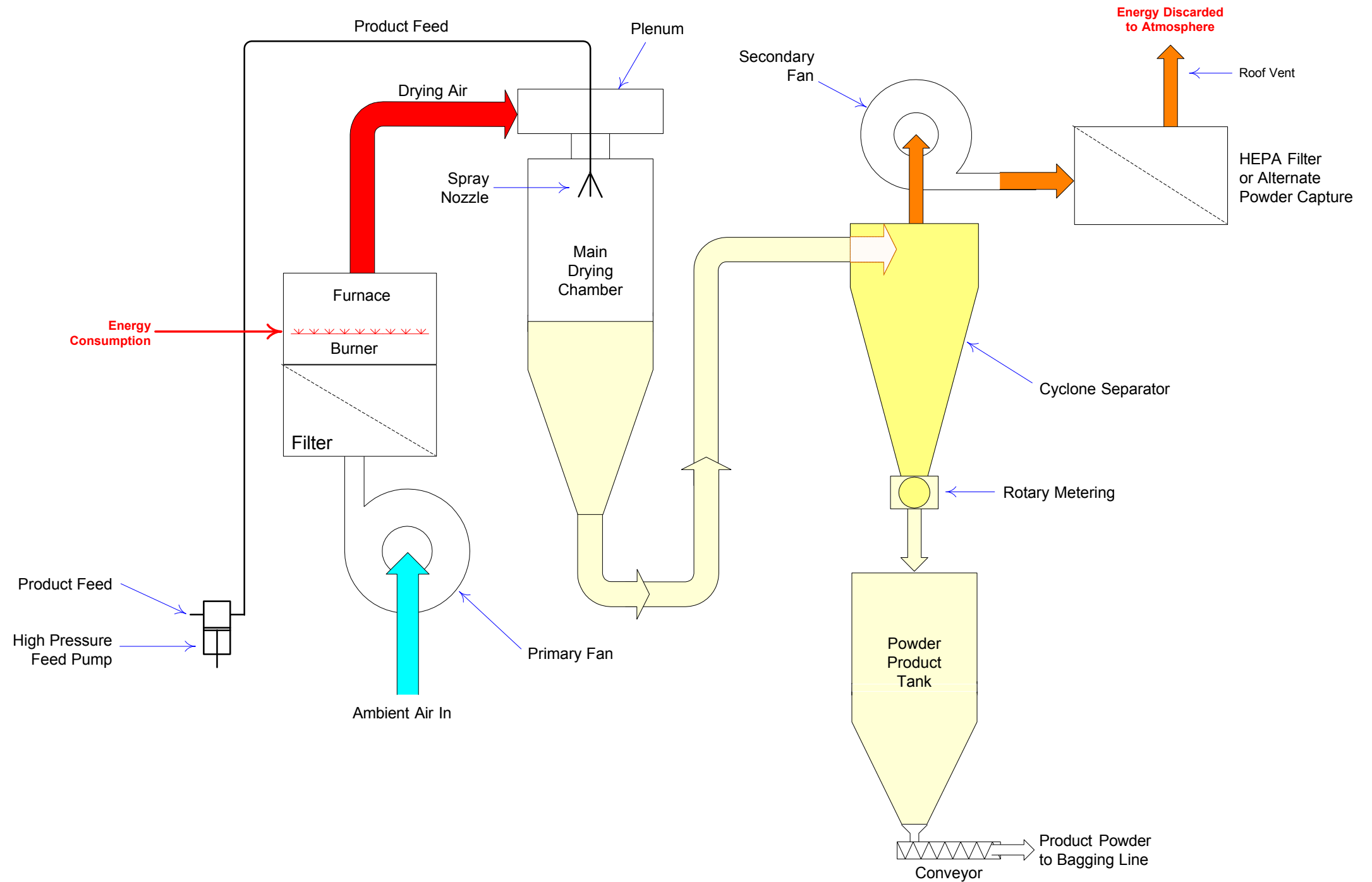
The drying air, with dry powder product in suspension, exits the drying chamber at the bottom.

The drying air and powder product enter the cyclone separator, which centrifugally separates the powder from the bulk airstream.

Powder product falls to the bottom of the separator, and is collected in the powder product tank.

*Delivered powder product is very hot, and must be cooled before storing or shipping.*

*This is often accomplished with electric chillers, presenting additional energy consumption.*



Conventional Fuel Fired  
Spray Dryer Operation  
*Powder Capture*

The drying air, with most of the powder removed, passes through the secondary fan and HEPA filter, to the atmosphere.

The HEPA filter captures powder fines that escape the cyclone separator.

*Most of the energy consumed by the furnace is discarded to the atmosphere.*

*Powder fines are a significant air pollutant. Related maintenance and regulatory compliance are time consuming and expensive.*

