

# HFlow 1 Flowmeter Funnel

The HFlow 1 measures both bulk density and flow rate in pharmaceutical and metal powders, offering a choice of three standard funnels—Hall, Carney, and Gustavsson. Complied with USP, Ph. Eur., ASTM, and ISO standards, it accommodates diverse applications, allowing customers to choose the best fit for their measurement requirements.



## Bulk Density Measurement with 3 Funnels



## Flow Rate Measurement with 3 Funnels



USP



Ph. Eur.



ASTM



ISO



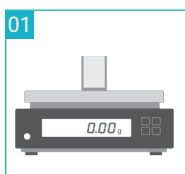
Hall Funnel

Carney Funnel

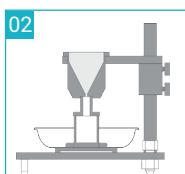
Gustavsson Funnel

## Measurement Procedure

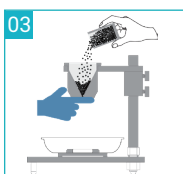
### Bulk Density



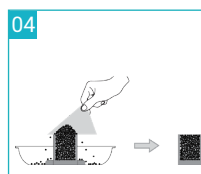
Empty cup and weigh



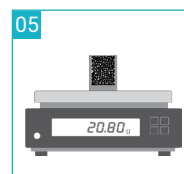
Adjust height with  
a 25 mm block



Block the bottom hole of  
funnel with a dry, clean  
finger and then add sample



Scrape

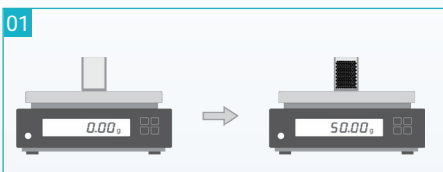


Weigh

$$\text{Bulk Density } (\rho_B) = \frac{M}{V_B} = \frac{\text{Mass (g)}}{25 \text{ cm}^3}$$

where  $\rho_B$  is the bulk density,  $M$  is mass in grams, and  $V_B$  is the bulk volume in milliliters or cubic centimeters.

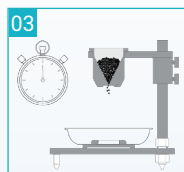
### Flow Rate



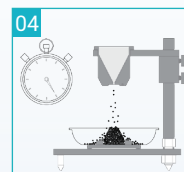
Weigh sample



Block the bottom hole of  
funnel with a dry, clean  
finger and then add sample



Start timing when  
powder begins to exit  
the orifice.



Record the elapsed time  
when the last of powder  
exits the orifice

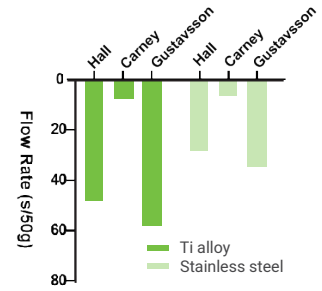
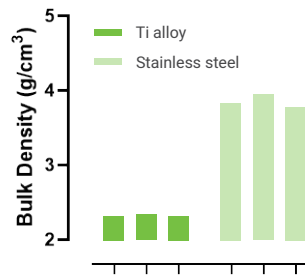
$$\text{Flow Rate (FR)} = \frac{\text{Time (s)}}{50 \text{ g}}$$

\* Both procedures are applicable across three types of funnels, according to corresponding standards.

## Application Example

Analyzing bulk density and flow rate of various metal powders applied in additive manufacturing (AM).

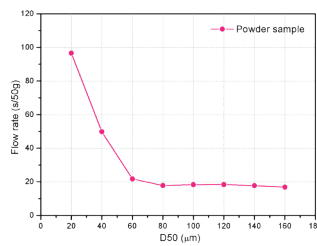
Hall, Carney, and Gustavsson funnels equipped in HFlow 1 have different orifice diameters and angles respectively. They can be employed to test the bulk density and flow rate of a wide range of metal AM powders for evaluating printability.



## Interoperability



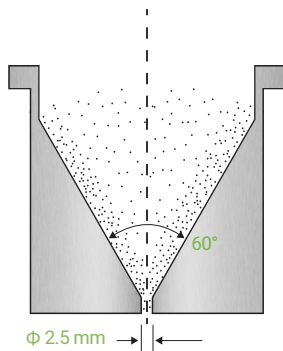
Bettersizer 2600



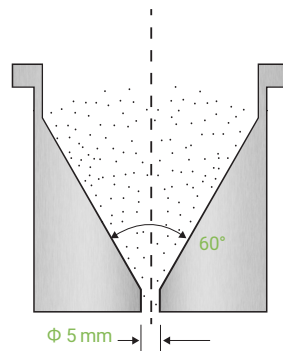
The combination of the laser diffraction analyzer Bettersizer 2600 and HFlow 1 assists in balancing the particle size distribution and flow property of AM powders.

In the feedstock preparation process, undersized particles tend to aggregate, which can be detrimental to powder bed fusion processes. The agglomerates will impede the flow behavior of the powder by increasing interparticle friction.

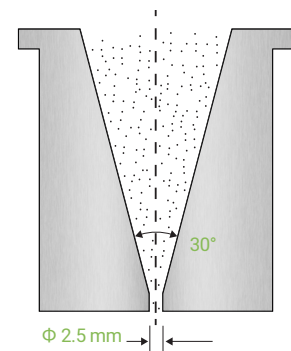
## Specification



Hall Funnel



Carney Funnel



Gustavsson Funnel

	Hall Funnel	Carney Funnel	Gustavsson Funnel
Orifice Diameter	2.5 mm	5 mm	2.5 mm
Funnel Angle	60° ± 0.2	60° ± 0.2	30° ± 0.5
Compliance (for flow rate)	• USP <1174> • Ph. Eur. <2.9.36>		
	• ISO <4490> • ASTM <B213>	• ASTM <B964>	• ISO <13517>
Compliance (for bulk density)	• ISO <4490> • ASTM <B212>	• ISO <3923-1> • ASTM <B417>	• ISO <3923-1> • ISO <13517>
Volume of Cups	25 ± 0.05 ml		
Materials	304 Stainless steel or Brass		

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