

# Ascentis<sup>®</sup> Express Backpressure

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# Background

- Ascentis Express columns have half the backpressure of sub-2  $\mu\text{m}$  columns – but exactly what backpressure should you expect?
- Ascentis Express can be used on both traditional and high pressure systems, including UHPLC. How far can I go on a standard 600-bar instrument? At what point would I need to transfer my method to a UHPLC instrument?
- We have many examples in our literature of comparisons of backpressure between the Ascentis Express, and sub-2  $\mu\text{m}$ , 3  $\mu\text{m}$  or 5  $\mu\text{m}$  porous particle columns, but this guideline will show you what backpressures you should expect from this novel technology.

# Test Setup

- Ascentis Express C18 columns of various dimensions were connected to a 600-bar instrument.
- Backpressure was recorded at specific flows with a representative mobile phase (40% acetonitrile) or a highly-viscous mobile phase (60% methanol).
- The backpressure of the instrument itself (ZDV union in place of column) under identical conditions was also recorded.
- For this test, the instrument was plumbed with 0.005" I.D. and 0.004" I.D. tubing; a 100 psi backpressure regulator was included in the flow path of the column outlet.
- All data was collected at ambient temperature.
- Data presented are total pressure; system pressure has not been subtracted out.
- Backpressure units are listed in bar (1 bar = 14.5 psi).

# Representative Backpressures

## Mobile Phase: 40% Acetonitrile

### 40% Acetonitrile

ID	L	mL/min:												
		0.1	0.2	0.3	0.4	0.5	0.6	0.8	1.0	1.2	1.5	2.0	2.5	3.0
2.1	150	130	250	365	470	568	>600							
3.0	150	66	130	194	254	319	376	494	600					
4.6	150	40	76	114	150	186	223	293	357	432	527	>600		
2.1	50	55	109	162	212	262	308	400	490	577	>600			
3.0	50	36	68	99	131	162	191	251	306	363	446	572	>600	
4.6	50	25	45	65	86	105	125	165	205	245	303	400	493	572
<b>system:</b>		18	29	41	52	64	75	100	124	149	185	245	300	350

Color coding of results is arbitrary: green at less than 80% limit of instrument pressure, orange at or greater than 80% of limit; red at or greater than 90% of limit of a 600-bar instrument. Above this, move the Ascentis Express column to a UHPLC system.

# Representative Backpressures

## Highly Viscous Mobile Phase: 60% Methanol

### 60% Methanol

ID	L	mL/min:														
		0.1	0.2	0.3	0.4	0.5	0.6	0.8	1.0	1.2	1.5	2.0	2.5	3.0		
2.1	150	190	375	548	>600											
3.0	150	113	221	324	427	531	>600									
4.6	150	64	126	184	246	304	366	480	586	>600						
2.1	50	95	183	269	350	425	504	>600								
3.0	50	58	112	165	217	266	318	419	505	>600						
4.6	50	41	76	112	150	185	219	290	354	421	510	>600				
<b>system:</b>		27	47	67	88	107	129	170	210	250	305	365	412	465		

Color coding of results is arbitrary: green at less than 80% limit of instrument pressure, orange at or greater than 80% of limit; red at or greater than 90% of limit of a 600-bar instrument. Above this, move the Ascentis Express column to a UHPLC system.

## To Estimate for Other Dimensions

In 60% MeOH and at 0.6 mL/min, a 15 cm x 4.6 mm I.D. Ascentis Express column gives a backpressure of 366 bar. What will a 10 cm x 3.0 mm I.D. column give approximately?

1. Calculate the equivalent linear velocity for the reduction in column I.D.:
  - $3.0^2/4.6^2 \times 0.6 = 0.26$  mL/min
2. Calculate the change in backpressure for the different column length (first deduct the system pressure):
  - $100/150 \times (366 - 129) = 158$  bar (at 0.26 mL/min)

So a 10 cm x 3.0 mm I.D. column would typically give a back pressure of 158 bar at 0.26 mL/min (plus system pressure).

# Comments

- The results of this survey represent a reference point of what end users can expect.
- Results encountered are very dependent on mobile phase conditions and will be dependent on temperature; increased temperature will decrease backpressure.
- Calculated column pressure must account for background system pressure under identical conditions.
- Background system pressure can be quite significant.