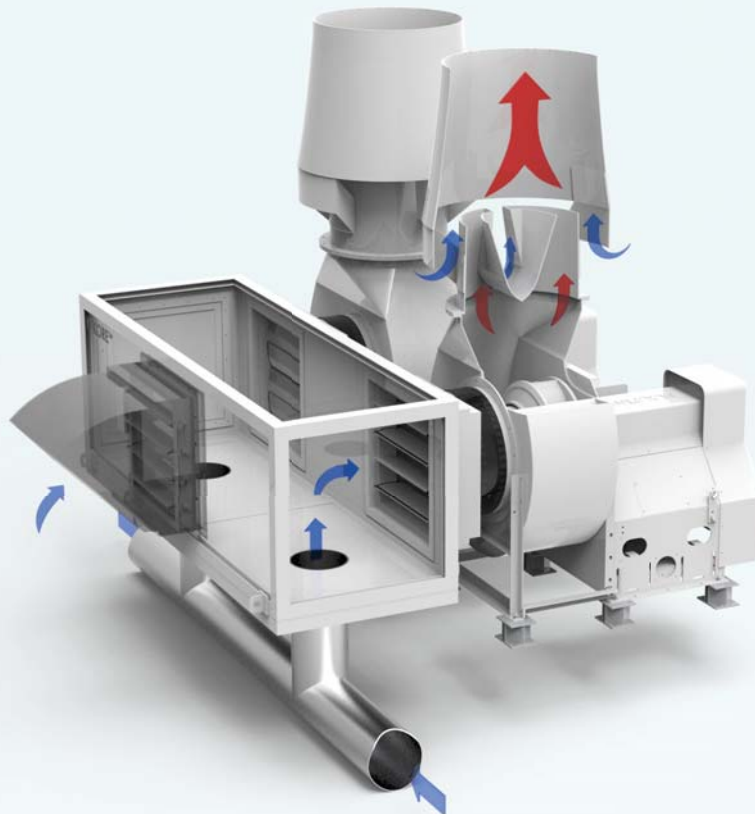


M. K. Plastics Technical Paper

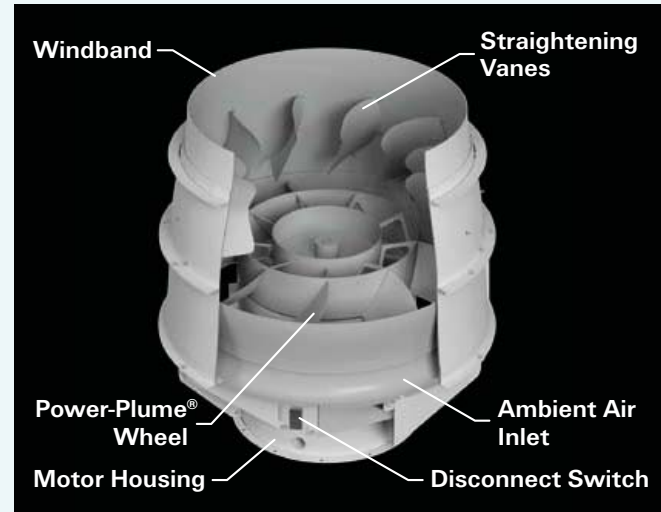
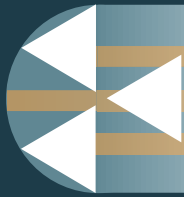
M. K. Plastics Axijet compared to Loren Cook Power-Plume

September, 2014

The M. K. Plastics Axijet is an induced flow fan tested in accordance with AMCA Standards 260 and 300, and Licensed to Bear the AMCA Certified Ratings Seal. It dilutes the exhaust effluent with entrained air. By design, it delivers high nozzle velocity at low BHP. As such, when used with a VFD, the Axijet offers a broad turndown range while maintaining high nozzle velocity, without the need for additional mechanical or electrical accessories.



Axijet-S High Plume Dilution Fan



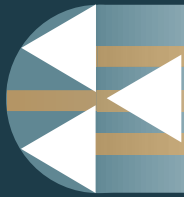
Power Plume Lab Exhaust Fan

The Loren Cook Power Plume is an auxiliary, or booster fan. It is designed to mount on top of the primary critical exhaust fan, typically an inline or SWSI centrifugal fan.

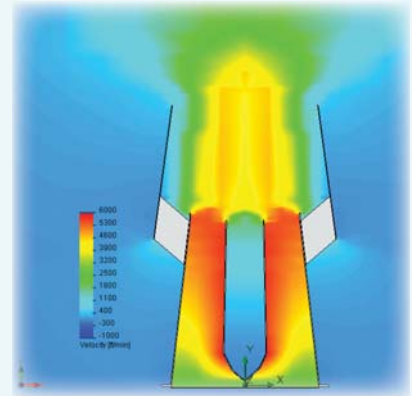
The idea is that the primary exhaust fan can be turned down with a VFD, theoretically to zero flow, while the Power-Plume auxiliary fan runs continuously to generate an exhaust flow rate at a minimum discharge velocity, typically 3,000 FPM.

Let's stop right here to note a few key points:

1. The Power-Plume is **AN EXTRA FAN**. It requires additional installation, wiring, and switchgear cost, and additional BHP and operating cost.
2. It presents additional static pressure loss in the exhaust system, raising exhaust BHP requirements, at any primary flow rate.
3. Many systems incorporate pressure independent air valves, which require static pressure maintenance in the duct. So there is a definite limit to the practical primary exhaust turndown range so as to maintain duct pressure.



In contrast, the M. K. Plastics Axijet has a high nozzle velocity by design. This fan adds no additional SP to the exhaust system. And it can be turned down (typically at least 40%) and still maintain a nozzle velocity above 3,000 FPM, without having to add a second, booster fan, or extra controls.



Consider this case example...

Let's assume a variable volume critical exhaust system. Maximum performance 25,000 CFM at 3.6" SP. Client wishes to maintain 3,000 FPM discharge velocity thru at least a 40% turndown.

The M. K. Plastics Axijet-S 4025

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AXIJET-S 4025

US Patent No.5439349
 CANADA Patent No.2,140,163
 EUROPE Patent No.EP0713011
 M.K. 2011 Version 14.0
 Copyright M.K. Plastics October 31, 2011

Representative: _____

Date: _____

Sys. No.: _____

Drawing Revision: _____ A

Customer Project: _____

Engineer: _____

P.O. #: _____

JOB #: _____

Model	AXIJET	EH	10 [mph]
Fan Size	4025	PH	56.0 [feet]
Dia.[in]	40.25	NV	41.1 [feet]
CFM	25000	WV	5695 [fpm]
SP	3.6	TF	2643 [fpm]
BHP	25.37	T	43149 [cfm]
RPM	1061	TS	11180 [fpm]
Recommended Motor HP :	30.00	T	70 [°F]
		ALT	0 [feet]

CLASS II WHEEL

Air performance
TF=Total Flow; NV=Nozzle Velocity; WV=Windband Velocity
PH=Plume Height; EH=Effective Height; PH+Fan Height; TS=Tip Speed

Sound power level
The sound power level ratings shown are in decibels, referred to 10⁻¹² watts calculated per AMCA standard 301. Values shown are for (outlet Lwo and LwoA) sound power levels for installation type C (Ducted inlet, Free outlet. Ratings do not include the effects of duct end correction. The A-weighted sound ratings have been calculated per AMCA Standard 301.

RPM	63	125	250	500	1000	2000	4000	8000	LWA
1061	94	89	85	85	85	85	78	68	91

Sound pressure level variation
Values shown are calculated based on a free-field over a reflecting plane conditions. (ASHRAE Fundamentals Handbook). dBA levels are not licensed by AMCA International.

Feet	1	3	5	10	15	50	100	150
dB(A)	93	84	79	73	70	59	53	50

Comments : _____

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Engineer: _____

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JOB #: _____

Model	AXIJET	EH	10 [mph]
Fan Size	4025	PH	37.4 [feet]
Dia.[in]	40.25	NV	22.5 [feet]
CFM	13170	WV	3000 [fpm]
SP	2.25	TF	1445 [fpm]
BHP	6.97	T	23590 [cfm]
RPM	690	TS	7271 [fpm]
Recommended Motor HP :	30.00	T	70 [°F]
		ALT	0 [feet]

CLASS II WHEEL

Air performance
TF=Total Flow; NV=Nozzle Velocity; WV=Windband Velocity
PH=Plume Height; EH=Effective Height; PH+Fan Height; TS=Tip Speed

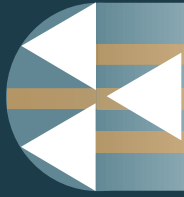
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RPM	63	125	250	500	1000	2000	4000	8000	LWA
690	84	83	76	76	76	76	72	63	80

Sound pressure level variation
Values shown are calculated based on a free-field over a reflecting plane conditions. (ASHRAE Fundamentals Handbook). dBA levels are not licensed by AMCA International.

Feet	1	3	5	10	15	50	100	150
dB(A)	82	73	68	62	59	48	42	39

Comments : _____



The Loren Cook CA 402 (primary) fan performance, net of Power-Plume (booster fan) performance



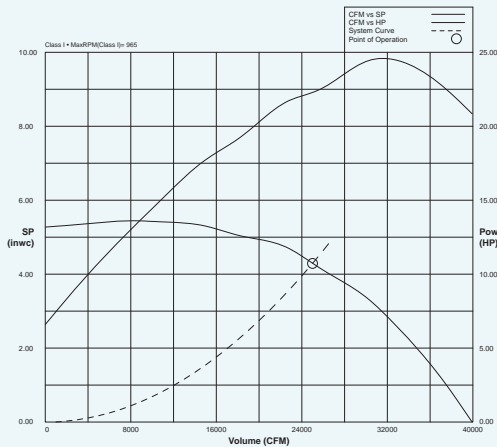
CA-SWSI

Performance	CFM	SP	Fan RPM	Power HP	Motor HP	OVEL (fpm)	TSPD (fpm)	SE	TEMP (°F)	ELEV (Ft)
402CA-SWSI	25000	4.29	951	22.3	25	2656	10021	76%	70	0

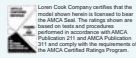
Sound Data 8 Octave Bands 10⁻¹² Watts

1	2	3	4	5	6	7	8	LwA
96	101	97	92	89	85	79	74	105

Performance certified to include the effects of transmission losses. Performance ratings do not include the effects of apparatus (accessories). The sound power level ratings shown are in decibels, referred to 10⁻¹² watts (calculated per ASHRAE Standard 20). Values shown are for duct exit and sound power levels for installation type B. The net sound power level ratings do not include the effects of duct exit connection. The A-weighted sound ratings shown have been calculated per ASHRAE Standard 301.



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CA-SWSI

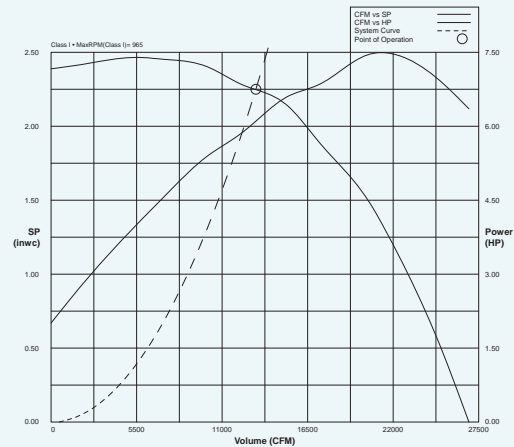
Performance	CFM	SP	Fan RPM	Power HP	Motor HP	OVEL (fpm)	TSPD (fpm)	SE	TEMP (°F)	ELEV (Ft)
402CA-SWSI	13170	2.25	640	6.1	**7.5	1389	6743	76%	70	0

Sound Data 8 Octave Bands 10⁻¹² Watts

1	2	3	4	5	6	7	8	LwA
80	80	83	81	77	72	67	63	83

**May require larger motor for starting.

Performance certified to include the effects of transmission losses. Performance ratings do not include the effects of apparatus (accessories). The sound power level ratings shown are in decibels, referred to 10⁻¹² watts (calculated per ASHRAE Standard 20). Values shown are for duct exit and sound power levels for installation type B. The net sound power level ratings do not include the effects of duct exit connection. The A-weighted sound ratings shown have been calculated per ASHRAE Standard 301.



452340

Note: only generic Power-Plume performance data is available to the public.

Data in this comparison was obtained from an actual job equipment schedule.

Now, compare opposite...

Mfrgr./Model	M. K. Plastics Axijet-S 4025	Cook CA 402 + Power Plume
Max. Condition		
Fan Inlet CFM	25,000	25,000
SP (" wg)	3.6	3.6 + .69 (PP) = 4.29
BHP *	25.37	22.3 + 5.7 = 28
Motor HP	30	25 + 15 = 40
EH **	75.3	62
Fan Discharge CFM	43,149	48,050
Dilution %	73%	92%
LwA	91	95 + PP
fan RPM	1,061	951
Nozzle Velocity, FPM	5,695	?
Min. Condition		
Fan Inlet CFM	13,170	13170
SP	2.25	2.25 + ? (PP)
BHP *	6.97	6.1 + 5.7 = 11.8
EH **	45.3	?
Fan Discharge CFM	23,590	?
Dilution %	79%	?
LwA	80	83 + PP
fan RPM	690	640
Nozzle Velocity, FPM	3,000	?
Fan Turndown %	47%	47%
Fan Height, ft.	14.9	15

* Less drive losses.

**Calculated per ASHRAE 2007 Applications Handbook, Urban; 100' bldg.



Clearly, the M. K. Plastics Axijet offers the following advantages:

1. Competitive HP/energy (operating) cost
2. Competitive turndown range
3. Lower noise
4. Lower installation and wiring cost
5. Lower equipment first cost
6. No discharge parts to seize or become inoperable due to failure or weather
7. Higher nozzle velocity
8. Higher effective plume height
9. The added benefit of dilution air
10. Less complicated controls

Control of the Cook Power-plume multiple fan, VFD, isolation damper, (optional) bypass damper, and redundant fan operation and exhaust system management will be difficult at best, and is up to someone else to figure out. If the power-Plume booster fan operates at constant speed, it will develop constant suction pressure, even as the primary fan is slowed down with a VFD, making it a challenge to effectively control the duct SP.

In contrast, the M. K. Plastics Patented LeadLag system actively controls fan motors, VFDs, isolation dampers, and bypass dampers (when required) to maintain pressure or volume in the system, whichever is the dependant variable. LeadLag also cycles operation of the redundant ran while maintaining full system control. LeadLag reports control activity to the BMS.

The M. K. Plastics Axijet with Leadlag control, is a simpler more reliable, and more complete critical exhaust solution!



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