PRESSURE, NOT CFM

A CHIMNEY DOESN'T FEEL CFM. IT FEELS PRESSURE.

VMASS tops out at 400 CFM. An XV250 draft inducer is rated for 900. That looks like a 500 CFM shortfall, but building science tells us something different. A building can only exhaust as much air as it takes in, and how much a fireplace takes is set by the size of its opening, not by the draft inducer's rating.

XV250 CAPACITY	GAS, 42 IN. OPENING	ENVELOPE AT 0.02 IN. W.C.*	LEFT FOR MAKEUP AIR
900 CFM	**~315 CFM**	**~300 CFM**	**~15 CFM**
ITS CEILING, WORST HOUR	ROOM AIR LEAVING	CODE-BUILT HOME	VMASS IDLES AT 25

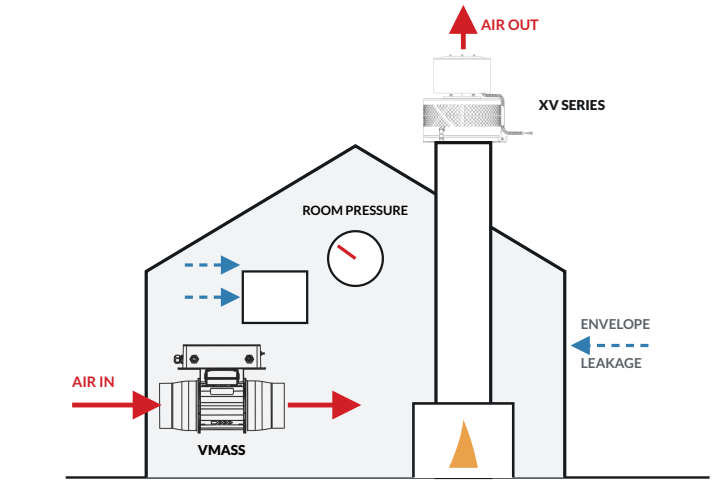
THE QUESTION WE HEAR MOST

"How is 400 CFM enough for an appliance whose draft inducer is rated at 900?"

It's a fair question, and it comes from a fair instinct: match the air in to the air out. The instinct is right. The yardstick is wrong. A CFM rating describes the draft inducer at its limit. It says nothing about how much air the fireplace actually takes, or how much the envelope already supplies.

SHORT ANSWER

One VMASS covers most fireplaces, usually at a fraction of its 400 CFM.



The opening decides.

A fireplace takes the air that crosses its opening. That sets what the room loses, whatever the draft inducer is rated for.

Capacity is a ceiling.

A 900 CFM capacity assumes no resistance. Every real chimney pushes back, and delivered flow falls.

Pressure is the limit.

Codes and combustion safety are written in pascals. A few pascals decides whether a fire drafts or spills.

CODE SIZES FIREPLACE AIR IN SQUARE INCHES

Not Hundreds of CFM.

The model code's exterior air intake for a wood-burning fireplace runs 6 to 55 sq in. At the −7 Pa safety limit for wood-burning appliances, even 55 sq in moves only ~150 CFM. Matching the ~450 CFM a 42 in. wood opening draws would take ~160 sq in, nearly three times the largest intake the code allows. Full replacement through that intake isn't possible, and the code doesn't ask for it.

THE POINT

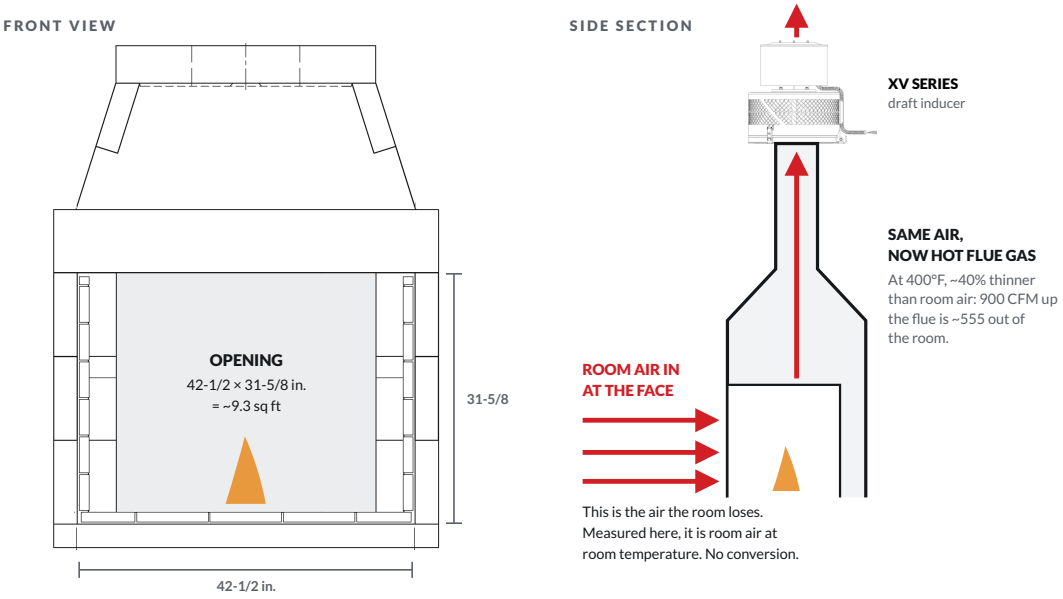
SO WHY SIZE MAKEUP AIR TO A NAMEPLATE?

*Model home used throughout: 3,000 sq ft, 9 ft ceilings (27,000 cu ft), tested at 3 ACH50, the most common energy code limit in the U.S. Leakage flow exponent 0.65. Calculated values, rounded.

STEP ONE

THE OPENING DECIDES HOW MUCH AIR LEAVES THE ROOM.

A fireplace doesn't take air at the draft inducer's rating. It takes the air that crosses its opening: enough to carry the smoke in and up, and no more. That air leaves the room at room temperature, so it is easy to measure and easy to size.



The Math Fits on One Line.

Air leaving the room = opening area × face velocity

Face velocity is how fast room air crosses the opening. Fireplace sizing practice uses ~0.8 ft/s for wood, the ASHRAE cold-start design figure. Gas burns cleaner and needs less: X-VENTISO field sizing uses ~0.56 ft/s.

42 IN. OPENING	FACE VELOCITY	AIR LEAVING THE ROOM
Gas	**~0.56 ft/s**	**~315 CFM**
Wood	~0.8 ft/s	~450 CFM

9.3 sq ft × 0.56 ft/s × 60 s/min = ~315 CFM.

Published makeup air tables are built the same way: opening size × a design velocity. What they leave out is the air the building already supplies.

So Where Does the 900 Go?

Into reserve. The XV250 is selected for the worst hour: a cold start, a windy night, a house pulling hard. At full speed on a 400°F flue, its 900 CFM rating is ~555 CFM of room air. The opening only asks for ~315.

XV250 AT FULL SPEED, AS ROOM AIR: ~555 CFM

USED ~315	RESERVE ~240

Reserve is why the draft holds in wind and on a cold start.
It is also why most installs are commissioned near 38 V.

The draft inducer's rating tells you how hard it can pull. The opening tells you how much air the room actually loses.

WHAT VMASS ACTUALLY RUNS AT

EVEN TIGHT HOMES DON'T RUN VMASS TO CAPACITY.

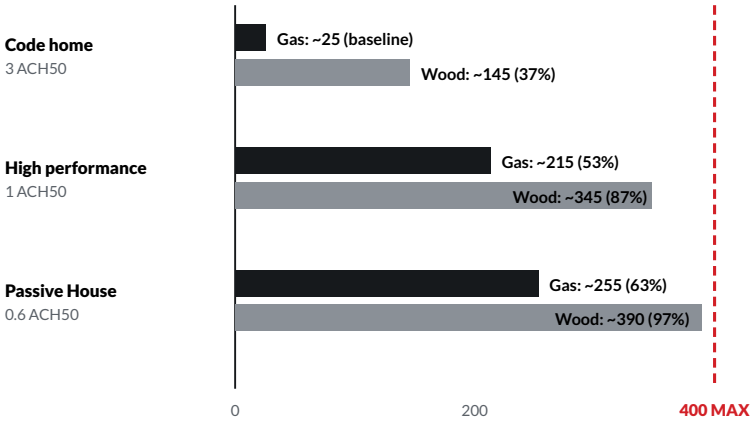
Part of the air the opening needs comes in through the envelope on its own. A blower door test measures how much: it pulls the house to 50 Pa and records the flow, CFM50. At VMASS's 0.02 in. w.c. band, a house admits ~22% of that flow.

$$\text{Leakage} = \text{CFM50} \times (\text{pressure} \div 50\ \text{Pa})^{0.65}$$

VMASS supplies only the difference: what the opening takes, minus what the envelope already lets in.

Model home: 3,000 sq ft, 9 ft ceilings. Same leakage method as every blower door report and the ASHRAE Handbook of Fundamentals.

VMASS AIRFLOW, 42 IN. OPENING



WORST CASE

Sized for the Cold Start, It Still Fits.

The wood bars use 0.8 ft/s, the design number for a cold start, not the steady burn. Even in a Passive House, a 42 in. wood opening stays inside one VMASS. With the fireplace off, it idles at its 25 CFM baseline.

HOW BIG CAN THE OPENING GET?

LARGEST OPENING, ONE VMASS	GAS	WOOD
Code home, 3 ACH50	~21 sq ft	~15 sq ft
High performance, 1 ACH50	~15 sq ft	~10 sq ft
Passive House, 0.6 ACH50	~14 sq ft	~10 sq ft

For scale: the 42 in. opening shown is ~9.3 sq ft; 48 × 36 in. = 12 sq ft; 60 × 36 in. = 15 sq ft. Larger openings in very tight homes: a second VMASS, sized from the plans.

OUR LARGEST DRAFT INDUCER

The XV350: Rated 2,100 CFM.

Shown on a 45 × 54 in. opening: ~570 CFM on gas, ~810 on wood. Big fireplaces go in big homes, and big homes bring more envelope.

6,000 SQ FT HOME	GAS	WOOD
Code home, 3 ACH50	**Baseline**	**~205 · 1 unit**
High performance, 1 ACH50	~365 · 1 unit	~610 · 2 units
Passive House, 0.6 ACH50	~445 · 2 units	~690 · 2 units

STEP THREE

PRESSURE IS THE LIMIT. A FEW PASCALS DECIDE.

Natural draft is weak. A warm flue produces only a few pascals of lift, and a room pulling harder than that wins. Every combustion safety limit is written in pascals, never in CFM.



Exhaust shown with no makeup air, in the 3,000 sq ft, 3 ACH50 model home. Fan ratings typical, for illustration.

Limits: CMHC chimney safety guidance (open fireplace), DOE Standard Work Specifications (wood-burning and power-vented appliances). Education only; consult the appliance manufacturer for its own limits.

HOW VMASS HOLDS THE LINE

FOLLOWS THE ROOM, NOT THE HOOD.

1. **Senses**

   Two pressure sensors, one outside the envelope and one in the zone. The setpoint moves with weather and elevation.

2. **Holds**

   Controls the zone to neutral against outdoor pressure, within 0.02 in. w.c., running quietly at a 25 CFM baseline most of the time.

3. **Ramps**

   When the zone goes past that band, VMASS ramps toward 400 CFM, as much as the room needs and no more.

4. **Tempers**

   A 2.0 kW duct heater warms the incoming air. Nothing to calibrate: the controller is factory-sealed.

Because VMASS measures the result instead of any one appliance, it answers to everything acting on the zone at once: the fireplace, the range hood, the dryer, the bath fans, the wind, and the envelope itself. Kitchen hoods over 400 CFM get their own makeup air, sized to the hood.

Oversupply has a cost too. Dump in a fixed 600 CFM with no exhaust running and the model home goes ~14 Pa positive, pushing warm, moist air into the walls, and every one of those CFM has to be heated.

> **One zone, one design, one call: the chimney and the air that feeds it.**

THE TAKEAWAY

SIZE MAKEUP AIR TO PRESSURE, NOT TO A NAMEPLATE.

Send us the plans. We size the draft inducer and the makeup air together, for the zone they share, and stand behind both.

SUBMIT PLANS

plans@x-ventiso.com

800.642.2920

x-ventiso.com

All flows calculated for the stated model home with a leakage exponent of 0.65 and rounded; actual results depend on the building, the chimney and the appliances. Installation per X-VENTISO instructions and the authority having jurisdiction.