fantech®
a systemair company

Makeup Air Systems

What goes out, must come in

MUAS
Makeup Air System

Why do we need makeup air?

In a nutshell - we would otherwise have problems. Today's homes are built to be more energy-efficient. "Tighter" construction resists the infiltration of outdoor air through the home's exterior, which limits the amount of makeup air the home will permit. Of course, you can only exhaust out from the home as much air as is able to come back in. Without makeup air, even a powerful exhaust fan can only remove as much air from the home as is permitted via infiltration.

When an exhaust fan operates without sufficient makeup air, some undesirable results can occur:

The exhaust system will not work to its intended capacity

Kitchen hood exhaust systems are sized to remove cooking-generated heat, odors and contaminants based on the cooking equipment's dimensions and heat rating. Inadequate makeup air can prevent a kitchen hood exhaust system from adequately removing contaminants.

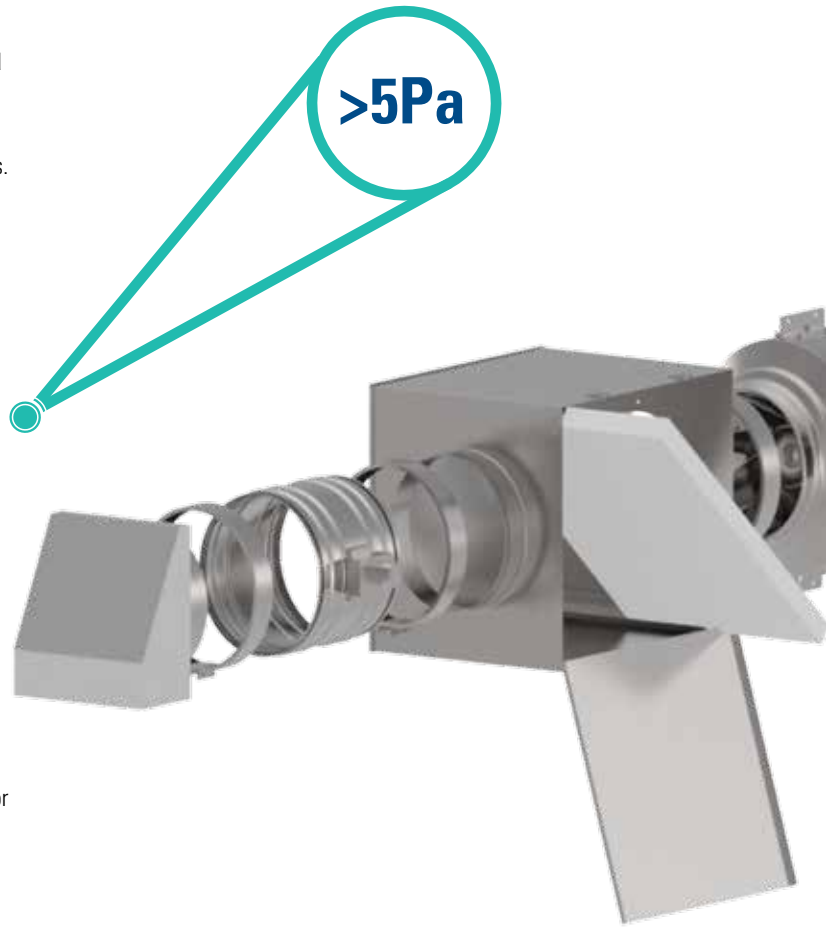
Backdrafting of chimneys and appliance vents

Insufficient makeup air will result in depressurization in the home. Depressurization works to halt the flow of hearth and appliance combustion products from exiting the home. This "backdrafting" can result in a dangerous accumulation of harmful gases in the home. Studies by the Building Performance Institute (BPI) and Residential Energy Services Network (RESNET) have shown that as little as **5 Pa (0.02" w.g.)** depressurization can cause backdrafting.

Non-compliance with the US and Canadian building codes

In the US, the construction industry has long recognized the need for adequate makeup air for exhaust systems. Beginning in 2009 and in every version since, the International Residential Code (IRC) has required that makeup air be provided for kitchen hood exhaust systems with capacity of 400 cfm or greater.

Canada's National Building Code has a section entitled, Protection Against Depressurization. Essentially, any exhaust device operating at a higher airflow rate than the normal operating exhaust capacity for the dwelling shall have provision for make-up air.



White paper available

SPECIFIERS: please visit our website at **www.fantech.net** to view our Independent Engineering White Paper, Residential Exhaust Makeup Air: Explanations and Solutions, which explains why active makeup air is the only proper solution for your customers.

The Fantech Makeup Air System is the only solution

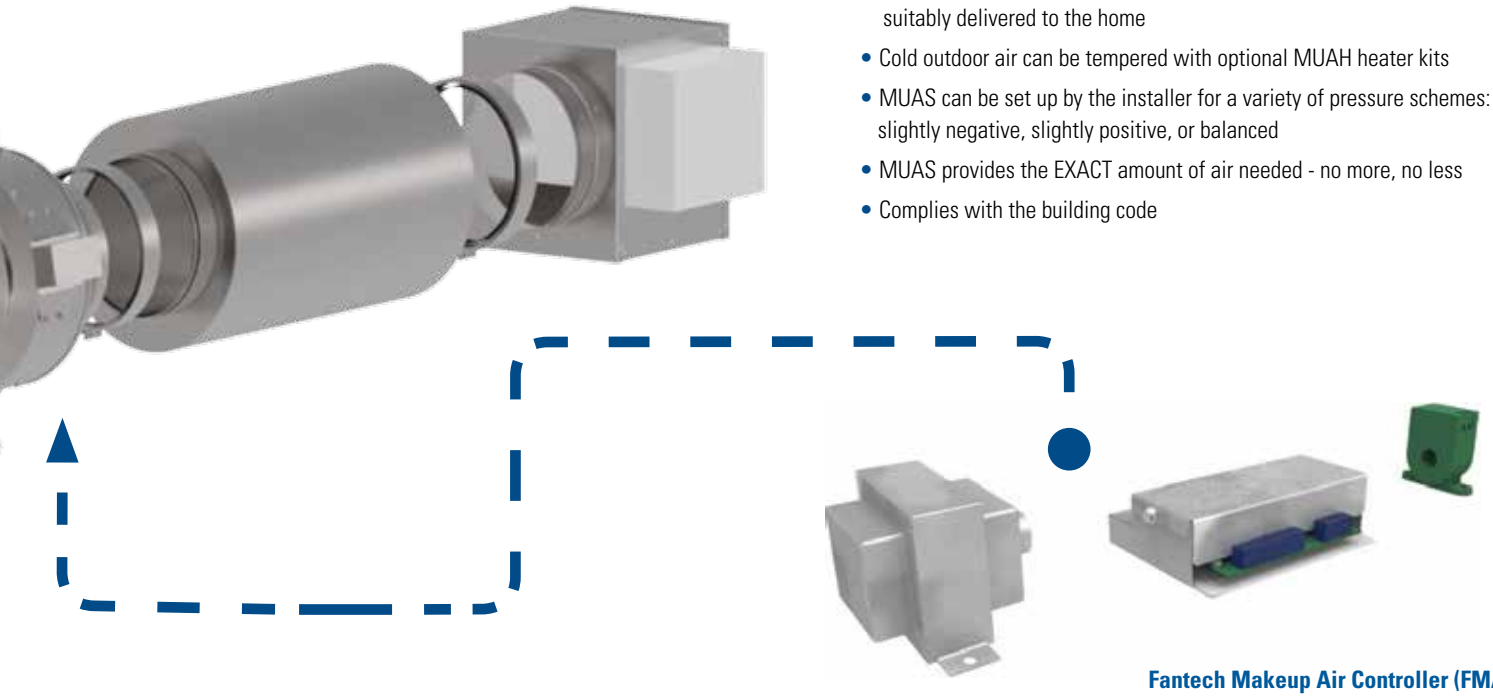
A home builder could actually satisfy a home's makeup air requirement by leaving a relatively large hole (or several) in the exterior wall. Although, a hole in the wall might satisfy the makeup air requirement in the code, most would agree that such a solution is hardly ideal, especially during peak seasonal weather conditions.

The "passive" solution is similar to the hole in the wall. This solution has no fan supplying air into the home, so the home MUST be depressurized for air to flow in. This results in a very large opening (or multiple ones) in order to keep the level of depressurization below the backdrafting threshold. The passive solution does not accommodate direct filtering and tempering, since it is not fan-forced.

The Fantech's Makeup Air System (MUAS) is a "powered" or "fan-forced" system. The MUAS is triggered when the compensated exhaust system is energized. The MUAS damper opens and the MUAS fan is powered on. The fan is speed-controlled relative to the speed of the compensated exhaust system's fan speed. In other words, as you speed up the exhaust fan, the MUAS fan speeds up too, and vice versa.

Fantech Makeup Air System advantages at glance:

- Automatic, infinitely modulating air flow in proportion to the exhaust
- Particulate matter is filtered from the outdoor air before it is delivered to the home
- Since it is fan-forced, makeup air can be ducted to where it can be most suitably delivered to the home
- Cold outdoor air can be tempered with optional MUAH heater kits
- MUAS can be set up by the installer for a variety of pressure schemes: slightly negative, slightly positive, or balanced
- MUAS provides the EXACT amount of air needed - no more, no less
- Complies with the building code



Fantech Makeup Air Controller (FMAC)

The patented FMAC is the brains of the makeup air system. While the compensated exhaust system is operating, the makeup air fan supplies air at a rate necessary to maintain the desired building pressure scheme as set up by the installer. The makeup air flow rate automatically and infinitely varies proportionally with the speed at which the exhaust is operated by the homeowner. A neutral (balanced) pressure scheme is common, but the installer can also employ a slightly positive or negative pressure scheme should he desire.

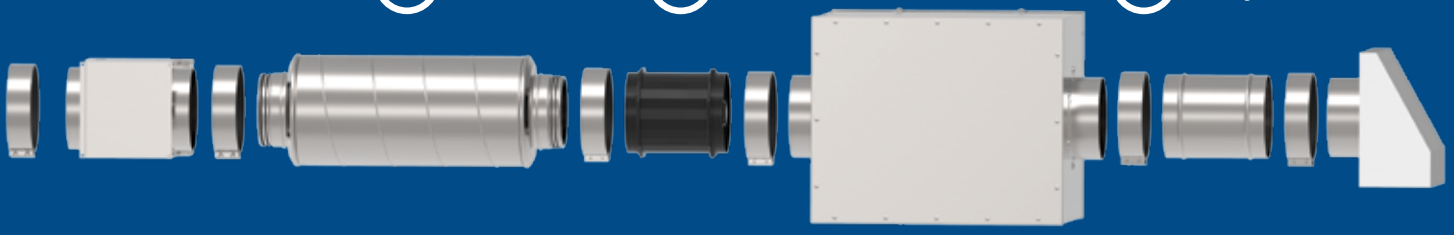
The FMAC includes a current transducer, system controller, transformer, and a NEMA electrical enclosure.

Makeup Air System
Ducted Components

Duct Silencer
Provides ducted sound attenuation between makeup air fan and the location of makeup air delivery to the home.

Makeup Air Fan
EC motor-driven fan is automatically speed-controlled by the makeup air system controller.

Fast Clamp
Lined with neoprene to give a vibration-absorbing, tight fit.



Duct Heater (optional)
Controlled via discharge air temperature, the heater automatically varies its modulating heat output to deliver air at the temperature set point, even as the air flow rate and outdoor air temperature vary.

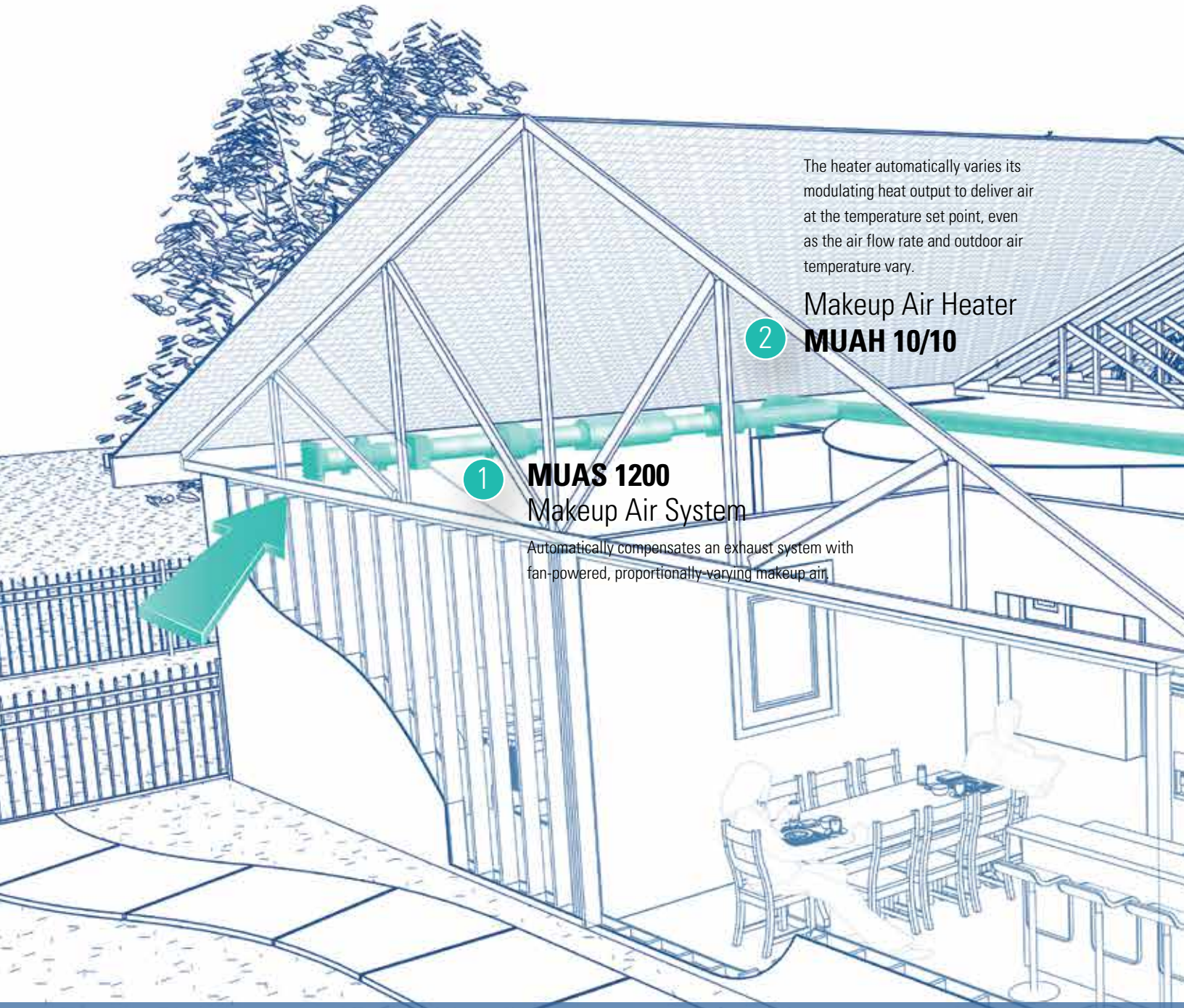
Filter Cassette
Galvanized housing with filter access includes MERV 8 filter for removing dust and pollen before air is delivered to the home.

Shut-off Damper
Normally closed, motorized damper is open only when makeup air system is operating.

Wall Intake Hood
Air inlet to makeup air system; includes bug screen.

Beginning in 2009 the International Residential Code® (IRC®), used in the US has included a kitchen makeup air requirement. A paragraph in chapter 15 of both the 2009 and the 2012 IRC® reads:

M1503.4 Makeup air required:
Exhaust hood systems capable of exhausting in excess of 400 cfm shall be provided with makeup air at a rate approximately equal to the exhaust air rate. Such makeup air systems shall be equipped with a means of closure and shall be automatically controlled to start and operate simultaneously with the exhaust system.



The heater automatically varies its modulating heat output to deliver air at the temperature set point, even as the air flow rate and outdoor air temperature vary.

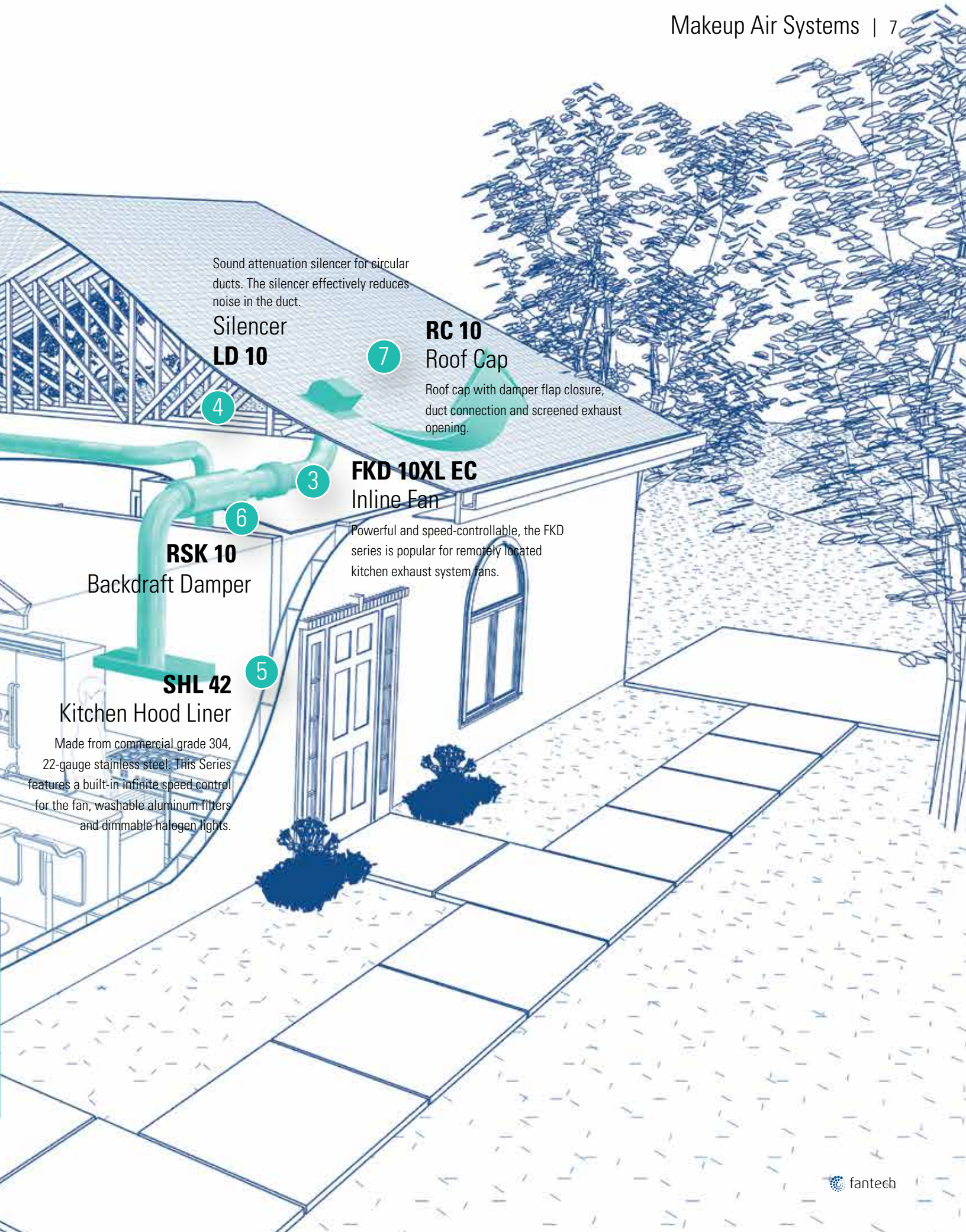
2 Makeup Air Heater
MUAH 10/10

1 **MUAS 1200**
Makeup Air System
Automatically compensates an exhaust system with fan-powered, proportionally-varying makeup air.

Makeup air system in a Single Family Home

A residential makeup air system needs to be both simple and effective. It must be versatile in how and where it can be installed in the home. It must operate automatically to accommodate a fluctuating exhaust air flow rate and a wide range of outdoor temperatures. And, most importantly, a makeup air system needs to replenish exhausted air while not endangering occupants with the potential for backdrafting appliance vents and hearth chimneys.

Fantech's Makeup Air System does more than provide a means to satisfy the building code – it's an engineered solution for a complex application.



Sound attenuation silencer for circular ducts. The silencer effectively reduces noise in the duct.

Silencer
LD 10

4

RC 10
Roof Cap

7

Roof cap with damper flap closure, duct connection and screened exhaust opening.

3

FKD 10XL EC
Inline Fan

Powerful and speed-controllable, the FKD series is popular for remotely located kitchen exhaust system fans.

6

RSK 10
Backdraft Damper

5

SHL 42
Kitchen Hood Liner

Made from commercial grade 304, 22-gauge stainless steel. This Series features a built-in infinite speed control for the fan, washable aluminum filters and dimmable halogen lights.

Choose a MUAS that fits your home

Step I - Size your system

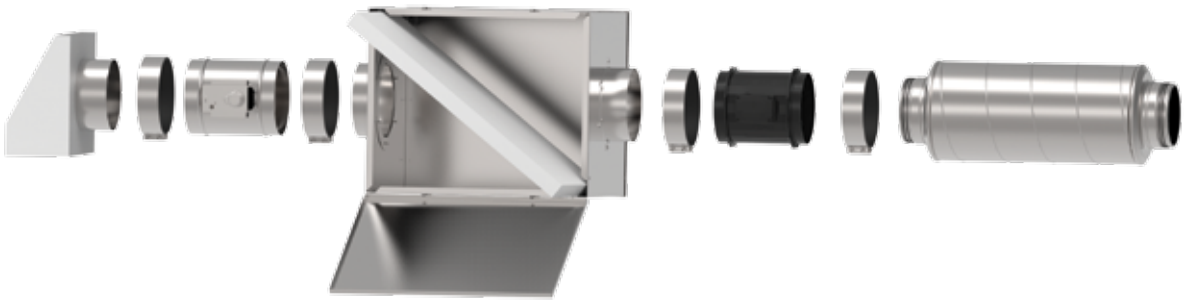
Select the Makeup Air System with capacity to compensate for the maximum air flow rate of the exhaust system being served. The MUAS includes all system component items except a heater (optional accessory), wiring, duct work, insulation and electrical disconnect. To choose a heater, follow Step II.

Specification data

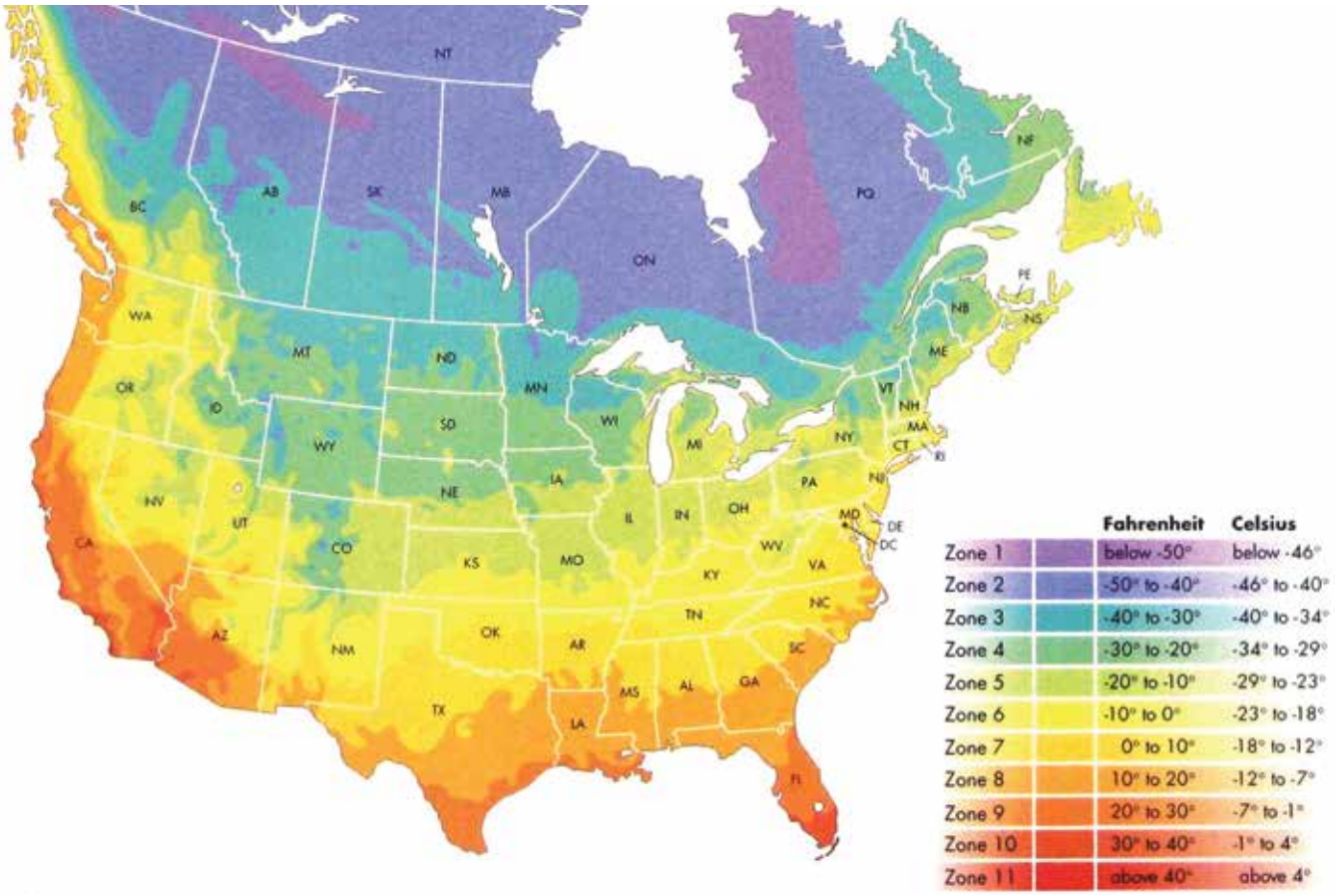
Model			MUAS 750	MUAS 1200	MUAS 1600	MUAS 2000
	Maximum Airflow Rate	cfm	750[1]	1,156[1]	1,600[2]	2,000[2]
Included components	FMAC Makeup Air Control[3]		(1) FMAC	(1) FMAC	(1) FMAC	(1) FMAC
	Metal Wall Intake Hood		(1) FML 8	(1) FML 10	(1) FML 12	(1) FML 14
	Motorized Shut-off Damper		(1) ADC 8	(1) ADC 10	(1) ADC 12	(1) ADC 14
	Filter Cabinet w/ Pleated Filter		(1) FGR 8HV	(1) FGR 10HV	(1) FGR 12HV	(1) FGR 14HV
	Fan with EC-motor		(1) PrioAir 8 EC	(1) PrioAir 10 EC	(1) FKD 12XL EC	(1) FKD 14XL EC
	Duct Silencer		(1) LD 8	(1) LD 10	(1) LD 12	(1) LD 14
	Mounting Clamp (in pairs)		(2) FC 8	(2) FC 10	(2) FC 12	(2) FC 14
					(1) FC 12-315	
	Item #		K46013	K46014	K46001	K46002
	Shipping Weight	lbs	121	132	179	202

[1] Air flow rate for fan operating at full speed against 0.2" w.g. static pressure
[2] Air flow rate for fan operating at full speed against 0.5" w.g. static pressure
[3] FMAC includes a current transducer, a control transformer, a system control board and an electrical enclosure

MUAS 750 and MUAS 1200



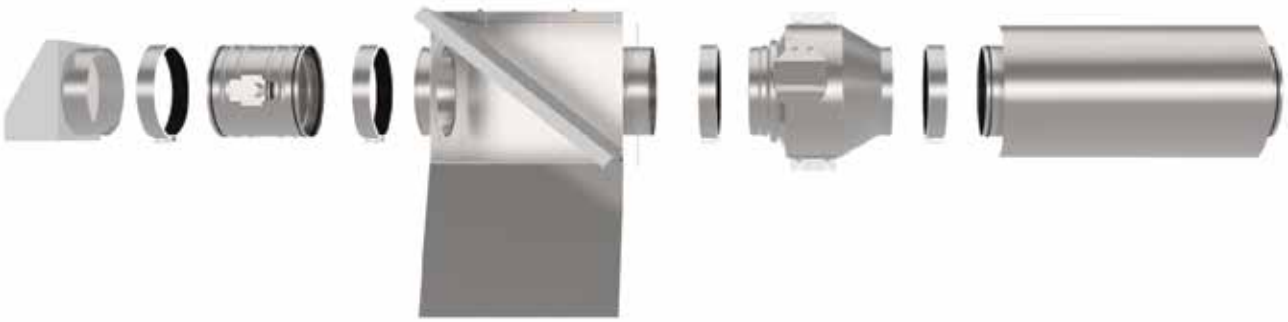
Outside average air temperature by zone*

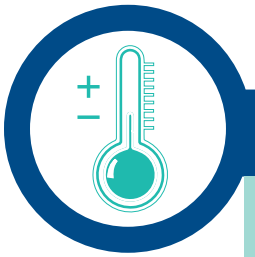


*** NOTE:**

Some areas, particularly those at high elevation, might experience colder average temperatures than the map suggests.

MUAS 1600 and MUAS 2000





Step II - Choose your heat

Select the appropriate Makeup Air Heater (if any). Select heat capacity as desired or as suggested by map zone. Each Makeup Air Heater includes an electric heater and mounting clamps.

Specification data

Model		MUAH 8 / 6	MUAH 10 / 10	MUAH 12 / 10	MUAH 12 / 20
Maximum Allowable Airflow Rate	cfm	750	1,200	1,600	2,000
May be used with MUAS model		MUAS 750	MUAS 1200	MUAS 1600	MUAS 2000
Maximum Heat Output	kW / BTUh	6 / 20,490	10 / 34,140	10 / 34,140	20 / 68,280
Heater Duct Connection Diameter	inch	8	10	12	12

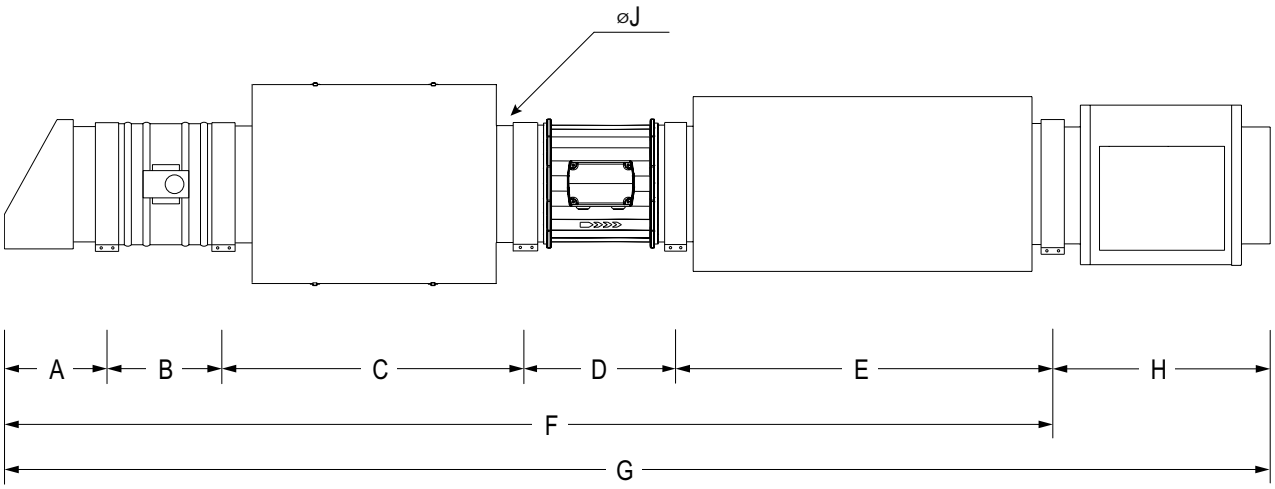
Electric Heater Application Table		Zones	Temp Rise (°F)	Zones	Temp Rise (°F)	Zones	Temp Rise (°F)	Zones	Temp Rise (°F)
Suggested Heater Selection for Map Zones[4,5]	400 cfm	7 - 11	47	4 - 7	79	n/a		n/a	
	500 cfm	7 - 11	38	5 - 7	63				
	600 cfm	8 - 11	32	6 - 9	53	6 - 9	53	1 - 4	105
	700 cfm	8 - 11	27	7 - 11	45	7 - 11	45	1 - 4	90
	800 cfm	9 - 11	24	7 - 11	40	7 - 11	40	4 - 7	79
	900 cfm	n/a		7 - 11	35	7 - 11	35	4 - 7	70
	1,000 cfm			8 - 11	32	8 - 11	32	5 - 7	63
	1,100 cfm			8 - 11	29	8 - 11	29	5 - 9	57
	1,200 cfm			n/a		8 - 11	26	6 - 9	53
	1,300 cfm					8 - 11	24	7 - 11	49
	1,400 cfm					8 - 11	22	7 - 11	45
	1,500 cfm					8 - 11	21	7 - 11	42
	1,600 cfm					8 - 11	20	7 - 11	40
	1,700 cfm					n/a		7 - 11	37
	1,800 cfm							7 - 11	35
	1,900 cfm							8 - 11	33
	2,000 cfm							8 - 11	32

Included components						
	Electric Heater		SDHR 8-6K	SDHR 10-10K	SDHR12-10K	SDHR 12-20K
	Mounting Clamp (in pairs)		(1) FC 8	(1) FC 10	(1) FC 12	(1) FC 12
Item #			K46015	K46017	K46010	K46011
Shipping Weight		lbs	70	75	75	75

[4] Map zones 9 -11 have a climate that does not necessarily require a heater for makeup air. Heat may be included, if desired.
[5] MUAH models can only provide the temperature rise as indicated. During very cold conditions heaters might not deliver air at the temperature set point.

Dimensions

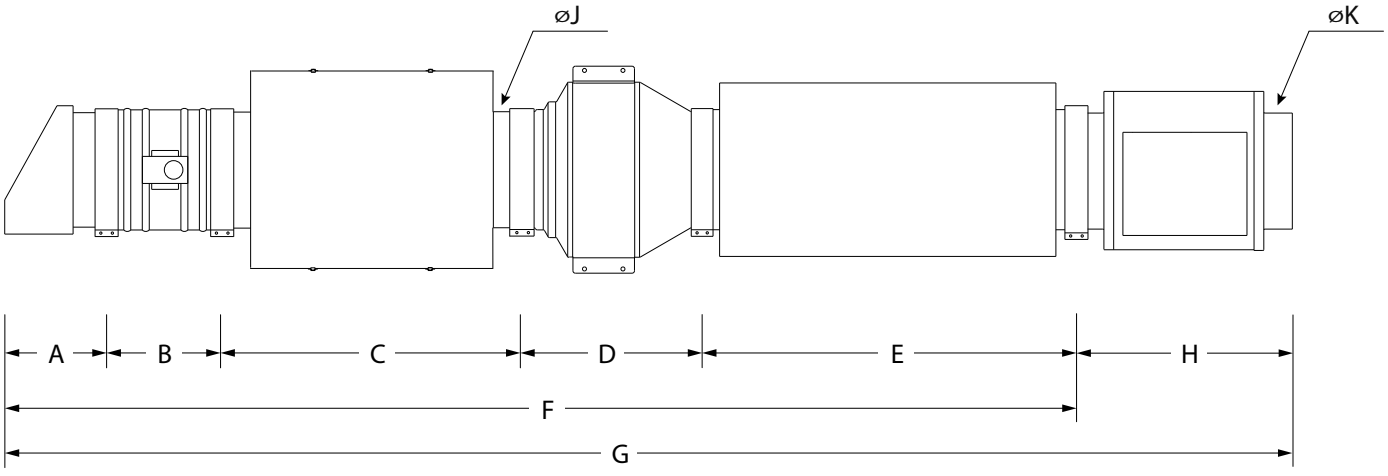
MUAS 750 and MUAS 1200



Model	A	B	C	D	E	F	H (optional)	G	J
MUAS 750	10	10	30 1/2	7 7/8	26 5/8	85	14	99	8
MUAS 1200	10	10	30 1/2	9 13/16	38 1/2	98 13/16	14	112 13/16	10

All dimensions are in inches.

MUAS 1600 and MUAS 2000



Model	A	B	C	D	E	F	H (optional)	G	J	K
MUAS 1600	10 1/2	12	30 1/2	18 7/8	38 1/2	110 3/8	14	124 3/8	12	12
MUAS 2000	10 3/4	14	30 1/2	20 3/8	38 1/2	114 1/8	24[6]	138 1/8	14	12

All dimensions are in inches.
[6] This dimension includes a 14"-12" duct size reducer (not shown), not provided.

Colorado Homebuilder Meets Kitchen Makeup Air Requirement with Fantech

Bruce Fraser of Fraser Construction LLC knows something that many builders do not. You can have a suitably sized kitchen exhaust system and still meet the IRC M1503.4 makeup air requirement without breaking the bank.

This "good-to-know" information came as a result of a major kitchen addition/ renovation that Fraser completed at a home just west of Vail, Colorado, in the upscale community of Cordillera. The kitchen already had a high-end, 1200 cfm exhaust hood that assimilated nicely with the renovation – but the building inspector had some bad news. The home did not meet the newly adopted IRC M1503.4 code, which states:

> Exhaust hood systems capable of exhausting in excess of 400 cfm (0.19 m^3/s) shall be provided with makeup air at a rate approximately equal to the exhaust air rate. Such makeup air systems shall be equipped with a means of closure and shall be automatically controlled to start and operate simultaneously with the exhaust system.

Luckily, Fraser's mechanical contractor had solution: a new Fantech Makeup Air System with an electric coil for makeup air reheat.

The Fantech makeup air system was specifically designed to help builders and contractors to meet IRC M1503.4. Per the code's requirement, the Fantech system automatically supplies makeup air at a rate that is equal to the exhaust air of the kitchen fan. An integral transducer actually measures the current draw from the exhaust fan and uses that information to precisely regulate the volume of make-up air so air is always balanced.

The packaged duct heater was particularly beneficial in this project since the Cordillera home relies on radiant rather than forced air for space heating.

> "At this home it would have been really expensive to connect the supply and return for the makeup heat back to the boiler plant. We would have had to purchase an additional pump, and getting all that piping through an existing home would have been tough," said Justin Nielsen, owner of Skyline Mechanical.

Although IRC M1503.4 has challenged builders, it is rooted in safety. Since modern homes are built with far less air leakage than they have in the past, the operation of a high-cfm exhaust hood can cause a negative pressure inside the home. This can result in back-drafts from fuel-burning appliances, which can lead to unsafe levels of carbon monoxide and other toxins inside the home.

Bruce Fraser understands and respects the purpose of the code.

> "My greatest concern as a builder was to avoid any potential for carbon monoxide poisoning. And of course we have to be able to meet code within the budget constraints of the project."

Project location:	Cordillera, Eagle County, CO	**Exhaust hood size:**	1,200 cfm
Builder:	Fraser Construction LLC	**Fantech products:**	MUAS 1600
Contractor:	Skyline Mechanical Inc.	**Month, Year completed:**	March, 2015

Abiding by Code in the Pacific Northwest
with Fantech's Makeup Air System

Some mechanical contractors are willing to sidestep a few building codes in order to keep a builder happy and on budget. Bob's Heating and Air Conditioning, the Washington state contractor, is not one of them, especially when comes to safety. That's why Doug Quinn, General Manager of Bob's Heating makes a point of meeting the IRC M1503.4 code for makeup air, even though it hasn't always been easy.

Without a make-up air system, the operation of high volume kitchen fans (common in homes today) could create a negative pressure and lead to "back-drafting" of hazardous combustion products (e.g. carbon monoxide) into the home. Although some jurisdictions may not yet be enforcing the code, Doug Quinn says, that's no excuse for failing to install a makeup air system.

> "We do work in just about every jurisdiction up and down the Puget sound region. Just because one jurisdiction is overlooking the requirements doesn't give us the right to overlook it. The whole idea of that code is health and safety," said Quinn.

It's a point that Bob's Heating and JayMarc Homes, a builder of fine homes in the greater Seattle area agree on. Jeremy DeBoer, site supervisor for JayMarc Homes worked with Bob's Heating on the mechanical HVAC installation at a new spec home on 90th Avenue, Mercer Island, WA. Like many homes on the island, the home had a commercial-sized oven and exhaust fan and needed a makeup air system.

> "Not many homeowners understand what [the Code] is for, but as the builder we understand and we try to explain the purpose and the benefits to the homeowners," said DeBoer.

In the past, Bob's Heating had always designed and built make-up air systems from individually sourced components. It was tedious and time consuming. The contractor decided to try something new on the Mercer Island home. He liked the Fantech system because it was modular, yet included everything he needed: Fantech's makeup air system is automatically energized whenever the kitchen exhaust fan is operating. By virtue of the control package, it closely matches the outgoing air with fresh makeup air, preheated as needed. Doug Quinn was impressed with the product's overall capability and how easy it was to install.

> "The installation went pretty darn well. I'm not aware of any other exhaust make-up air solution that allows the flexibility to automatically adjust the makeup air CFM and preheat the incoming air."

Project location:	Mercer Island, WA	**Exhaust hood size:**	600 cfm
Builder:	JayMarc Homes	**Fantech products:**	MUAS 650[1]
Contractor:	Bob's Heating & Air Conditioning Inc.	**Month, Year completed:**	January, 2015

[1] The MUAS 650 has now been replaced with the MUAS 750.

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