HAVEN SUPPLY AND EXTRACT TERMINALS SPECIFICATION GUIDE

Haven RANGE

CONTENTS

PROUD TO BUILD BRITISH

We've been pioneers in new air technology since 1966. Our heritage is in the design and manufacture of fans and ventilation systems. We put our energy into efficient ventilation so you don't waste yours.

Pioneering
We lead the way in product innovation with a stream of ground-breaking products over decades.

Trusted
We have a reputation for our build quality. We establish long term relationships and are always transparent with our test data.

Agile
We're one of the UK's leading manufacturers, covering both residential and commercial air quality. We offer innovative advice and provide flexible solutions.

Expert
Our team is made up of over 600 people, 50 of which have over 25 years' experience. We have the skills and knowledge to help find the best solution for our customers.

Attentive
We're expert listeners, rising to any challenge and going the extra mile for our customers. We add value by solving problems. We sell solutions, not fans.

Personal
We work closely with our customers and can provide bespoke solutions to meet their specific project needs. Many of our product ranges were developed this way.

"Our expertise, experience and innovation is what makes us stand out from the rest of the market."

Wayne Glover, Managing Director, Nuaire.

For help with selecting a unit, speak to us on 02920 858200 or email: enquiries@nuaire.co.uk

THE WIDER IAQ ISSUES

The quality of the air we are exposed to, day in and day out, makes a massive difference to how we feel. That's why indoor air quality is always a big priority for building designers.

The UK Government recently recognised air pollution as the most significant environmental risk to public health, costing the economy around £20bn and the associated increase in poor health and early death make poor air quality a bigger killer worldwide than smoking, contributing to 20,000 premature deaths every year.

Given we spend around 90% of our time indoors, addressing the quality of the air we breathe when inside – both in terms of pollutants from external sources and pathogens circulating within – is critical.

The ventilation in workplaces is critical for employees' health and safety risk assessments, particularly when looking at protective measures to help stop the spread of airborne pathogens.

GOING FURTHER TO CREATE HEALTHY BUILDINGS

A well-designed ventilation system creates a healthy, comfortable environment for building occupants by supplying fresh air whilst extracting pollutant-laden air. These systems help to make our offices, living and leisure spaces healthier places to be.

The efficacy of a ventilation system is typically verified during the commissioning process, based on the design of the building at that time. But this does not accommodate the changes in usage and personnel layout that happen in most buildings over time.

Most ventilation systems do not have the flexibility to sufficiently adapt to these changes so that they can maintain an adequate supply of fresh air for all individuals.

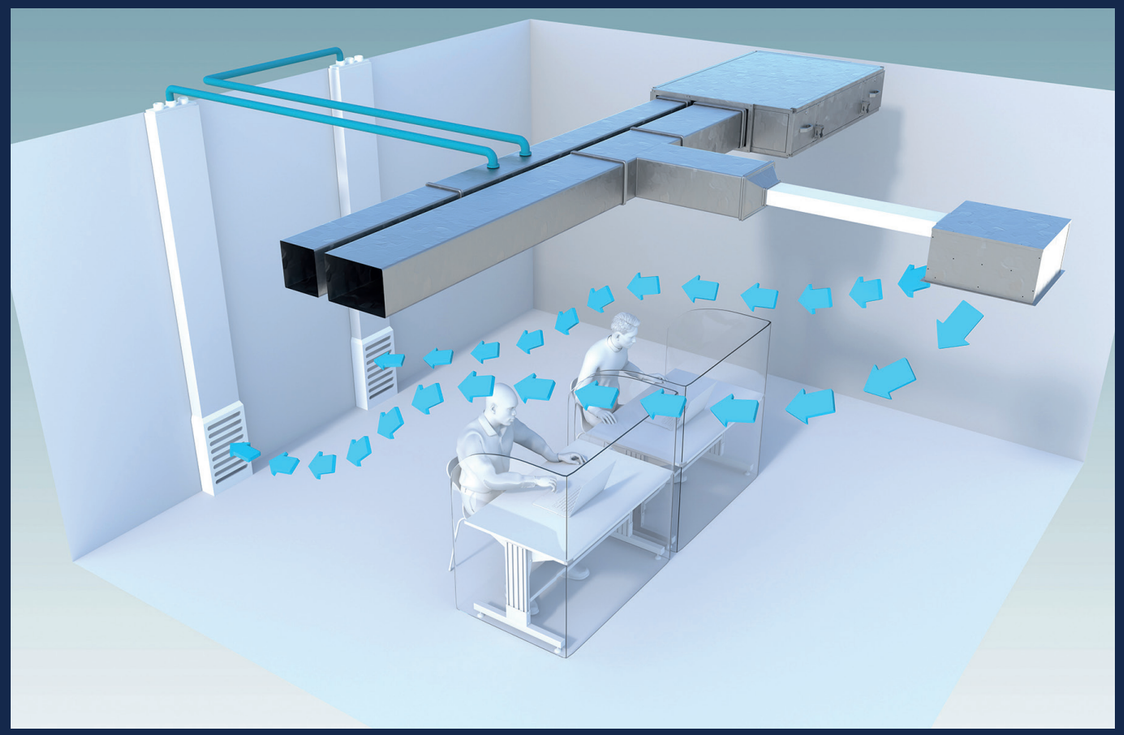
This therefore creates a greater risk that pollutants generated by the occupants can be shared with others – making a building a less healthy place to live, work or enjoy leisure time

This led us to develop the Haven Supply and Extract terminals system – a unique concept that makes it easier to deliver targeted, filtered ventilation and help keep occupants healthy.

INTRODUCING HAVEN SUPPLY AND EXTRACT TERMINALS

Haven Supply and Extract Terminals overcome challenges often encountered when ensuring all occupants receive the right supply of fresh air, even when building layouts are changed.

PATENT APPLIED FOR



REDUCED RISK TO OCCUPANTS FROM POLLUTANTS

with fully specified and accessible terminal or module filtration.

CONTROL OF EXTERNAL AND INTERNAL POLLUTION SOURCES

when using filtration and high intensity UVC radiation as a sterilisation option.

FLEXIBILITY TO MEET EXISTING AND FUTURE NEEDS

with readily adjustable targeted supply airflow and localised extract.

OPTIMISED ENERGY USAGE

when installed with highly efficient air movement equipment, even where filtration levels may be more than today's typical standards.

THE HAVEN STANDARD

With occupant health and well-being at the core of our thinking, Haven Supply and Extract Terminals have been developed to allow the provision of the best air quality possible for each individual – without resorting to extremes of personnel segregation. This led us to consider how we could set new industry standards by combining existing regulatory guidelines with best practice from a range of sectors and applications.

We have looked at specialist systems such as those employed in clean rooms and medical facilities, where the task defines the supply and extract air paths. We studied the growing mass of information and research on the distribution of pollutants within a space. This is an ongoing and long-term commitment as reflected in our sponsored PhD programme with the Welsh School of Architecture at Cardiff University.

We have actively evaluated the many air treatment methods that have recently emerged and been revisited as industry challenges evolve.

Our analysis showed that it was possible to combine these approaches to produce a complete ventilation system that can:

- Be readily understood and implemented.
- Make optimal use of existing ventilation equipment.
- Help to produce the healthy environment sought and demanded for any kind of public office or venue.
- Reduce the immediate, short and long term health risks to occupants of shared spaces.

Haven Supply and Extract Terminals selection criteria

Haven Supply and Extract Terminals provide ventilation locally targeted at a practical level.

Although research indicates that there are health benefits of ventilation rates in excess of those considered typical today, our recommendation is that the overall fresh air supply capacity of the ventilation system should reflect the current regulatory guidance for offices of 10 l/s per person.

When effectively directed and targeted, this air supply rate is sufficient to deliver a healthy environment without the increased noise levels and energy usage of higher flowrate systems.

TERMINAL QUANTITY

INDIVIDUAL OFFICE

The illustrations below represent typical systems found in work and public spaces – with each occupant's location considered. We can apply the overall concept to other room types and layouts.

Haven Supply and Extract Terminals create a fresh air zone local to the individual. By extracting air at low level we can also keep locally generated pollutants away from other occupants.

In each case, the primary system selection criteria is the supply air flowrate, followed by consideration of the intended arrangement of personnel in the space. The system capacity must be a minimum of 10 litres per second per person.

The Haven Supply and Extract Terminals supply air terminal (HTS) range offers a number of formats based on nominally providing one directionally adjustable supply outlet (SO) per individual occupant.

Each SO is configured to handle a nominal flow rate of 10l/s – which results in a maximum local discharge velocity of less than 1.5m/s.

The flow rate can be varied by up to 15% without significant effects on system performance (provided that the fan selection also reflects this).

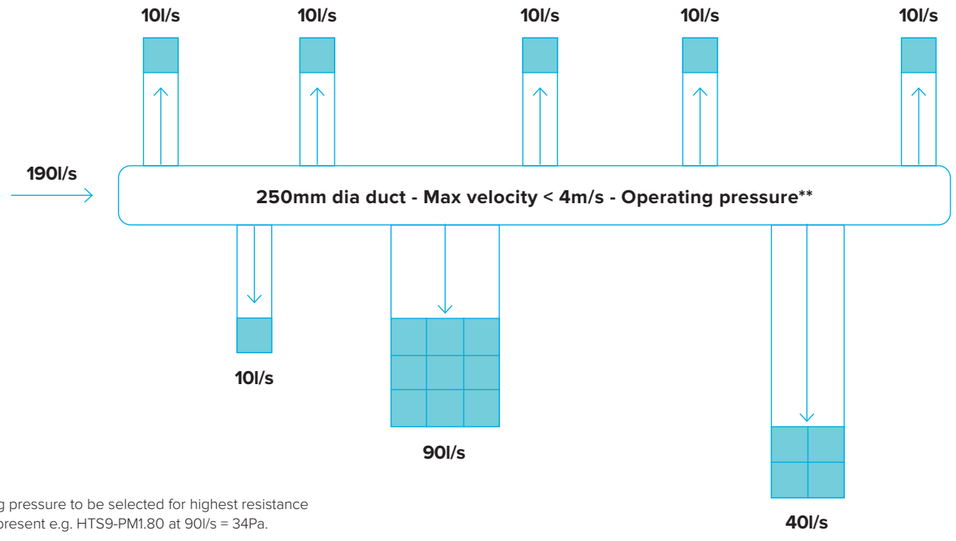
The extract riser terminal is available in a range of flow rate capacities. Its location must be determined in relation to the supply terminal location and any spatial constraints specific to the application.

LARGE OFFICE

DISTRIBUTION DUCTWORK

The configurable distribution ductwork is both cost effective and convenient. Additionally, it may be possible to re-use existing systems, further reducing costs*.

SUPPLY DISTRIBUTION DUCT EXAMPLE



**Operating pressure to be selected for highest resistance terminal present e.g. HTS9-PM1.80 at 90l/s = 34Pa.

The most straightforward configuration method is to use the main distribution duct as a plenum, operating at a nominally constant pressure throughout its length.

In practice, this simply means minimising the design velocity in the distribution duct(s). (At a velocity of 3 m/s, the resistance of 20m of spiral wound ducting is less than 10Pa in total.)

Haven Supply and Extract Terminals have a similar resistance per unit airflow.

Once achieved additional Haven Supply and Extract Terminals may be added to the system at a later date without significant impact on overall performance.

This provides a great potential benefit to expanding businesses and allows for futures changes in operating requirements.

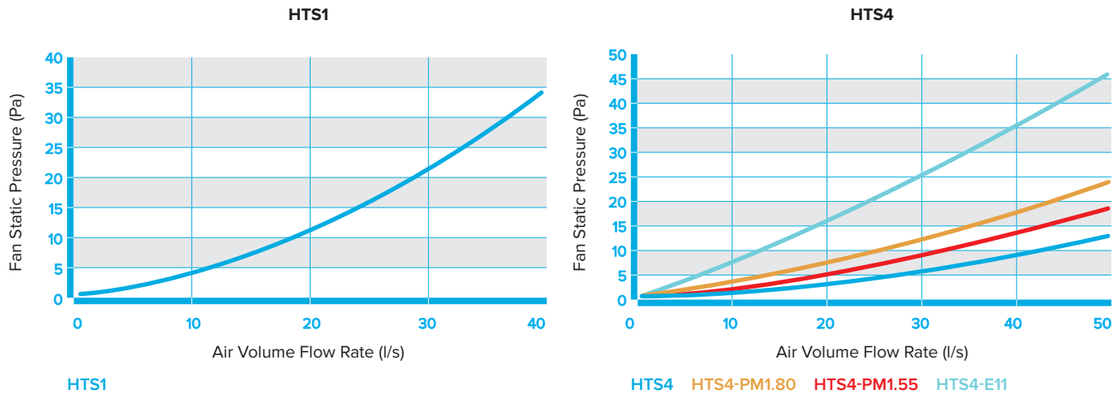
*If existing ductwork systems are to be re-used, it is highly recommended that they be intensively cleaned to TR19, leakage tested DW144, and if necessary, brought up to current performance standards by a competent technician.

TERMINAL RESISTANCE - SUPPLY

The Haven Supply and Extract Terminals unit shall be designated according to the following coding protocol.

HAVEN T	S / E	1/2/3/4/9/12	F epm1.0 / E11	UVC
Terminal	Supply / Extract	No. Adjustable Ports	Filter Grade	UVC

TERMINAL RESISTANCE CURVE



HTS1 terminal available with no filter only.
For more information please contact Nuaire.

	RESISTANCE (Pa)			
	10l/s	20l/s	30l/s	40l/s
HTS1	3	10	21	34

	RESISTANCE (Pa)				
	10l/s	20l/s	30l/s	40l/s	50l/s
HTS4	1	3	5	9	13
HTS4-PM1.55	2	5	8	13	18
HTS4-PM1.80	3	7	12	17	24
HTS4-E11	7	16	25	35	46

E11 Hepa filtration will provide an additional allowance of 1.0w/l/sec on the unit SFP value.

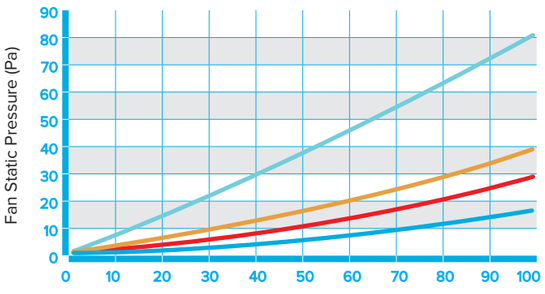
TERMINAL RESISTANCE - SUPPLY

The Haven Supply and Extract Terminals unit shall be designated according to the following coding protocol.

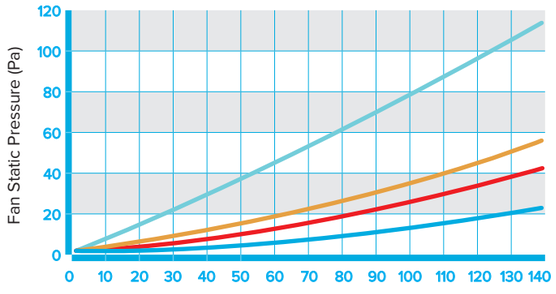
HAVEN T	S / E	1/2/3/4/9/12	F epm1.0 / E11	UVC
Terminal	Supply / Extract	No. Adjustable Ports	Filter Grade	UVC

TERMINAL RESISTANCE CURVE

HTS9



HTS12



	RESISTANCE (Pa)									
	10l/s	20l/s	30l/s	40l/s	50l/s	60l/s	70l/s	80l/s	90l/s	100l/s
HTS9	0	1	2	3	5	6	8	11	13	16
HTS9-PM1.55	1	3	5	7	10	13	16	20	24	29
HTS9-PM1.80	3	5	8	12	16	20	24	29	34	39
HTS9-E11	7	14	22	29	38	46	54	63	72	82

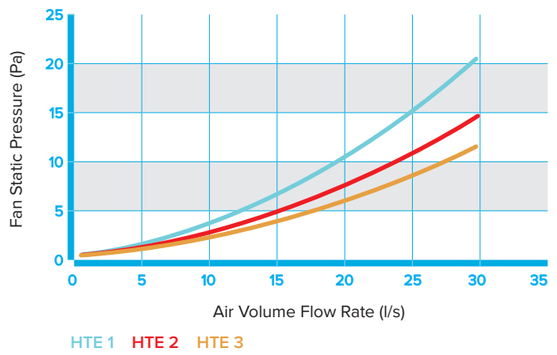
	RESISTANCE (Pa)													
	10l/s	20l/s	30l/s	40l/s	50l/s	60l/s	70l/s	80l/s	90l/s	100l/s	110l/s	120l/s	130l/s	140l/s
HTS12	0	1	1	2	3	4	6	8	10	12	14	17	19	22
HTS12-PM1.55	1	3	4	6	9	11	14	17	21	24	28	33	37	42
HTS12-PM1.80	2	5	8	11	14	18	22	26	30	35	40	45	50	56
HTS12-E11	7	14	21	28	36	44	52	60	69	77	86	95	104	114

E11 Hepa filtration will provide an additional allowance of 1.0w/l/sec on the unit SFP value.
(One per filter type per terminal size = 7 for initial document).

TERMINAL RESISTANCE - EXTRACT

TERMINAL RESISTANCE CURVE

HTE 1/2/3



	AIR VOLUME FLOW RATE (l/s)	RESISTANCE (Pa)
HTE1-SLOT HTE1-DIAG	0	0
	10	3
	20	10
	30	21
HTE2-SLOT HTE2-DIAG	0	0
	10	2
	20	7
	30	15
HTE3-SLOT HTE3-DIAG	0	0
	10	2
	20	6
	30	11

AIR TREATMENT

Haven Supply Terminals shall optionally be supplied with an integral air / air filter treatment module.

The module shall consist of a high intensity UV-C emitter complete with electronic ballast operating at an emission wavelength of 254 nm with efficient operation at 95W.

The UV-C emitter shall not produce Ozone during operation and has an expected life span of 8,000 hours, at this stage the lamps must be changed.

Primarily selected to ensure the maintenance of sterile conditions within the terminal and filter, the emitter shall be positioned to offer additional microbial load reduction for the incoming supply air.

Operation of the UV-C lamp shall be interlocked to the terminal access door, ceasing operation if the access door is opened. An operational indicator LED shall be provided.

The emitter shall be capable of intermittent operation under remote timer control (by others) for energy saving purposes. It is recommended that the device is operational during at least 40% of the building occupancy period.

TERMINAL SPECIFICATION

SPECIFICATION
Haven T S 4/9/12 Supply Terminal

GENERAL
The Haven Supply Terminal shall be suitable for supply ventilation rates of 40 – 120 l/s* via the specified quantity of independent supply ports, each with 360 degree directional adjustability. The air shall be discharged from each port at an initial velocity not exceeding 1.5 m/s, and at an initial angle of 45 degrees from the horizontal. The terminal shall include means of flow equalisation.

The non-combustible terminal housing shall be constructed from heavy gauge Aluzinc coated steel and shall be compatible with square ceiling tile grids with nominal 600mm module dimensions.

The housing shall be installed such that its lower face is flush with the ceiling surface and shall be rigidly supported from the building structure using the fixing detail provided.

Each terminal shall be provided with 1 side mounted air entry point with ducting connection spigot.

Note that access to the interior of the terminal is necessary for inspection and maintenance of (optional) filter and air treatment components, and shall be provided via the hinged lower terminal face.

The Haven Supply Terminal shall suitable for use with a range of compatible filters. The filters shall be conveniently replaceable in situ.

It shall be possible to add / alter / upgrade the type of filter fitted in the terminal – but note that this will affect the airflow delivery performance of the system, and the fans used must be compatible with the revised operational requirements.

The terminal shall be constructed with leakage and filter bypass rating appropriate to the highest grade of compatible filter.

The Haven Terminal shall be fitted with pressure tappings for use with an optional filter pressure indicator. Contact Nuaire for details.

FILTRATION
The Haven Supply Terminal shall optionally be supplied with a compatible air filter. Compatible filters types available for the Haven Supply and Extract Terminals shall include:-

- EN 1822: E11 ISO 20E / EN 16890 ePM1 > 80%
- EN779: 2012 F9 / EN 16890 ePM1 > 55%
- EN779: 2012 F7 / ACTIVATED CARBON for NOx, SOx VOC removal

SUPPLY

CODE	ADJUSTABLE VENTS	FILTER GRADE	UVC
HTS1	1	N/A	
HTS4	4	N/A	
HTS9	9	N/A	
HTS12	12	N/A	
HTS4-ePM1.55	4	ePM1 > 55%	
HTS9-ePM1.55	9	ePM1 > 55%	
HTS12-ePM1.55	12	ePM1 > 55%	
HTS4-ePM1.80	4	ePM1 > 80%	
HTS4-ePM1.80	9	ePM1 > 80%	
HTS12-ePM1.80	12	ePM1 > 80%	
HTS4-E11	4	E11	
HTS9-E11	9	E11	
HTS12-E11	12	E11	
HTS4-E11-UVC	4	E11	UVC
HTS9-E11-UVC	9	E11	UVC
HTS12-E11-UVC	12	E11	UVC

Since the useful life of an air filter is highly dependent on local conditions, the recommended strategy for filter maintenance is to inspect after 3 and 6 months of operation use, assess filter condition based on the degree of contamination that has developed and determine the appropriate service interval.

Refer to Nuaire Guide to Filtration for discussion on filter life expectancy. Alternatively, a compatible filter pressure indicator is available. Nuaire recommend a pressure increase over clean conditions of 125Pa.

As an example, at full capacity in a polluted urban environment the useful life of a ePM1 >80% filter is estimated to be 6 months.

SPECIFICATION
Haven HTS1 Supply Terminal

GENERAL
The Haven Supply Terminal shall be suitable for supply ventilation rates of 10l/s* via its 360 degree directional adjustable port. The air shall be discharged from each port at an initial velocity not exceeding 1.5 m/s, and at an initial angle of 45 degrees from the horizontal.

The non-combustible terminal housing shall be constructed from heavy gauge Aluzinc coated steel and shall be suitable for mounting into a prepared opening in ceiling materials.

The housing shall be installed such that its lower face is flush with the ceiling surface and shall be rigidly supported from the building structure using the fixing detail provided.

A facia plate shall be provided for finishing purposes.

Each terminal shall be provided with 1 top mounted air entry point per supply port suitable for direct connection to 75mm semi rigid ducting.

Connection shall be of tool-less push-fit type and with rubber sealing gasket.

The terminal shall be supplied with 1 x 1m length of 75 mm semi-rigid ducting, and 1 main duct attachment plate per supply port.

SPECIFICATION
Haven T E 1/2/3 Extract Terminal

GENERAL
The Haven Extract Terminal set shall be suitable for extract ventilation rates of up to 30l/s.

The air shall be extracted from close to floor level via a heavy gauge steel base vent assembly, vertical riser duct and 3 port terminal connector.

The steel base vent assembly shall be provided with non-directional extract slots, a floor attachment plate and duct retainer.

The vertical riser duct shall be manufactured from UV stable PVC.

The terminal housing shall be constructed of heavy gauge ABS polymer and shall be suitable for mounting into a prepared opening in ceiling materials.

The housing shall be installed such that its lower face is flush with the ceiling surface and shall be rigidly supported from the building structure using the fixing detail provided.

A facia plate shall be provided for finishing purposes.

Each terminal shall be provided with 3 no. top mounted tool-less push-fit air connection ports each suitable for direct connection to 75mm semi rigid ducting, and 2 no. blanking plates.
See page 14 for plate illustration.

Duct connection shall be of tool-less push-fit type and with rubber sealing gasket.

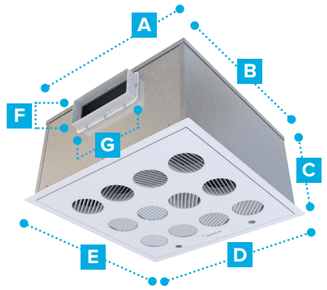
The extract terminal shall be supplied with 1 – 3 x 1m length of 75 mm semi-rigid ducting, and 1 – 3 main duct attachment plates as appropriate.

EXTRACT

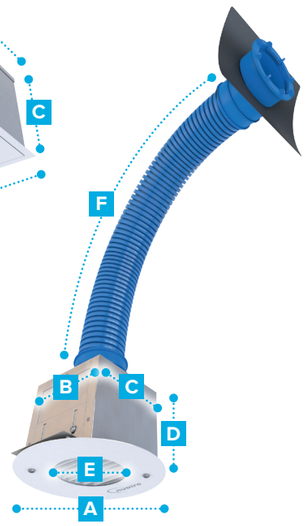
CODE	RADIAL DUCTING	DUCT ATT PLATES
HTE1-SLOT	1m	1
HTE2-SLOT	1m	2
HTE3-SLOT	1m	3
HTE1-DIAG	1m	1
HTE2-DIAG	1m	2
HTE3-DIAG	1m	3

DIMENSIONAL DRAWINGS

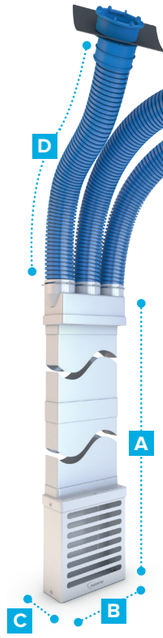
MULTI-PORT TERMINAL
HTS12



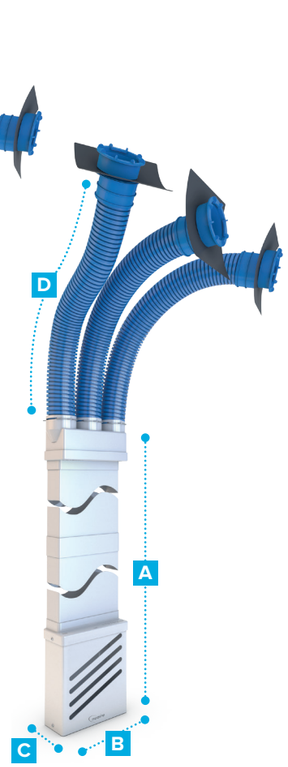
SINGLE-PORT TERMINAL
HTS1



EXTRACT TERMINAL
HTE1/2/3 HORIZONTAL FACIA



EXTRACT TERMINAL
HTE1/2/3 DIAGONAL FACIA



DIMENSIONS (mm)

CODE	A	B	C	D	E	F	G
HTE1/2/3	3374	223	96	1000	-	-	-
HTS1	180	128	128	125	100	1000	-
HTS12	571	573	300	556	556	220	90

Multi-port terminal dimensions are all the same physical size.

AIR QUALITY CRITERIA

Classification of contaminants and selection criteria for filtration is a complex topic and Nuaire have collated this information in a short guide and CIBSE approved CPD programme – please speak to your sales representative for details.

Haven Supply and Extract Terminals provide an efficient means of providing high specification filtration to provide maximum protection to the building occupants.

Where Nuaire ventilation units are specified for use with the system, options exist for initial filtration at the unit.

By using fine particulate or chemical filters in the Haven Terminal unit or in the Haven inline filter module, treatment is provided for residual external and system-based contaminants to the greatest practical extent.

Note - Cleaning schedules for the supply and extract air ducting should be established, and particular attention given to system components such as cooling coils – known to be at risk of microbial contamination.

FILTER SPECIFICATION

According to the principles outlined in **EN ISO 16890** (Air filters for general ventilation) it is necessary to identify the type and concentration of contaminants that are likely to be present in the outdoor air environment local to the building.

Often carried out as part of the planning consent process, where such information exists, filtration decisions should be based on this.

If this is not the case, the main categories of outdoor air as defined in the standard broadly coincide with Rural, Sub-Urban and Urban environments.

SUPPLY AIR CATEGORIES

SUP 1	Refers to supply air with concentrations of particulate matter which fulfilled the WHO (2021) guidelines limit values multiplied by a factor x 0,25 (annual mean for PM2,5 ≤ 1,25 µg/m³ and PM10 ≤ 3,75 µg/m³).
SUP 2	Refers to supply air with concentrations of particulate matter which fulfilled the WHO (2021) guidelines limit values multiplied by a factor x 0,5 (annual mean for PM2,5 ≤ 2,5 µg/m³ and PM10 ≤ 7,5 µg/m³).
SUP 3	Refers to supply air with concentrations of particulate matter which fulfilled the WHO (2021) guidelines limit values multiplied by a factor x 0,75 (annual mean for PM2,5 ≤ 3,75 µg/m³ and PM10 ≤ 11,25 µg/m³).
SUP 4	Refers to supply air with concentrations of particulate matter which fulfilled the WHO (2021) guidelines limit values (annual mean for PM2,5 ≤ 5 µg/m³ and PM10 ≤ 15 µg/m³).
SUP 5	Refers to supply air with concentrations of particulate matter which fulfilled the WHO (2021) guidelines limit values multiplied by factor x 1,5 (annual mean for PM2,5 ≤ 7,5 µg/m³ and PM10 ≤ 22,5 µg/m³).

RECOMMENDED MINIMUM EFFICIENCIES

Minimum filtration efficiencies recommended in this document refer to various PM particle size ranges, depending on the application (a type of premises served by a ventilation system).

For the most demanding applications with high and medium hygienic requirements (SUP 1 and SUP 2), ePM_1 efficiencies are shown. For premises with standard and low hygienic requirements (SUP 3), $ePM_{2,5}$ efficiencies are recommended.

For applications with very low or without hygienic requirements (SUP 4 and SUP 5), ePM_{10} efficiency is shown.

The recommended minimum efficiencies depending on ODA and SUP categories are summarised in the table below.

OUTDOOR AIR			SUPPLY AIR				
			SUP 1* $PM_{2,5} \leq 1,25$ $PM_{10} \leq 3,75$	**SUP 2*** $PM_{2,5} \leq 2,5$ $PM_{10} \leq 7,5$	**SUP 3**** $PM_{2,5} \leq 3,75$ $PM_{10} \leq 11,25$	**SUP 4** $PM_{2,5} \leq 5$ $PM_{10} \leq 15$	**SUP 5** $PM_{2,5} \leq 7,5$ $PM_{10} \leq 22,5$
Category	**$PM_{2,5}$**	**PM_{10}**	**ePM_1**	**ePM_1**	**$ePM_{2,5}$**	**ePM_{10}**	**ePM_{10}**
ODA 1	≤ 5	≤ 15	70%	50%	50%	50%	50%
ODA 2	≤ 7,5	≤ 22,5	80%	70%	70%	80%	50%
ODA 3	> 7,5	> 22,5	90%	80%	80%	90%	80%

Recommended min. ePMx filtration efficiencies depending on ODA and SUP category (annual mean PMx values in µg/m³).

* Minimum filtration requirements ISO ePM_1 50% refer to a final filter stage.
** Minimum filtration requirements ISO $ePM_{2,5}$ 50% refer to a final filter stage.

Presented efficiency values concern both single filter and multi-stage filtration systems with a cumulated efficiency.
A method how to estimate the cumulated efficiency is described in the next chapter.

The Table 7 in the Annex shows non-exhaustive examples of filter class specifications meeting the recommended minimum efficiencies for respective SUP/ODA categories .

ADDITIONAL RECOMMENDATIONS CONCERNING THE PROTECTION OF HVAC SYSTEMS

As the task of air filters in HVAC systems is not only to protect ventilated rooms from too severe level of contamination, but also the HVAC system itself, the minimum efficiency of a first stage filter (on fresh air inlet) should be at least ePM_{10} 50%.

Yet, if air humidification is applied in the system, the minimum efficiency of a filter located downstream the humidifier should be at least $ePM_{2,5}$ 65%.

Source: EUROVENT 4/23-2022 Selection of EN ISO 16890 Rated air filter classes for general ventilation applications.
SUP 1 Refers to supply air with concentrations of particulate matter which fulfilled the WHO (2021) guidelines limit values multiplied by a factor x 0,25 (annual mean for $PM_{2,5} \leq 1,25$ µg/m³ and $PM_{10} \leq 3,75$ µg/m³).

SUPPLY AIR CLASSIFICATION

As a starting point, the following approach is suggested.

- **SUP 1** applies where the supply of air fulfils the WHO (2005) guidelines limit values and any National air quality standards limit values or regulations with a factor x0,25.
- **SUP 2** applies where the supply of air fulfils the WHO (2005) guidelines limit values and any National air quality standards limit values or regulations with a factor x0,5.
- **SUP 3** applies where the supply of air fulfils the WHO (2005) guidelines limit values and any National air quality standards limit values or regulations with a factor x0,75.
- **SUP 4** applies where the supply of air fulfils the WHO (2005) guidelines limit values and any National air quality standards limit values or regulations.
- **SUP 5** applies where the supply of air fulfils the WHO (2005) guidelines limit values and any National air quality standards limit values or regulations with a factor x1,5.

Assuming coarse or ePM10 grade filtration at the supply ventilation unit, the recommended filter grades for specification in Haven Supply and Extract Terminals or filtration modules are:

OUTDOOR AIR	OCCUPATION PROFILE	RECOMMENDED FILTRATION GRADE (TO EN ISO 16890-1:2016)
ODA1	Regular / Continuous Occupation	HST 4/9/12- PM1.55
	Occasional Occupation (eg. circulation spaces)	HST 4/9/12- PM1.55
ODA2	Regular / Continuous Occupation	HST 4/9/12- PM1.80
	Occasional Occupation	HST 4/9/12- PM1.55
ODA3	Regular / Continuous Occupation	HST 4/9/12- 11
	Occasional Occupation	HST 4/9/12- PM1.80

x = terminal designation.

For any category, if regular high concentrations of traffic fumes are to be expected, and it is not possible to improve the air inlet position, then consideration should be given to adding activated carbon gas filtration.

For further details on Haven IAQ Module please contact Nuaire directly.

NOTES

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COMMERCIAL
WWW.NUAIRE.CO.UK/COMMERCIAL

RESIDENTIAL
WWW.NUAIRE.CO.UK/RESIDENTIAL

INTERNATIONAL
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