National Association of Air Duct Specialists UK

NAAD UK
National Association of Air Duct Specialists UK

Edition 1

2021



NAAD-21

Part 1: GREASE (Kitchen Extract)

Legal Standards and Guidance applicable to the risk management of the fire and grease levels within commercial kitchen extract systems to EC852:2004

Part 2: AIR (Indoor Air Quality)

Regulation Guidance standards for Indoor Air Quality in occupied zones

NAADUK
National Association of Air Duct Specialists UK

Our History & Vision

The National Association of Air Duct Specialists UK (**NAADUK**) was formed in 2015. It was founded by a collective of ventilation hygiene specialists, individuals and companies who are experienced and knowledgeable within the industry of ventilation and air conditioning.

All members of **NAADUK** are either IAQ technicians and/or Fire Damper Inspectors who have passed a **NAADUK** approved training course and are listed on the **NAADUK** register. This enables the public or clients to find a reputable and competent technician easily from the website.

NAADUK's guidance document **NAAD21** is the basis of the course and enables the technicians to work towards a National Occupational Standards (NOS) certification in Ventilation Hygiene Cleaning Level 5.

NAADUK's objective is to improve industry standards in ventilation hygiene and facilitate communications between its members.

NAADUK hold regular meetings, ensuring that discussions are up to date, with topics focusing around ventilation hygiene and the importance of cleaning techniques and frequencies.

NAADUK vision for the future and are champion for: -

1. *Collaboration between other organisations, associations and manufacturers.*
2. *Competency and standard of cleaning to current regulations and standards.*
3. *Improving technology and methodology.*
4. *Investigating and improving best practice.*
5. *Improving the health of the nation within the working environment - in particular improving IAQ.*
6. *Raising awareness of Ventilation Hygiene to the general public, building owners, companies and clients.*

The purpose of this specification is to inform, educate and improve standards for both grease and air ventilation cleaning, across all sections and types of buildings in the UK.

NAADUK believe this document will contribute to a safer and healthier environment for all. Many of the guidelines, standards and regulations developed by the various associations concerned have contributed greatly to our increased safety and wellbeing

NAADUK would like to thank all Associations and organisations for their willingness to share their information for the benefit of the environment and people's health.

For further information about **NAADUK** and the benefits of joining, visit our website www.naaduk.co.uk .



GREASE — Part 1

Part 1: GREASE (Kitchen Extract)

Legal Standards and Guidance applicable to the risk management of the fire and grease levels within commercial kitchen extract systems to EC852:2004

NAAD UK
National Association of Air Duct Specialists UK

SECTION	CONTENTS	PAGE
1	**Introduction to Kitchen Grease Extract Systems**	6
2	**Purpose of a Kitchen Grease Extract System**	6
3	**Law & Guidance for Commercial Kitchen Grease Extract Systems**	7 –10
3.1	General	7
3.2	Legal Requirements	8
3.3	Guidance Documents	9
3.4	Insurance Requirements	10
4	**Kitchen Grease Extract Systems Cleaning Frequency**	11—12
4.1	Frequency of Cleaning for New Builds & 1st Clean	11
4.2	Establishing Correct Cleaning Frequency for an Existing Kitchen Grease Extract System	12
5	**Wet Film Thickness Gauge (WFTG) Test**	13—14
5.1	How to Take A Wet Film Thickness Gauge (WFTG) Test	13
5.2	How to Read a Wet Film, Thickness Gauge (WFTG)	14
5.3	Industry Standard Accepted Practice	14
5.4	Competency in Cleaning Kitchen Grease Extract Systems	14
6	**Cleaning Methods for Contractors**	15—17
6.1	General	15—16
6.2	Summary Advice to Cleaning Contractors	16
6.3	Checklist of Cleaning Contractors Responsibilities	17
7	**A Client's Guide to Good Housekeeping**	18
7.1	Client's Responsibilities to Help Lower the Risk of Fire	18
8	**Kitchen Grease Extract Schematics**	19-20
8.1	Criteria for a Schematic	19
8.2	Symbols to Use on a Schematic Drawing	20
8.3	Drawing a Schematic	20
9	**Kitchen Fire Suppression Systems**	21—23
9.1	General	21—22
9.2	Extinguishing system cause and effect (sequence of events)	23
9.3	Building fire alarm system configured as the means of isolation of the fuel supplies	23
9.4	Conclusion	23
10	**Reducing Odours in a Kitchen Grease Extract System**	24—25
10.1	General—Various Applications	24
10.2	Odour Neutralisation	24
10.3	Activated Charcoal Filters - Most Common Types	25

SECTION	CONTENTS	PAGE
11	**Health and Safety**	**26-27**
11.1	General	**26**
11.2	Access to Ductwork	**26**
11.3	Golden Advisory Rules	**27**
12	**Basic Components of a Kitchen Grease Extract System—Index**	**28 –53**
12.1	General	**28—29**
12.2	Components of Kitchen Grease Extract System	**30**
12.3	Components of a Hood or Canopy	**31**
12.4	Filtration in Kitchen Grease Extract Systems	**32**
12.5	Filter Types	**33—34**
12.6	Plenums	**35**
12.7	Kitchen Grease Extract Ductwork	**36**
12.8	Fire Resisting Ductwork	**37—40**
12.9	Fan Systems	**41—46**
12.10	Access Panels	**47**
12.11	Exhaust Grilles	**48**
12.12	Attenuators/Silencers	**49**
12.13	Turning Vanes	**50**
12.14	Ancillary Components	**51—53**
13	**The Future of Kitchen Grease Extract Systems**	**54**
13.1	Legal Changes Ahead	**54**
13.2	Other Future Technologies in the Marketplace	**54**
13.3	Ductless Kitchen Extraction & Free Standing Self Contained Recirculation Units	**55—58**
	APPENDIX	
Appendix 1	Reference of regulations/Standards/Guidance Pertaining to Commercial Kitchen Extract Systems	**59**
Appendix 2	LPS 2084 Issue 1 Standard for Inspection, Cleaning & Maintenance of Ductwork Systems	**60—61**
Appendix 3	Research Projects -The impact Of Ductwork Cleaning on a Fire Resisting Kitchen Grease Extract System and New and On-Going Projects	**62**
Appendix 4	IP Ratings for Fans	**63**
Appendix 5	Reference of Tables Part 1: Grease	**64**

1. INTRODUCTION TO KITCHEN GREASE EXTRACT SYSTEMS

For over four decades the importance of grease capture and removal has grown in significance. Initially, it was assumed that vent to atmosphere was acceptable, but the massive increase in takeaways and surge in eating out, has led to an exponential increase in food outlets across the UK. Equally there has been steps over the past decade to try and restrict the amount of pollutants and particulates being vented to atmosphere. Advanced filtration, improved maintenance, and new products, such as ductless recirculation systems are improving emissions to the environment.

NAADUK believes it is just as important that Commercial Kitchen Users are aware of the rules and regulations as given in various guidance documents, such as FPA (Fire Protection Association) RC44, Recommendations for fire risk assessment of catering extract ventilation as to what their responsibilities are in reducing the risk of fire. **See Appendix 1 Page 59.**

2. PURPOSE OF A KITCHEN GREASE EXTRACT SYSTEM

A grease extract system uses mechanical means to:

- Remove fats, oils and grease generated from cooking food
- Reduces the risk of fire in a Kitchen Grease Extract system
- Remove Steam
- Remove Heat
- Remove gaseous grease
- Produce the best possible safe working environment for catering staff

3. LAW & GUIDANCE FOR COMMERCIAL KITCHEN GREASE EXTRACT SYSTEMS

3.1 GENERAL

This flow chart depicts the legal requirements and guidance that is available for Commercial Kitchen Grease Extract Systems in the UK. All buildings are governed by EC852:2004 (Food Standard Agency FSA) and H&S 1992 Section 5 & 6 L24.

In addition, it is imperative that adhering to the regulations and guidance documents is a requirement by many insurance companies. A full explanation of the various regulations, guidance and standards referred to in this flow chart is shown below.

Table No. 1. Law & Guidance for Commercial Kitchen Grease Extract Systems

LAW	**EC852:2004**	**Regulatory Reform (Fire Safety) Order 2005**	**H&S Policy (Rev 2013) L24 Section 5 & 6**	
GUIDANCE	**RC44**	**LPS 2084:1**	**NAAD21**	**BESA DW172 & TR19 Grease**



3.2 LEGAL REQUIREMENTS

There are three main standards which relate to Kitchen Grease Extract systems as shown in the chart previously and a short synopsis is given of each is given below. NAADUK expect and check to see that all NAADUK members adhere to these standards.

3.2.1 Regulation EC852/2004 Enforcement of Regulation on the Hygiene of Foodstuffs - Annex II, Chapter 1 paragraph 5

This regulation states that, "There must be suitable and sufficient means of natural or mechanical ventilation. Mechanical airflow from a contaminated area to a clean area must be avoided. Ventilation systems must be so constructed as to enable filters and other parts requiring cleaning or replacement to be readily accessible."

This regulation ratified by the European Union and translated into the local languages of member states has potential far reaching consequences to the design, construction and installation of kitchen grease extract ductwork in relation to maintenance and cleaning. Mr. Nick Laverty, of The Food Standards Agency, has confirmed that under European treaty this forms part of British law. Since 1st January 2006. As ductwork is a component part of a kitchen ventilation system, it falls under the requirements of EC852/2004 Annex II Chapter 1 paragraph 5. Many Environmental Offices enforce under this Regulation.

3.2.2 Regulatory Reform (Fire Safety) Order 2005

This Order requires the appointment of a responsible person to assess fire risk and consideration on the methods of prevention. A grease extract ductwork system should be included in this assessment identifying risk, hazards and control measures to ensure protection and the prevention of fire risk. This document is under review by the Government.

3.2.3 L24 Workplace Health, Safety and Welfare Regulation 1992 (Revised 2013)

Approved Code of Practice and guidance

Regulation 5 Maintenance of workplace, and of equipment, devices and systems Paragraph (1) states:-

"The workplace and the equipment, devices and systems to which this regulation applies shall be maintained (including cleaned as appropriate) in an efficient state, in efficient working order and in good repair."

Paragraph (3) states:-*" (b) mechanical ventilation systems provided pursuant to regulation 6 (whether or not they include equipment or devices within sub-paragraph (a) of this paragraph); and (b)"*

Regulation 6. Ventilation

Paragraph (1) states:- "*Effective and suitable provision shall be made to ensure that every enclosed workplace is ventilated by a sufficient quantity of fresh or purified air"*

ACOP 47 "Enclosed workplaces should be sufficiently well ventilated so that stale air, and air which is hot or humid because of the processes or equipment in the workplace, is replaced at a reasonable rate."

ACOP 52 "Mechanical ventilation systems (including air-conditioning systems) should be regularly and adequately cleaned. They should also be properly tested and maintained to ensure that they are kept clean and free from anything which may contaminate the air."

3.3 GUIDANCE DOCUMENTS

These guidance documents are not a legal requirement but are generally adopted to ensure competence and best practice.

3.3.1 Recommendations for Fire Risk assessment of catering extract ventilation

This publication is a best practice guidance document that provides for a fire risk assessment of extract ventilation in catering kitchens together with supporting explanation and guidance. It is aimed principally at the person responsible for ensuring that such an assessment is performed. It explains the legislative background to the need to carry out and record the findings of fire risk assessments.

3.3.2 Loss Prevention Standard 2084 – Issue 1—Standard for Inspection, Cleaning & Maintenance of Ductwork Systems

This standard defines the requirements for the LPCB approval of companies carrying out inspection, cleaning and maintenance of ductwork systems that may be contaminated with combustible deposits. The standard ensures that companies engaged in the above activities, meet the requirement of the client contract, document and report correctly, identify and record areas of limited access where inspection, cleaning and maintenance are impractical and communicate these limitations to the client and give recommendations for access improvements to better facilitate the ongoing cleaning and maintenance of the ductwork system. Full details of this document are shown in **Appendix 1 Page 59.**

NAADUK approves of the LPS 2084 standard for grease extract cleaning under BRE's Loss Prevention Certification Board (LPCB). This body have set their standards independently with no self-interest from owning training or cleaning companies in this field. Thus ensuring the best possible standards through impartial and comprehensive monitoring and auditing of its certified members in the UK. A completely impartial and the comprehensive monitoring and auditing of its certified members.

Whether a member or not, we recommend all parties to accept these standards as the absolute minimum.

3.3.3 NAAD21— Part 1 Grease (Kitchen Extract) - Legal Standards and Guidance requirements applicable to the risk management of the fire and reduction of grease levels within commercial kitchen extract systems to EC852:2004

3.3.4 BESA TR19 Grease—Fire Risk Management of Grease Accumulation within Kitchen Extraction Systems.

3.3.5 BESA DW 172—Specification for Kitchen Ventilation Systems

See Appendix 1 Page 59, for full details of regulations and guidance standards for Commercial Kitchens.

3.4 INSURANCE REQUIREMENTS

Insurance companies will normally recommend a minimum frequency of extract ductwork cleaning, together with any terms and conditions to comply with the buildings insurance requirement. This should include an assessment of business resilience. The Client has a "Duty of Care" to their clients, their employees and members of the general public under Health & Safety Regulation requirements.

Insurers define cleaning to a "good standard", and this can be proven that works have been carried out to the recommended cleaning frequencies and **WFTG Test**. For frequency of cleaning and WFTG Test see table and information on **Page 11 to 14.** Insurance companies use this as a threshold.

Adherence to regulations and recognized guidance documents would be expected by an insurance company.

It is the Clients responsibility to keep records and photographs of when the system was last cleaned. The Report to the Client must advise them if there are any Advisory Notes, any additional work has been carried out and any COSHH chemicals used. If the Client is a tenant of a building, they should be advised to forward Reports and Advisory to the owner/landlord of the building.

The Cleaning Report must contain pre and post clean photographs taken from the same place and deposition measurements which can subsequently be used to determine increased frequencies and identify any issues with system inaccessibility.

In addition to the above requirements, insurance companies will expect that a Fire Risk Assessment has taken place and evidenced, as recommended in FPA RC44—Recommendation for fire risk assessment of catering extract ventilation.

Insurers recommend that third-party auditing of cleaning is undertaken as an overarching audit check. The audit should be independent from cleaning companies or Associations i.e. BRE LPCB LPS 2084, and carried out by a qualified auditor.

Insurers would expect that Cleaning Timetables are enforced and followed by a verifiable and relative cleaning process that is acceptable.

In the event of any fire loss, Insurers will require proof and written records of the cleaning procedures that were enforced and that these had been followed prior to the loss. If these have not been complied with, then insurers could reject the client's claim.

3.5 COMPETANCY IN CLEANING KITCHEN GREASE EXTRACT SYSTEMS

It is recommended that technicians should be compliant with BSEHV11—Clean industrial and commercial ventilation systems, kitchen hoods and grease filters.

4. KITCHEN GREASE EXTRACT SYSTEM CLEANING FREQUENCY

4.1 FREQUENCY OF CLEANING FOR NEW BUILDS & 1st CLEAN

The following chart is for **newly** installed and **first** clean only. Thereafter it is recommended to refer to historical information which can be gathered or collated from the Client.

Refer to the **Table 3** for full details of frequency cleaning on existing building

Table No. 2. Initial Cleaning Frequency Chart or 1st Clean

No. of Hours of Daily use	LOW Very little production of grease laden air in food preparations	MEDIUM Moderate levels of grease laden aerosols	HIGH Heavy and contami-nant amounts of grease laden aerosols
6 hours	Once a year 12 monthly	Once a year 12 monthly	Twice a year 6 monthly
6.-12 hours	Once a year 12 monthly	Twice a year 6 monthly	4 times a year 3 monthly
12-16 hours	Twice a year 6 monthly	Three times a year 4 monthly	4 times a year 3 monthly
16+ hours	Twice a year 6 monthly	4 times a year 3 monthly	6 times a year 2 monthly

The table above is for guidance only and consideration should be taken into account for a change of the menu, foodstuffs being cooked or changes of use.

NAADUK recommend the Three Word Test Method as detailed on Page 12 for existing systems.

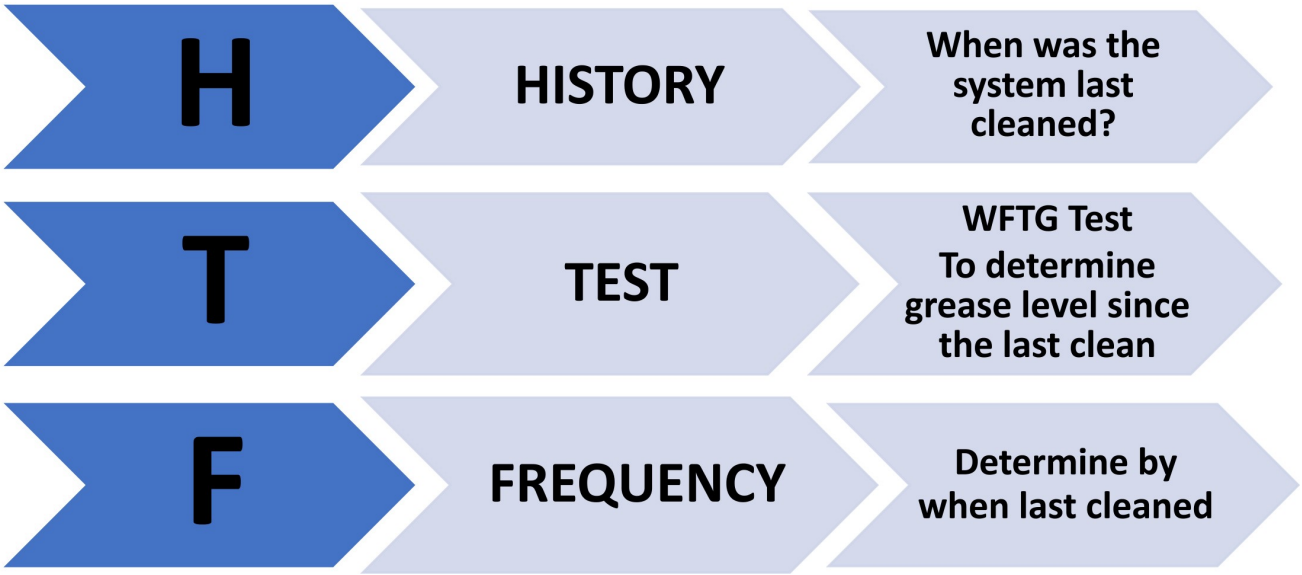
4.2 ESTABLISHING CORRECT CLEANING FREQUENCY FOR AN EXISTING KITCHEN GREASE EXTRACT SYSTEM

After the first clean, in accordance with the Initial Cleaning Frequency Chart on **Page11**. NAADUK do not promote fixed charts for cleaning guidelines as these could be misleading and inaccurate. This could lead to increased risks due to the incorrect interpretation by the users.

Strict adherence through the use of fixed charts increases the risk to insurers and other building users. These charts where designed for rough guidance purposes only and not to be followed to the letter. Consideration should be given for local conditions, seasonal changes to the menu, and types of foodstuffs cooked.

NAADUK recommends the **Three-Word Test.** This requires establishing the History, Test & Frequency (HTF) on the system and is explained below:-

Table No. 3. History, Test, Frequency (HTF)



To show how this works in practice, an example is given below. The Example demonstrates that the system would require cleaning every 3 months due to actual usage.

Table No. 4. Example of methodology of HTF in practice

HISTORY	Question: When was the system last cleaned?	Answer: Last cleaned 6 months ago	Move to Test
TEST	Action: Carry out a WFTG Test	Result: A level of 406 microns detected	Annual Grease level 812 Microns (2 x 406)
FREQUENCY	Frequency: Determined by the facts gathered	Fact: 12 Months is 812 microns	Result: Grease accumulation 203 microns 3 monthly, Clean required 3 monthly

Alternatively, depending on commercial viability remote sensor could be fitted to give automatic warning at the 200 micron level.

5. WET FILM THICKNESS GAUGE (WFTG) TEST

5.1 HOW TO TAKE A WET FILM THICKNESS GAUGE (WFTG) TEST

Correct at 90° angle

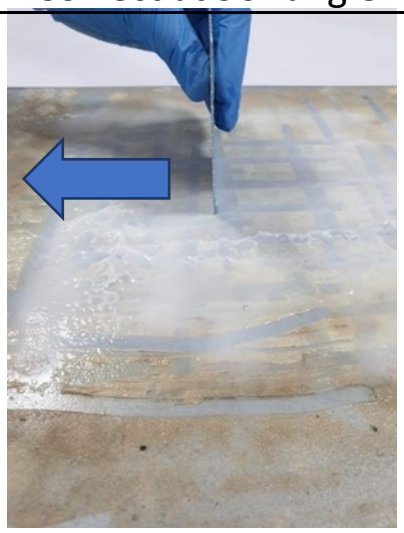


Fig No. 1. Example of Correct Sampling



NOTE— Scrape 100mm

INCORRECT

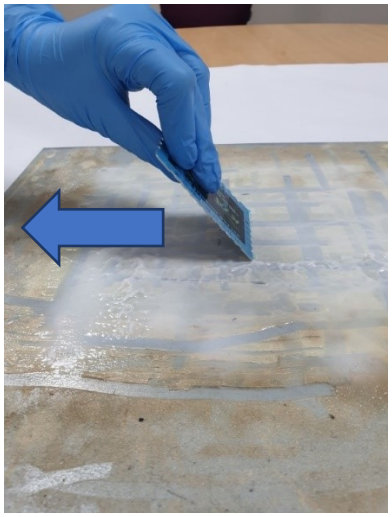


Fig No. 2. Example of Incorrect Sampling



This Photo by

INCORRECT

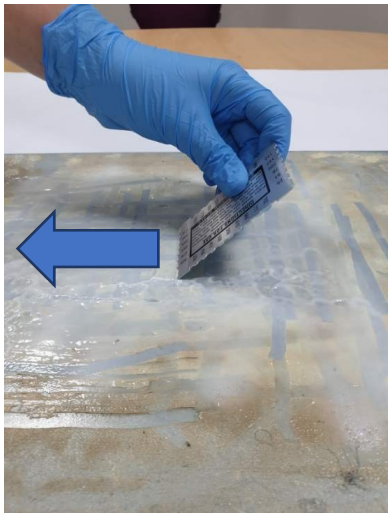


Fig No. 3. Example of Incorrect Sampling



This Photo by

5.2 HOW TO READ A WET FILM THICKNESS GAUGE (WFTG)

Fig No. 4. WFT Gauges demonstrating reading markers



Wrong place to take the reading

Correct place to take the reading – The tip point is the measurement

Fig No.5. WFT Gauge with grease



The last tip with grease adherence is the depth of the reading.

Rotate the gauge to use all measurements

5.3 INDUSTRY STANDARD ACCEPTED PRACTICE

An acceptable level of cleanliness of a system is recognised in the within the industry as 200 microns. It is recommended to clean the whole system if an average reading exceeds 200 microns. For example, if two WFTG readings are taken, add them together and divide by two for the average. Likewise if 4 readings are taken, add them together and divide by four. If the individual reading exceeds 500 microns then urgent cleaning is required for that one area. These may be in areas such as sills behind the grease filters, header duct above canopy, base of riser and fan. This list is not exhaustive and all components of the ductwork can be affected.

6. CLEANING METHODS FOR CONTRACTORS

6.1 General

There are many varied cleaning methods that contractors may use to clean a system . Some of the most common manual methods are as follows:-

Table No. 5. Cleaning Methods and Contamination

Most Common Manual Methods	Type of Contamination
Hand wiping: wiping grease from surface with a cloth	Light contamination
Scraping: removing grease by hand scraping	Heavy contamination
Steam cleaning: hot water under pressure to dissolve grease **(NAADUK do not recommend the use of steam –see CAUTION)**	Burnt on
Rotary brushing with chemical: brush & spraying to remove grease	Burnt on
Hot chemical foam: spray foam to hang and dissolve grease	Burnt on and heavy
Chemical: to soften grease for easier removal	Burnt on and heavy

CAUTION:

1) **When using pump or trigger sprays technicians must wear personal protection including respiratory protection, as long-term effects of inhaling some chemicals on internal organs are not yet known.**

All the above methods have been used generally by the industry for several decades, however new equipment and methods are continually being developed.

The main priority is to ensure you meet the requirements of the post clean verification required by law and using current guidelines.

If you have to use wet methods, ensure all wet and damp cleaning fluids are removed from the system before handover.

When using chemical cleaning agents, ensure all Control of Substances Hazardous to Health (COSHH) assessments are measured not only for the effects on materials but also for its disposal to minimise any effects on the environment. COSHH assessment should include the potential health effects on personnel and precautions to be implemented to ensure safe use, storage and handling.

It is not normally possible to clean an old system to shiny new condition, because of long term staining in the substrate. Unless a brand-new system is kept clean regularly, then some staining must be expected. This does not affect the quality of the clean.

When scraping or brushing fan casing and other parts of extraction power units, care must be taken not to remove paint and other protective coatings.

On fire Resisting systems check with manufacturers and the Association for Specialist Fire Protection (ASFP) for recommendations. A joint research project between National Association of Air Duct Specialist UK (NAADUK) and the Association for Specialist Fire Protection (ASFP), tested various methods and chemicals, and conclusion can be found in the report. **See Appendix 3 Page 62.**

Do not just use standard industry approved chemicals as damage will occur on seals and other intumescent screw seals. Only use a solution that is less than 8% caustic strength.

All technicians should be trained to minimum standards i.e. National Association of Air Duct Specialist UK (NAADUK), Construction Industry Training Board (CITB), and National Occupational Standards (NOS), to ensure awareness of requirements.

Before commencing cleaning a WFTG measurement should be taken, in accordance with method in **5.1 Page 13** and assessed in line with **Table 4 Page 12.**

6.2 SUMMARY ADVICE TO CLEANING CONTRACTORS

Before undertaking any cleaning please note the points below:-

6.2.1 The system is not under any special warranty / service contract that prohibits the direct / internal cleaning of the unit. Advice can be sought from the client and the manufacturer.

6.2.2 Seek advice from the manufacturer on internal cleaning particularly if the unit contains any sensors or monitoring equipment or fire Resisting sensors to avoid potential damage and costly repairs.

6.2.3 Report any high level accumulates / contamination observed at the point of entry or exhaust from such units as part of your normal reporting procedures.

6.2.4 Agree what is and is not to be cleaned with the client in writing and obtain written agreement prior to any works being undertaken.

6.2.5 Use the **Checklist of Cleaning Contractors Responsibilities** as a guide, see **Page 17**

CAUTION:

Some chemicals are very aggressive, so all persons carrying out these cleans must wear full PPE Including FFP3 masks. Long-term effects on internal organs from breathing in vapour when spraying on chemicals are not yet known.

6.3 CHECKLIST OF CLEANING CONTRACTORS RESPOSIBILITIES

A Cleaning Contractor has the responsibility of carrying out the cleaning works in a safe and responsible manner. The Checklist below will aid you in reminding you of the tasks that should be completed, this list is not exhaustive.

Table No. 6. Checklist of Cleaning Contractors Responsibilities

√	CHECKLIST OF CLEANING CONTRACTORS RESPONSIBILITIES
	Tape or zone off working areas
	Make or update schematic of duct location of existing panels, canopies, filters, etc – See template guide on **Pages 19 & 20**
	Ensure catering equipment has cooled and isolate if necessary
	Cover area/equipment with protective covering
	Measure all areas with WFTG (Wet Film Thickness Gauge) and photograph gauge and duct
	Remove filters and if not previously cleaned, clean. (Remind the client that these should be cleaned weekly by them)
	Clean plenum area rear of filters, taking care not to activate the fire suppression system
	If necessary fit access panels in the system, max 3m apart, closer if other components require
	Clean ductwork using COSHH approved chemicals and equipment that can be utilised to carry out a full clean
	Every effort must be made to access all areas, if any areas are inaccessible then you must issue an advisory note. If inaccessibility is due to a solid ceiling, advise the client to install a ceiling type access panel as shown on **Page 47**. Ceiling access panels must be of the same integrity as the existing ceiling
	When applying chemical, score the grease first and allow the chemical to dwell for 10 minutes
	Then brush or scrape to remove all grease and wipe clean
	All waste to be disposed of in correct containers by licensed operators, or licenced waste carriers
	If inaccessible areas cannot be reached by hand, then rotary brush methods should still be used to reduce amounts of grease in these areas to minimum levels possible
	Although the grease will be removed there may be some substraight staining on the duct-work. This does affect its compliance. Take final WFTG Test and record readings

Contractors should be NAADUK approved to ensure they can perform necessary works safely

TIP:

Create an "At Risk Register " which can be used to produce formal letters to the Client warning them of the potential risk of fire where remedial works have not been carried out.

7. A CLIENT'S GUIDE TO GOOD HOUSEKEEPING

7.1 CLIENT'S RESPONSIBILITIES TO HELP LOWER THE RISK OF FIRE

If you can see grease, so can fire. Keep the two as far apart as possible

To reduce the risk of a fire starting in a Kitchen Grease Extract System it is best practise to create a checklist with tasks that should be completed daily and weekly. These need to be signed by a responsible person as part of a Fire Risk Assessment, as stated in Regulatory Reform Fire Safety Order 2005.

7.1.1 Ensure that all appliances are serviced annually by qualified engineers.

7.1.2 **Refer to Pages 11 & 12** to determine frequency of use of ductwork and associated equipment to be cleaned by competent people

7.1.3 Ensure all staff working in kitchen area are aware of procedures in an event of a fire

7.1.4 Ensure all staff working in kitchen area are aware of how to use fire extinguishing equipment, manual or automated

7.1.5 Display the Schematic drawing provided to you by your Cleaning Contractor.

7.1.6 Ensure the insurer is updated on an on going basis with any system findings that may change the frequency of cleaning of any issues that may prohibit access.

The above points are from RISCAuthority/FPA document RC44.

RECOMMENDATIONS FOR FIRE RISK ASSESSMENT OF CATERING EXTRACT VENTILATION

Table No. 7. An Example of a Checklist for Client's Use

CHECKED √	CHECK DAILY
	Clean all visible kitchen surfaces
	Clean parts of hood visible to kitchen staff
	Check grease drip tray and clean as required
	Check that the filters are in place during any cooking or catering activity.
CHECKED √	**CHECK WEEKLY**
	Remove and clean filters or baffles from hood dependent on use, more frequently if necessary, clean all corners and crevices – Insurers may specify a minimum
	Wipe grease from inside of filter housing
	Remove filter, check grease in the plenum chamber and wipe if necessary, twice if required (Check for sign of damage to filter(s))
	Remove access panel from hood if safe to do so and wipe away all local areas of grease within reach
	Ensure catering equipment is wiped and cleaned daily, before or after use
	Ensure area around catering equipment i.e. walls/floors are also cleaned
	Do not store old, used or new oil in the kitchen area
	Flammable solvents or other flammable solutions must not be used
	Check any visible exhaust grills for signs of accumulate / grease drips

Prevention is best—
Ensure all the above is adhered to and you will lower the risk of fire

8. KITCHEN GREASE EXTRACT SCHEMATICS

8.1 CRITERIA FOR A SCHEMATIC

A Schematic is required to be enclosed within the report for the Client. The Schematic should be placed in a visible position near an Entrance Door, to enable Fire Officers to view the layout of the Kitchen Grease Extract in the event of a fire. It should also be placed in the Kitchen Area and in the O & M manuals.

This list below is not exhaustive but includes some common elements necessary to complete a meaningful Kitchen Grease Extract Schematic for the Client. Schematic drawings can be drawn up with the assistance of the client. This would assist with the initial access and familiarisation of the system for both parties.

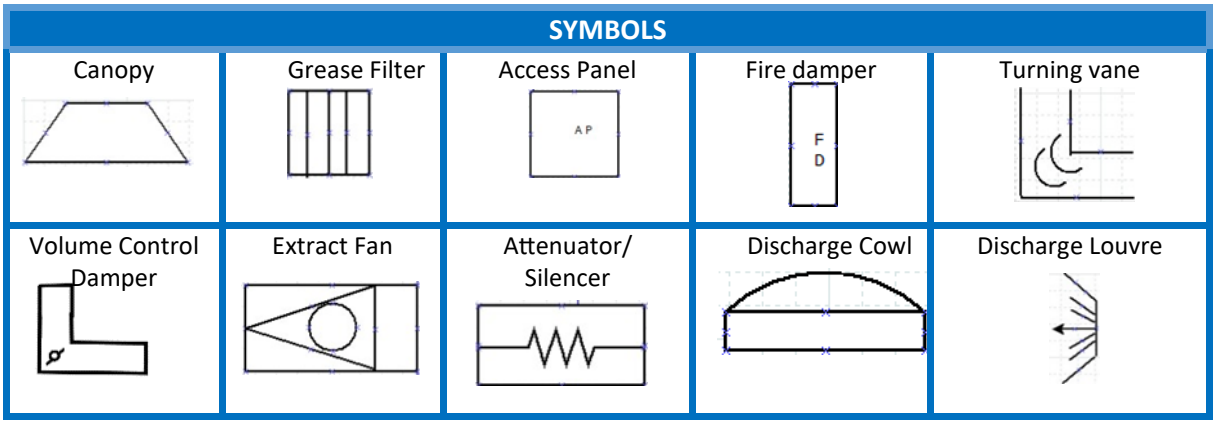
Table No. 8. Suggested details to be noted on a Schematic

IDENTIFY THE BUILDING TYPE	♦ Building Name & Room No. ♦ Site contact & Details/Occupiers ♦ Right of access details ♦ Type of floor & ceiling: Concrete/Tiles etc ♦ Location of door entrances ♦ Areas requiring additional access requirements
IDENTIFY AREAS BY COLOUR CODING	♦ **GREEN** **Accessible Ducting** ♦ **BLUE** **Ducting that is Inaccessible at present** ♦ **RED** **Fire Resisting Ductwork** ♦ **BROWN** **Walls & Interior Dividing Walls** ♦ **BLACK** **Access Panels** ♦ **PURPLE** **Additional Access Panels Required**
IDENTIFY PARTS OF THE VENTILATION SYSTEM **FROM EXTRACT CANOPY TO FAN & OUTLET**	♦ Access obstructed ♦ Access panels fitted ♦ Access panels required ♦ Airflow ceiling ♦ Attenuators ♦ Canopy ♦ Ceiling Hatches ♦ Ducting/Spigots/Risers ♦ Fan ♦ Fan Fire curtain ♦ Fire Dampers ♦ Terminal Point ♦ Trion/ESP ♦ Volume Control Dampers
ESSENTIAL DETAILS	♦ Schematic should be in at least 2D ♦ Show the direction of duct travel ♦ Limited or poor access to allow cleaning ♦ Routes to access ducting location. ♦ Circular/Rectangular Duct ♦ Lagged Ducting ♦ Access Fitted ♦ Access Required ♦ Access Fitted but Obstructed ♦ Specialist Equipment to Access ♦ Type of Access Doors – RD, Circular, Bolted, Toggle. ♦ Specific Safety warnings (i.e.) Harness required for roof. ♦ Key Locations

8.2 SYMBOLS TO USE ON A SCHEMATIC DRAWING

When drawing a Schematic you should use basic symbols that others will recognise. We have listed a few here—see full list **Part 2 Appendix 5 Page 63.**

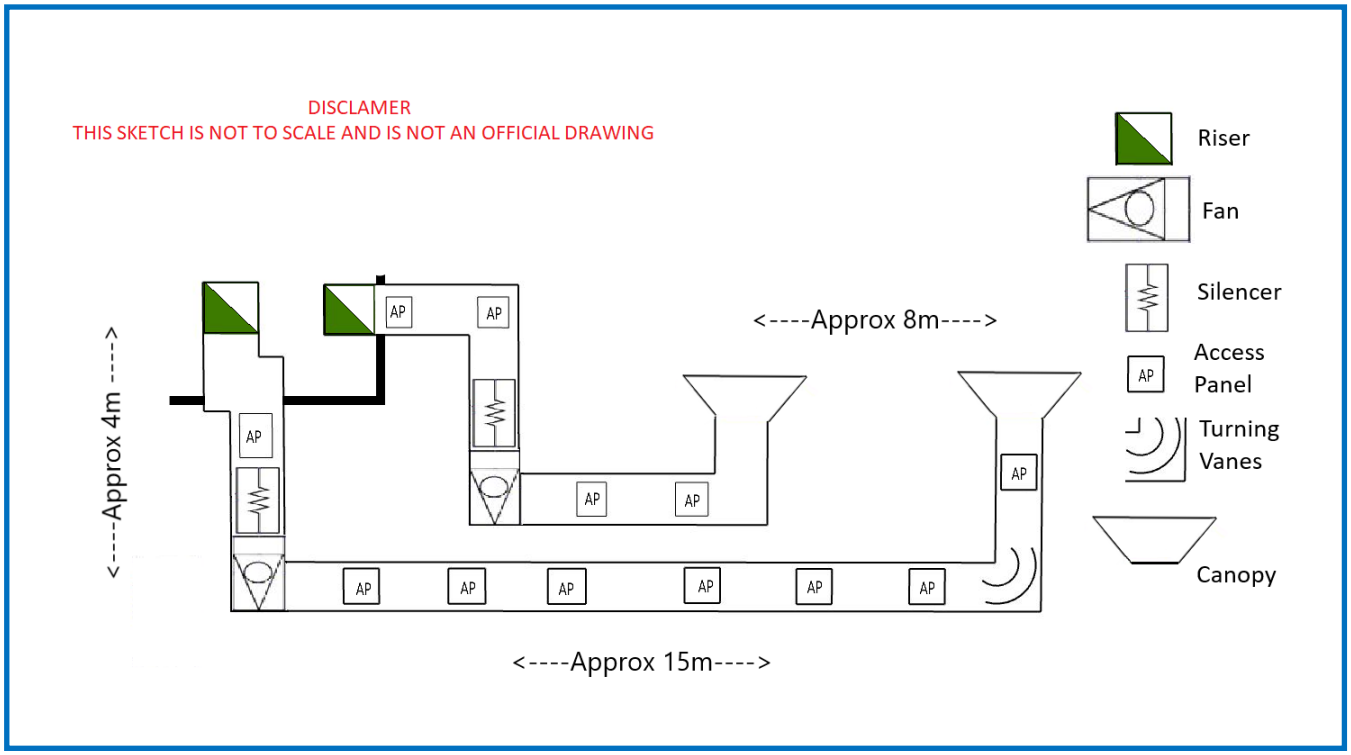
Fig No. 6. Basic Symbols to be used on a Schematic drawing



8.3 DRAWING A SCHEMATIC

A Schematic should be drawn on graph paper or on specialist software. All schematics should carry a disclaimer by the author and NAADUK suggest as shown in the example below.

Fig No. 7. Example of a Kitchen Extract Schematic



9. KITCHEN FIRE SUPPRESSION SYSTEMS

9.1 GENERAL

A kitchen extinguishing system should be approved by the USA Certification Body, Underwriters Laboratories (UL) to the UL 300 fire testing standard for testing of fire extinguishing system for the protection for restaurant cooking risks or to standards such as LPS1223 in compliance with BAFE SP206 certification scheme. The following points highlight some of the important factors when this type of system is in place. Also, in future ductless systems these will become even more important to prevent damage from fire, to building fabric outside of the kitchen area.

9.1.1 The system actuation should provide both a **manual** and **automatic** operation of the protection system to the cooking equipment.

9.1.2 Discharge nozzles are to be strategically situated above all cooking appliances e.g. frying ranges, overhead canopies and ducting system and this is to include wall mounted grilles such as Salamander grilles.

9.1.3 Installation and subsequent servicing is to be undertaken by a company approved by the manufacturer of the extinguishing system.

9.1.4 The extinguishing system can be accepted as a recognised solution for fire protection when the selected fire protection system is:

9.1.5 Is approved, certified or listed by a recognised testing laboratory i.e. LPCB—Redbook

9.1.6 Passes an acceptable test protocol (such as UL300 test protocol)

9.1.7 Is installed in accordance with a fire protection standard, such as the National Fire Protection Association (NFPA) 17A Standard

Fig No. 8. Example of a Fire Suppression system



Most common systems accredited to the UL300 standard are the Ansul R 102 and Amerex KP Systems. A system which is not listed by UL as having passed the UL300 criteria may be acceptable only if independent test data has been provided to demonstrate that the system has passed all of the UL 300 criteria but has not been specifically submitted to UL for official listing.

Some fire suppression systems are designed to protect the catering equipment and **not** the grease extract system.

It is recommended that duct cleaning companies have a clear written procedure in relation to working around fire suppression systems and a disclaimer for the accidental discharge of same.

Fig No. 9. A photograph of a kitchen fire suppression system.



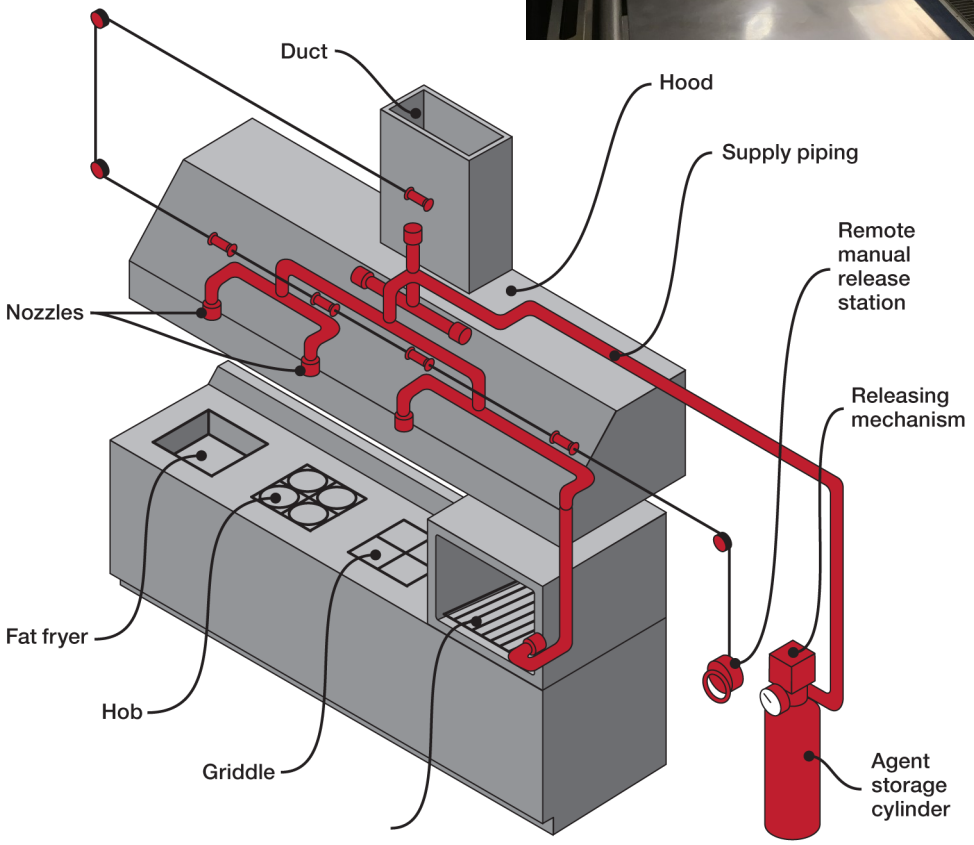


Fig No. 10. Typical layout and components of a kitchen fire suppression system.

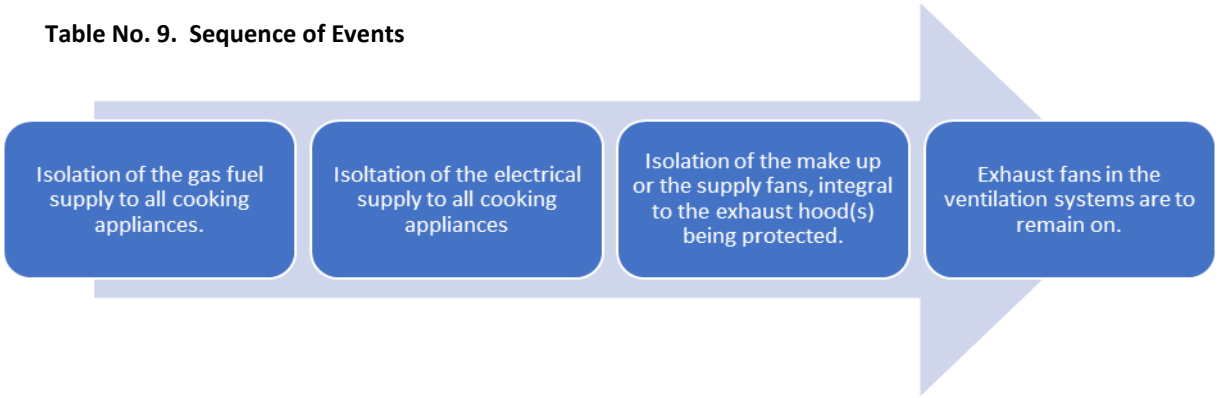
TIP: If a fire suppression system limits access to the ductwork then a note should be made stating the reasons on the advisory note.

9.2 EXTINGUISHING SYSTEM CAUSE AND EFFECT (SEQUENCE OF EVENTS)

Where kitchen extinguishing systems are to be installed the configuration of the cause and effect sequence of events need careful consideration at the design stage. Where systems are being installed the cause and effect (sequence of events) on-site installation/configuration can often be inconsistently applied.

A written cause and effect matrix is to be provided and affixed to the front of the extinguishing system control panel. This is to show clearly and unambiguously the configuration of the interlocks/cause and effect set up (sequence of events), upon activation of the extinguishing system, typically the fire protection system is configured as follows:

Table No. 9. Sequence of Events



It is important to verify these factors when assessing proposed or existing systems:

9.3 BUILDING FIRE ALARM SYSTEM CONFIGURED AS THE MEANS OF ISOLATION OF THE FUEL SUPPLIES

Alternatively; the automatic fire alarm may be configured as the trigger to provide means of isolation for the extinguishing system. Where the fire alarm is the means of isolation for the fuel supplies to the cooking equipment it is important to verify that the sequence of events does in practice immediately isolate the gas/and electrical fuel supplies to all cooking equipment.

Fig No. 11. Example of automatic gas isolation valve



9.4 CONCLUSION

Extinguishing systems selected for the protection of cooking risks are an acceptable solution when the elected system is a recognised solution for the specific application of protecting kitchens. Additional operational requirements may apply (such as power supply connections, water supply, and test facilities) to achieve a system acceptable for property insurance purposes.

Always refer to specific manufactures'' manual for final guidance.

10. REDUCING ODOURS IN A KITCHEN GREASE EXTRACT SYSTEM

10.1 GENERAL—VARIOUS APPLICATIONS

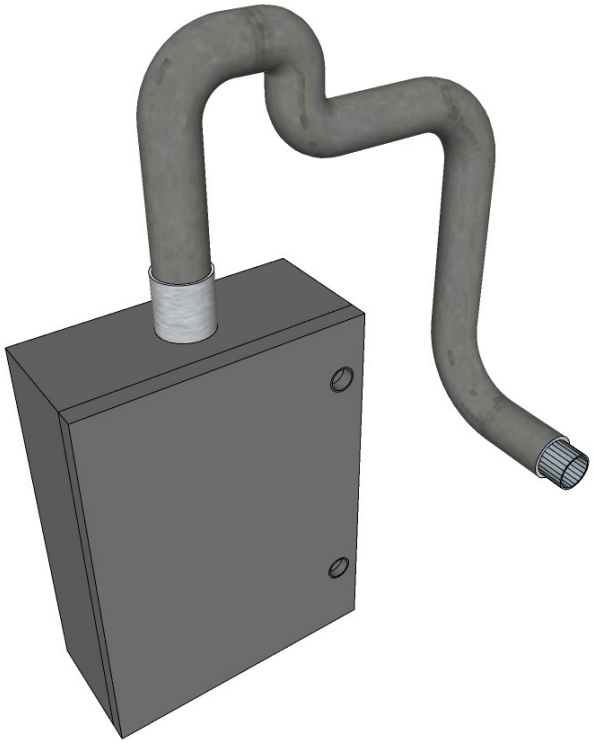
Please note: not all odour reduction solutions are suitable for all cooking methods. In all the cases below, grease filters must also be installed.

Here we have identified three of the most common types:-

10.2 ODOUR NEUTRALISATION

This is the application of a spray of odour neutralising chemical into the air stream as it passes along the ductwork. A typical unit can be installed adjacent to the extract duct in order to facilitate routine servicing, near to the discharge, but still on the negative pressure side of the duct. A neutralising mist is fed via a delivery tube into the duct from a typical unit. The housing can contain a reservoir of neutralising agent.

Fig No. 12. Example of a typical Ozone Control Unit



10.3 ACTIVATED CHARCOAL FILTERS - MOST COMMON TYPES

This type of filter, is the most common and filters out the majority of the cooking odour. Most often these filters are disposable and will last for around 6 months to a year subject to usage. Many manufacturers will specify the specific filter that is to be used in their system.

Fig No. 13. Charcoal Filter

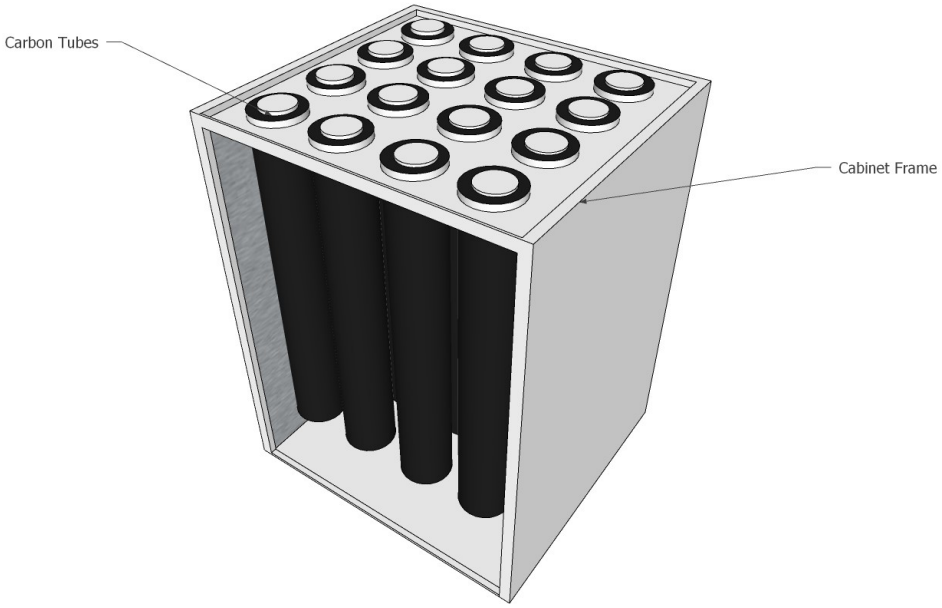




Fig No. 14. Roller Charcoal Filter

11. HEALTH AND SAFETY

11.1 GENERAL

The basic fundamentals of safe working are:-

11.1.1 Risk assessments and method statements for the work, and approved by the Client prior to work commencing.

11.1.2 Always ensure **FANS ARE FULLY ISOLATED, LOCK ISOLATOR AND LABELLED BEFORE WORK COMMENCES.**

11.1.3 COSHH Risk assessments – control of substances hazardous to health include preparations, storage, chemical compositions, restrictions of use and health and safety. These are issued to every team leader to be held in the company vehicle for reference.

11.1.4 Team review Site specific risk assessments and walkthrough the job, identifying any workplace hazards.

11.1.5 Fully detailed site surveys including system drawings and explanatory text should be available. These are all combined with service instruction and site specific risk assessment.

11.1.6 Appropriate PPE (Personal Protective Equipment) as provided and as specified in the Risk Assessment must be worn at all times. All PPE must be selected by a competent person as suitable for purpose and must fit the individual technician properly L24 Health and Safety Regulations 1992). **See Appendix I Page 59** and **Caution Notice** on **Page 16**.

11.1.7 Team leaders are responsible for ensuring PPE and safe systems of working are utilised. Remedial replacement or repair requirements are to be reported to the relevant named person before any technicians are put at risk. Check HSE for full standards.

11.1.8 Safety signs warning others of cleaning work in progress must be used at ALL times during the cleaning operation.

11.1.9 An identified rescue plan for any working at height or working in confined spaces should be preplanned and all technicians understand the building emergency procedures, including fire exits and muster points.

11.1.10 All individuals are responsible for their own safety

11.2 ACCESS TO THE DUCTWORK

If a duct system has no access panels then it is unlikely to have been cleaned.

A grease extract system post 2005 without access panels is in contravention of the legal regulation EC852:2004, **see Appendix 1 Page 59.**

11.3 CAUTION: GOLDEN ADVISORY RULES

11.3.1 Never fit a standard access panel into fire Resisting ductwork as this will invalidate any warranty and change the fire rating of the system

11.3.2 Where possible try not to fit access panels on the underside or the base of the sides of ductwork to avoid liquid grease seepage. However, this may be necessary due to restricted duct access or shallow duct section.

11.3.3 Determine and agree in advance the type of door required. It may be necessary to get fire Resisting access doors fitted by the original installer as defined methods of installation and competency are often required.

11.3.4 Avoid sharp edges which may cause injury. Always install a framed access door with progressive cam closing device on flat ductwork.

11.3.5 Do not install access doors on the top surfaces outdoors as they can be penetrated by rain if not sealed correctly.

12. BASIC COMPONENTS OF A KITCHEN GREASE EXTRACT SYSTEM

This section deals with all the different types of components that can be found in a Grease Extract system.

12.1 GENERAL

The components that make up a Kitchen Grease Extract System are:-

Table No, 10. Components of a Kitchen Grease Extract System

COMPONENTS	SECTION NO.
Filters	12.5
Plenums	12.6
Extract Ductwork	12.7
Fire Resisting Ductwork	12.8
Fan Systems and Fans	12.9
Access Panels	12.10
Exhaust Grilles	12.11
Attenuators/Silencers	12.12
Turning Vanes	12.13
Ancillary Components	12.14

The diagrams on **Pages 29 to 30** show in detail the layout and components that can be found within a standard Kitchen Grease Extract System.

When marking drawings and creating schematics, it is recommended to use the following colour coding chart for ease of identification.

Table No. 11. Colour Coding Chart

COLOUR CODING:	
GREEN	Accessible Ducting
BLUE	Ducting that is Inaccessible at present
RED	Fire Resisting Ductwork
BROWN	Walls & Interior Dividing Walls
BLACK	Access Panels
PURPLE	Additional Access Panels Required

These diagrams depict an example of a general layout of a standard grease extract system including components.

Fig No. 15. FPA RC44 Fig 1 Typical detail showing cooker extraction system

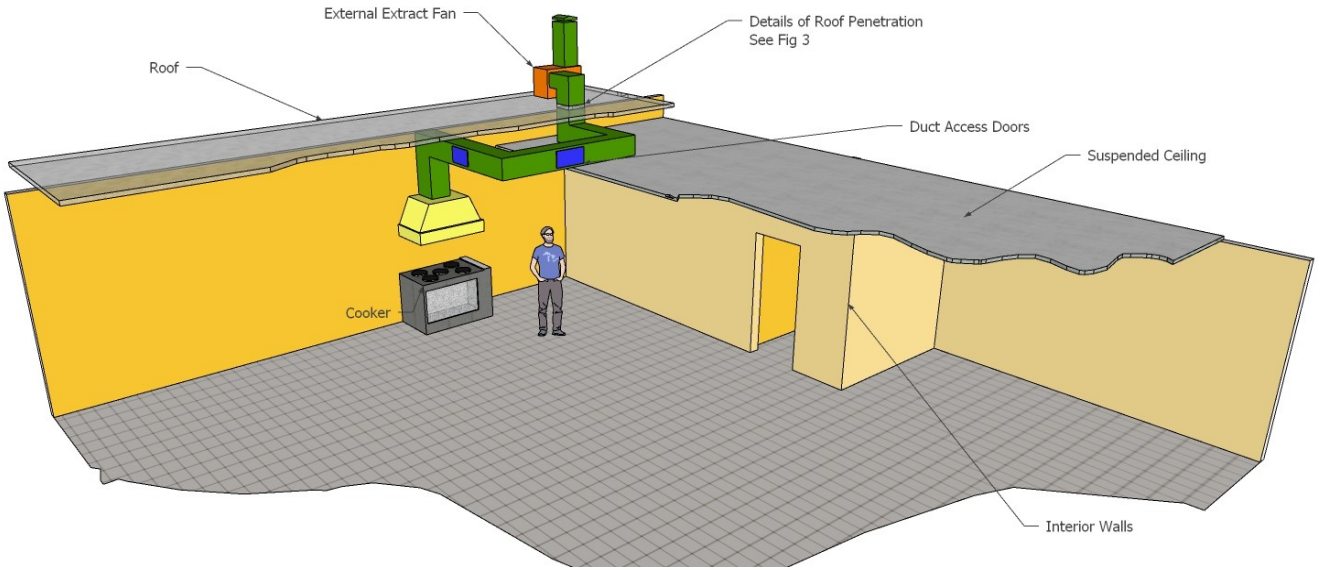
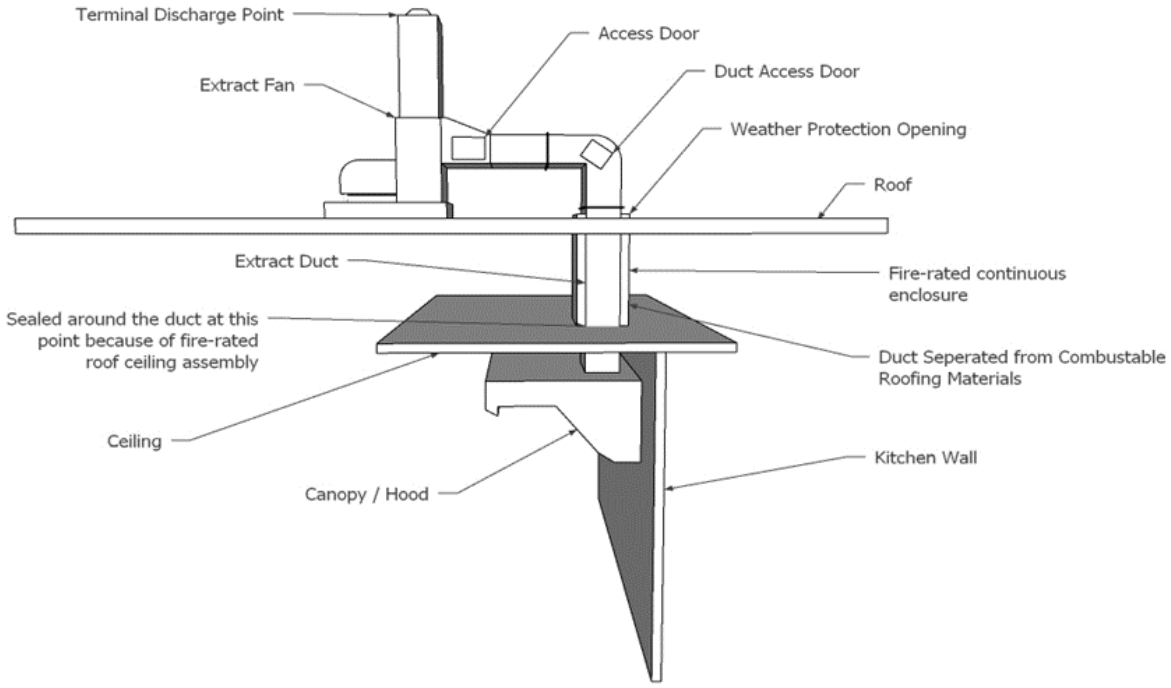


Fig No. 16. Side view of cooker extraction system



12.2 COMPONENTS OF A KITCHEN GREASE EXTRACT SYSTEM

Fig No. 17. A full kitchen grease extract system with components

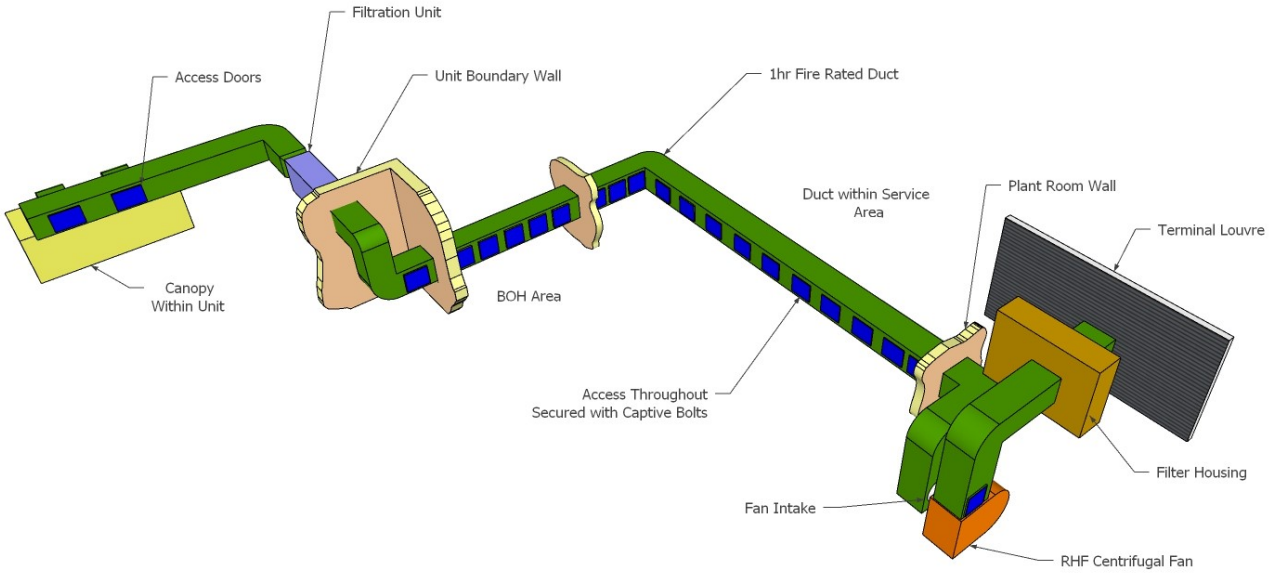
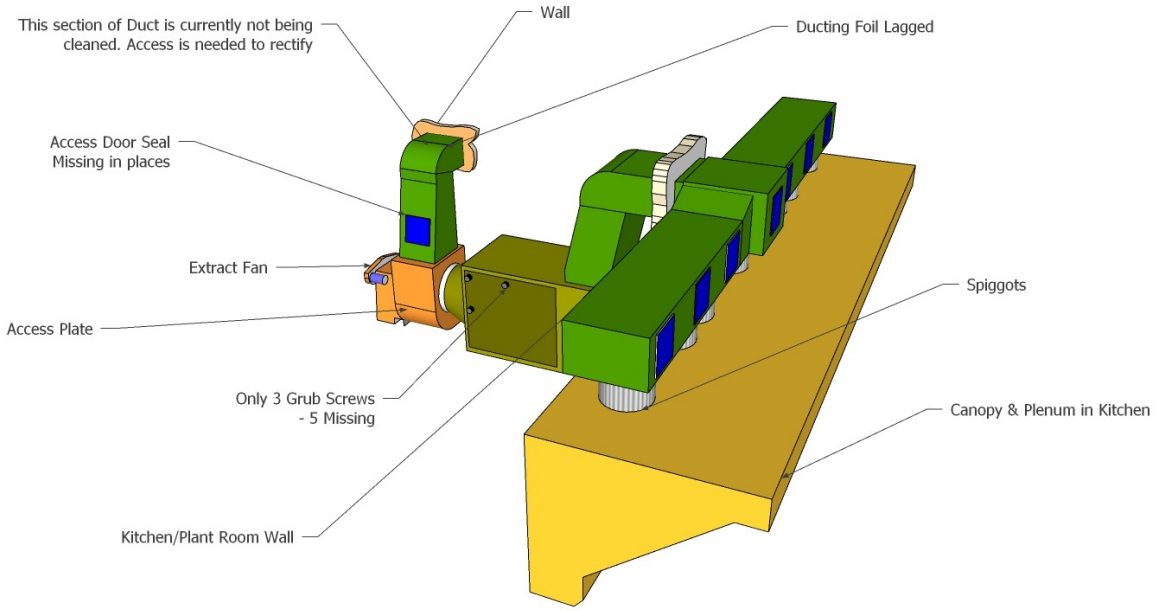


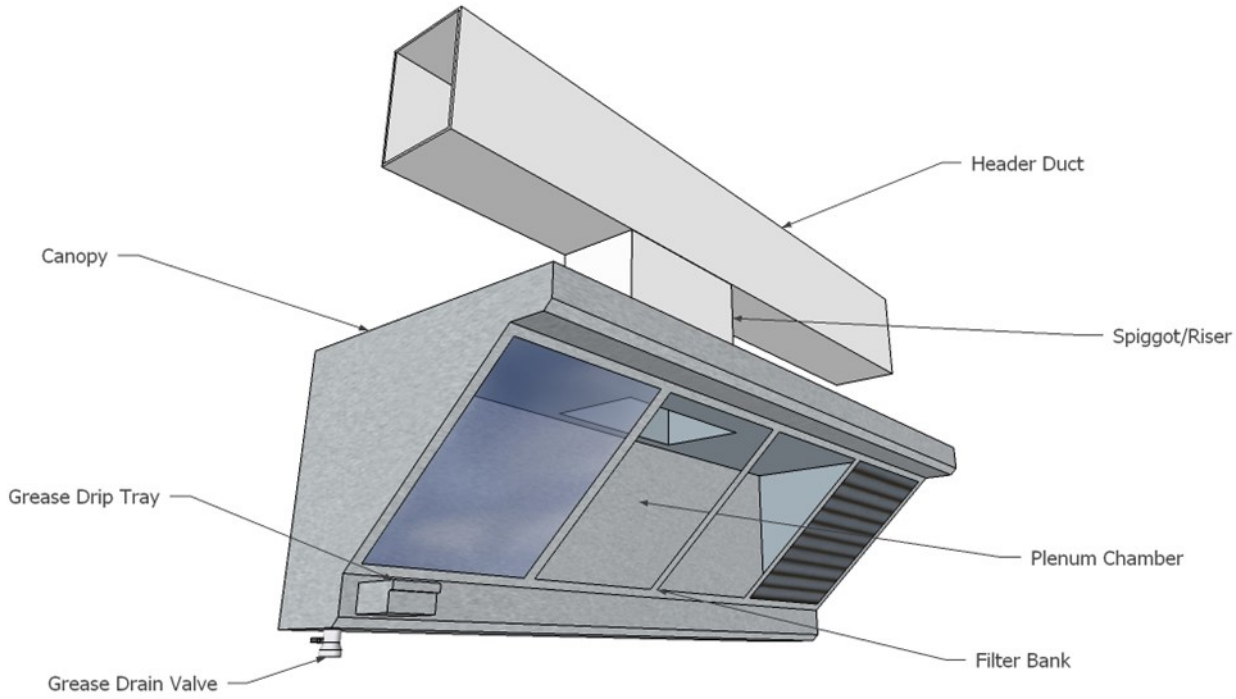
Fig No. 18. Example of a small kitchen grease extract system with components



12.3 COMPONENTS OF A HOOD OR CANOPY

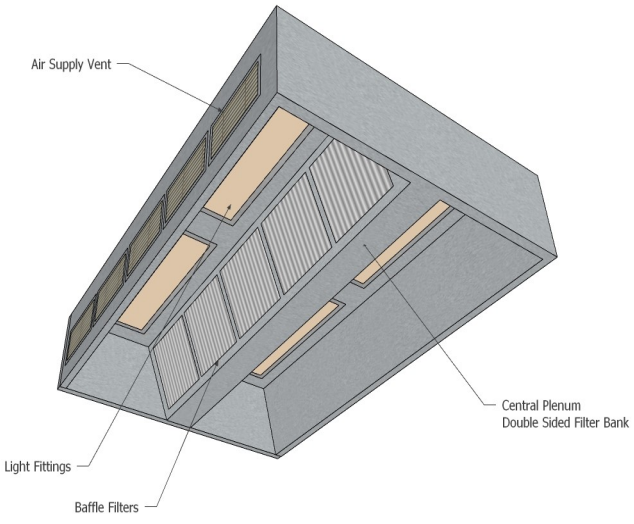
Normally located over catering equipment and designed to remove airborne grease associated with food production. Further removal of fumes, steam, heat and smoke is also facilitated through the hood utilizing filtration and air extraction. The canopy hood can be found in various shapes including square, circular or ridge type.

Fig No. 19. Canopy Hood



Double Canopies have a slightly different components. Please refer to Manufacturer's User Manuals.

Fig No. 20. Double Canopy



12.4 FILTRATION IN KITCHEN GREASE EXTRACT SYSTEMS

Filters installed in canopies are the first line of defence to protect ductwork from excessive grease buildup. Poor installation, incorrect selection and lack of maintenance can all lead to excessive buildup of grease in the ductwork and can increase the risk of fire considerably.

Filters must fit into frames correctly leaving no gaps and they must be installed in the correct orientation. Advice on cleaning frequency is addressed under client responsibilities.

It is important to remember:

The canopy and canopy/extract plenum is an area of higher fire risk and consideration should be given to more frequent cleaning in accordance with insurer's requirements.

Periodic specialist cleaning should be accompanied by daily or weekly cleaning of canopies and filters which is typically carried out by the kitchen staff.

These are designed as the first stage of grease / contaminant removal. Currently the most commonly used filters are a baffle type, but mesh and cartridge can also be found or a combination of the three. Filters are normally housed within the canopy hood .

Safety advice: Please ensure that any UV system is isolated prior to any filter removal—UV is harmful to human health.

The most common standards are:-

- **DIN 18869-5 -** Equipment for commercial kitchens - Components for ventilation Part 5:Aerosol separators, requirements and testing—Average Aerosol Efficiency 77.6%
- **DW172**– Specification for Kitchen Ventilation Systems—All systems should be compliant to this specification.

The next pages illustrate some common filters i.e.

Fig 21—Standard Construction Baffle Style Grease Filters with Aluminium Frame

These filters are designed for use in commercial kitchens and ventilation from food preparation areas, where their primary function is to reduce flame from travelling from the cooking area up into the extract duct.

They are manufactured by rolling Aluminium to create a series of baffle plates which are welded onto a sub frame. The sub frame is then wrapped with the outer frame. These must be cleaned regularly.

Fig 23 –Mesh Style Grease Filters with 45mm Thick Aluminium Frame and Galvanised Steel Mesh

These style grease filters are designed for use in commercial kitchens and ventilation from food preparation areas where their primary function is to reduce grease carry over from the cooking area. Rated at 1.5m/sec where the pressure drop is 15Pa for 45mm filters and less than 10Pa for 20mm filters. Construction involves rolling an Aluminium frame which holds a series of expanded and corrugated Galvanised Steel layers. These layers create an impingement barrier which catches grease from the extract air.

Fig 25—Duo Grease Filter. Baffle Mesh Combination. All Stainless Steel Construction

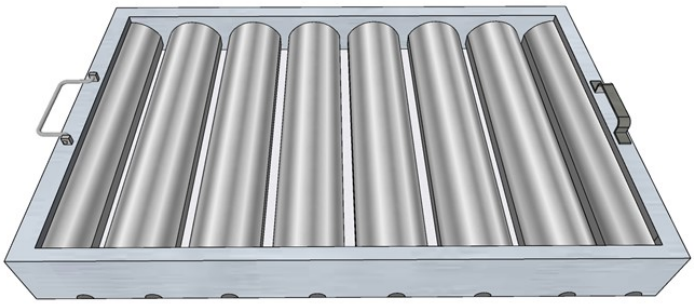
These filters are designed for use in commercial kitchens and ventilation from food preparation areas where their primary function is to reduce flame from travelling from the cooking area up into the extract duct.

The extra mesh layers improve grease collection rates over standard baffle filters. These filters are manufactured by rolling Stainless Steel to create a series of baffle plates which are welded onto a sub frame.

The sub frame is then wrapped with the outer frame. To the rear are located layers of expanded fine mesh which improve filter efficiency without sacrificing flame stopping performance. This gives the best of both worlds.

12.5 FILTER TYPES

Fig No. 21. Baffle Filters

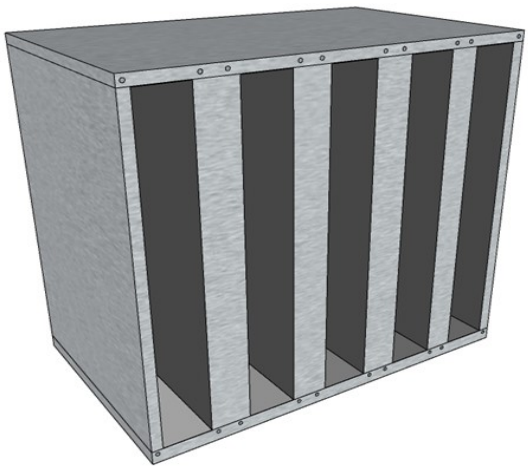


BAFFLE FILTERS

Two-way grease removal via interlocked vanes which work by changing the air velocity and direction. Grease becomes separated through this process and is collected in drip trays via weep holes at the bottom of the filter.

TIP: Report on your post clean report any unprotected gaps between the filter and the housing which leaves the ductwork exposed to fouling.

Fig No. 22. Carbon Filters Unit



CARBON FILTER UNITS

These filters are manufactured for ease of installation and incorporation into ducted air systems. They can be used on both supply for purifying air, and can be used on the extract to remove toxic gasses and odours generated within a process

Fig No. 23. Mesh Filters

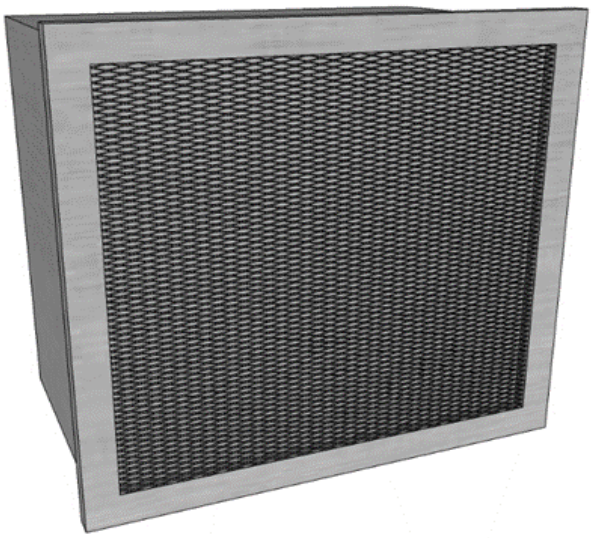


MESH FILTERS

Layers of stainless steel or non-corrosive galvanized mesh screens which collect grease, accumulate on the mesh surface.

These tend not to be used as first stage filtration in canopy hoods as grease and accumulation can be concentrated across the whole surface area, and create a potential ignition source. However, manufacturers use them as part of a second stage or hybrid solution combining with other types.

Fig No, 24. Compact Filter

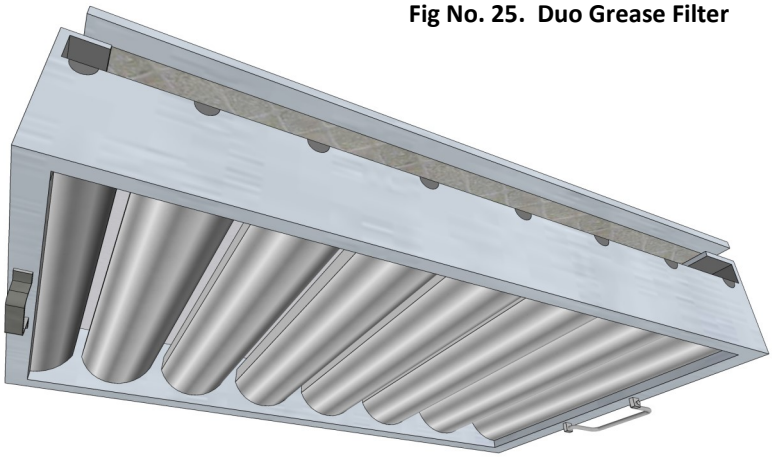


COMPACT FILTERS

Designed for use in high temperature applications.

Typically used in Kitchen Extract systems, however it is a versatile and robust filter which can be used in all situations.

Fig No. 25. Duo Grease Filter

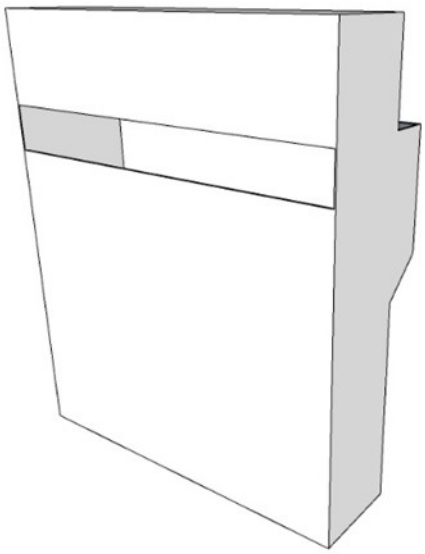


DUO GREASE FILTER. BAFFLE MESH COMBINATION

These filters are the best of both worlds. These filters are designed for use in commercial kitchens and ventilation from food preparation areas where their primary function is to reduce flame from traveling from the cooking area up into the extract duct. The extra mesh layers improve grease collection rates over standard baffle filters.

Please note: Fans may need uprating.

Fig No. 26. Cartridge Filter



CARTRIDGE FILTERS

Installed to form a high velocity opening for a number of baffle filters. These cause the air to change direction four times over at a lower pressure than baffle filters and installed in a sloping assembly over the full length of the canopy hood. Liquid grease is collected into a grease drawer.

12.6 PLENUMS

This void is inside the canopy, normally after the filters and prior to the start of the ductwork. It is designed to facilitate air circulation. It should be readily accessible for cleaning and maintenance. Please note: In some system plenums access can be restricted by fire suppression detection systems. Any restrictions to access should be recorded and reported in the post clean report.

Fig no. 27. Air flow through the plenum

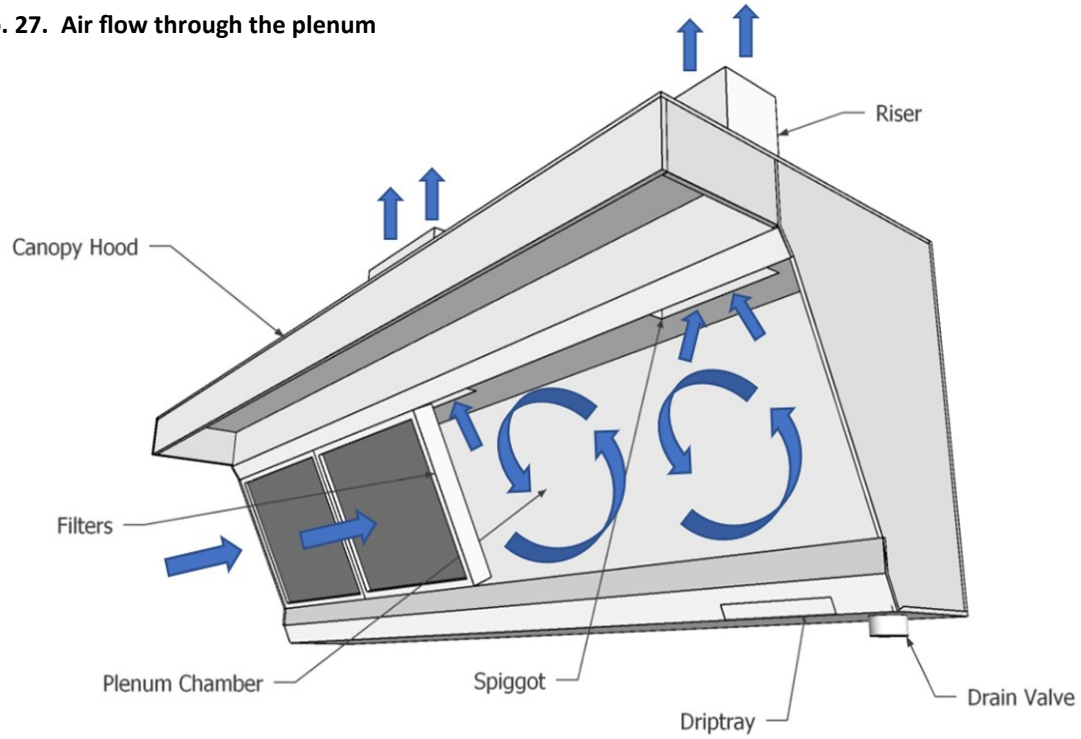
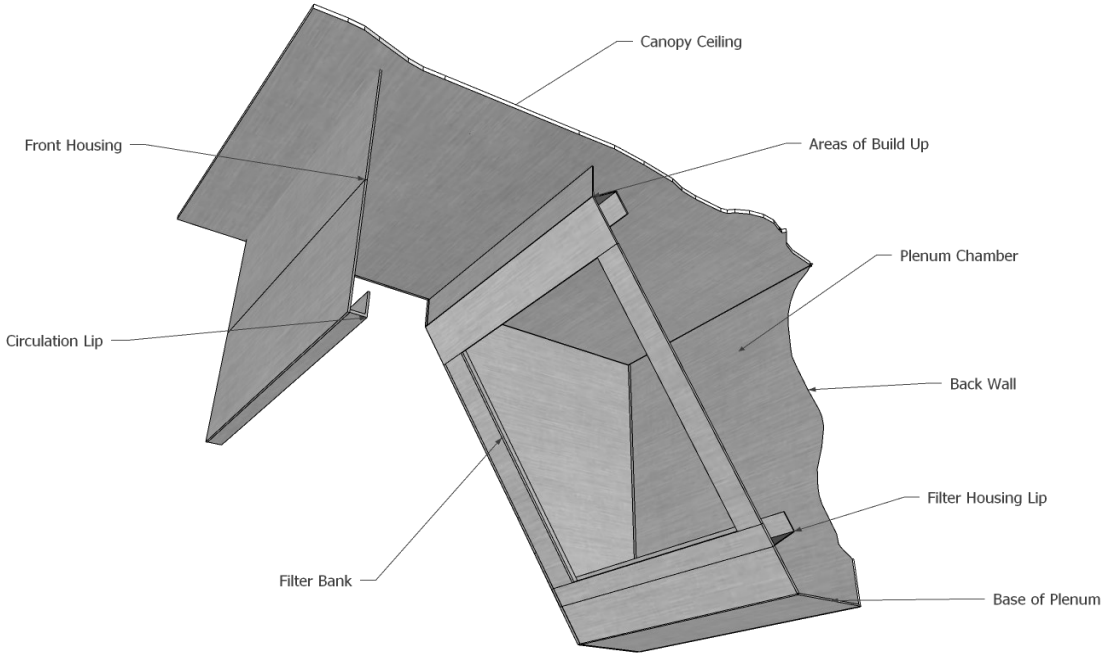


Fig No. 28. Filter housing & plenum chamber



12.7 KITCHEN GREASE EXTRACT DUCTWORK

Ductwork is conduits conveying grease aerosol or fumes, in this case from the kitchen, to the fan and the point of exhaust

Fig no. 29. Rectangular Ducting

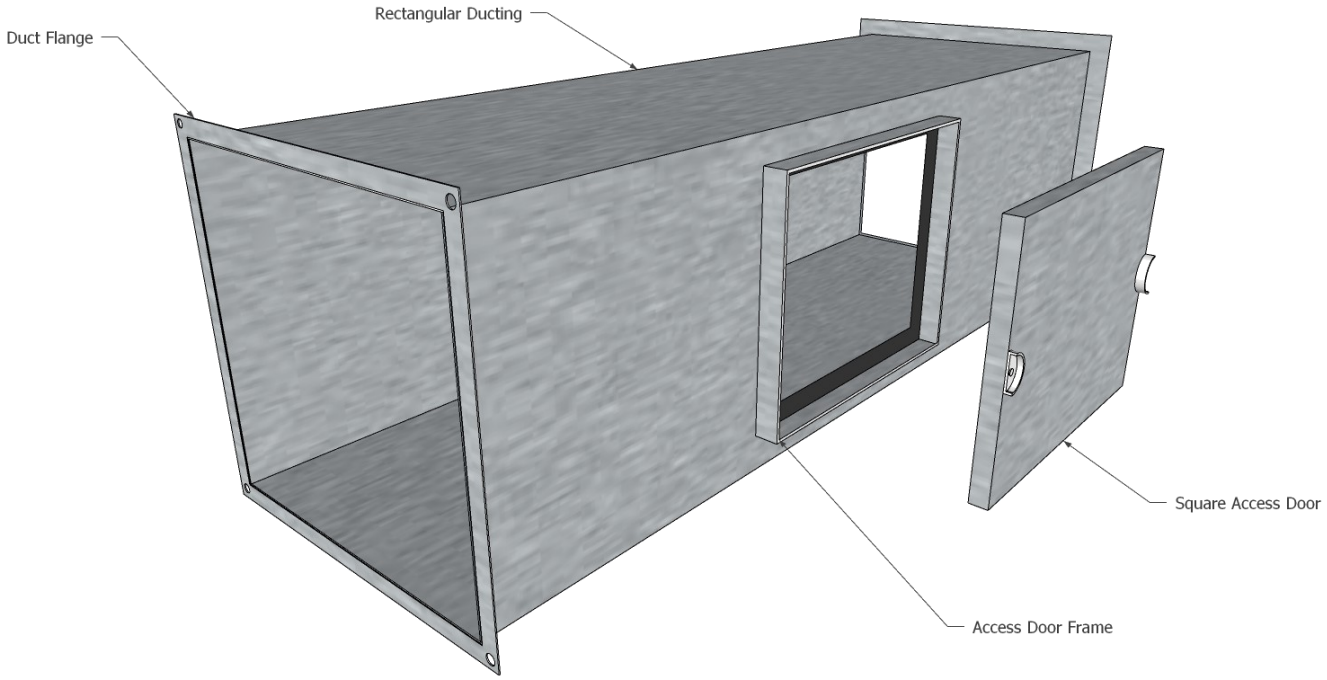
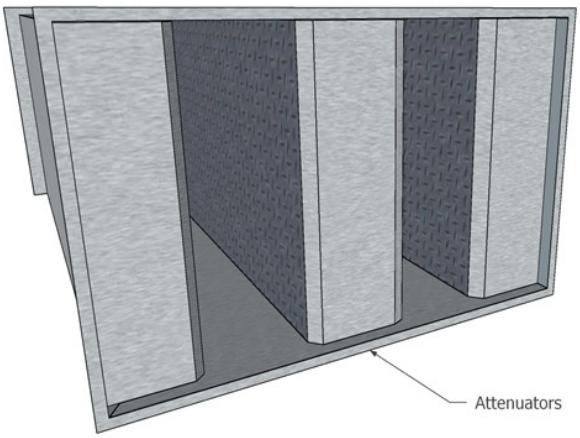


Fig No. 30. Grease Extract Ductwork—Attenuators



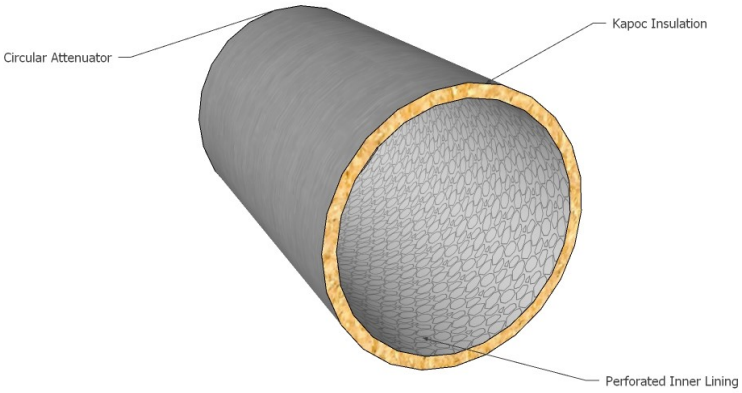


Fig no. 31. Perforated Inner Lining of an circular Attenuator

12.8 FIRE RESISTING DUCTWORK

12.8.1 THE IDENIFICATION OF TYPES OF FIRE RESISTING DUCTWORK

The market place for fire resisting ductwork is constantly changing and the table below shows information that's indicative at the time of publication and thus subject to change and amendment. The fire resistance periods given below are based on website statements by the manufactures. However, care should be taken that fire stopping methods are incorporated to insulated ductwork as it passes through walls or other fire compartmentations.

Fire resisting ductwork is not always labelled and can appear very similar to standard ductwork.

Table No. 12. Types of Fire Resisting Ductwork

NAME	DESCRIPTION	DETAIL
Flame bar BW11	Fire resisting ductwork. Fabricated galvanised sheet steel is degreased and then sprayed with a specially formulated compound. Coating tends to be a natural buff or sandy white colour with pits / indentations to surface.	Can also be supplied in circular, four sided or flat oval shapes. Prescribed fire resistance in terms of insulation, integrity and stability for between 30 to 240 minutes.
FirePro Fire duct systems Rock-wool	Fire resisting duct system with reinforced aluminium foil on one side. These can take the form of a slab, duct section or high-density slab with machined grooves around circular ducts.	Can be supplied in rectangular or circular ducts. Fire resistance stated at 0.5, 1, 1.5 and 2-hour periods. 'Kitchen extract' ducts are subject to separate BS 476–24 requirements and are additionally covered for 0.5 and 1-hour protection periods
CASWELL FIRESAFE®	Heavy duty fire Resisting non-coated ductwork for passive fire protection. Silver in colour with red flame symbols on the exterior of the duct.	Can be supplied in rectangular or circular ducts. Fire resistance periods up to 240 minutes for stability, integrity and insulation.
Safe4	Fire resisting non-coated silver coloured duct-work. May be manufactured from sheet metal. Newer installs have a picture of a side ways flame with the words safe4 printed below.	Can be supplied in rectangular or circular ducts. 4-hour fire rated ductwork.
Durasteel fire ducts	Lightweight fire resisting ductwork constructed to various sizes with configurations of 1 to 4 sides. Appears perforated in a number of colours including silver and black.	Configurations include rectangu-lar ducts. 4-hour fire rated ductwork. WARNING—Pre 1978 contains Asbestos Post 1978 Do not con-tain Asbestos Information from AIC (Asbestos Information Cen-tre)
Firemac	A specially woven glass fibre cloth applied to steel ductwork at the point of fabrication.	The range includes a non-combustible fire protection board made up of a central cementitious core that is faced on both sides with specially designed, mechanically bonded, galvanised steel.

TIP:
Engineers are advised to obtain clarification of any fire resisting ductwork system from the client's hand over documents.

12.8.2 PICTORIAL EXAMPLES OF FIRE RESISTANT DUCTWORK

An few pictorial examples of fire resisting ductwork in rectangular and circular configurations.

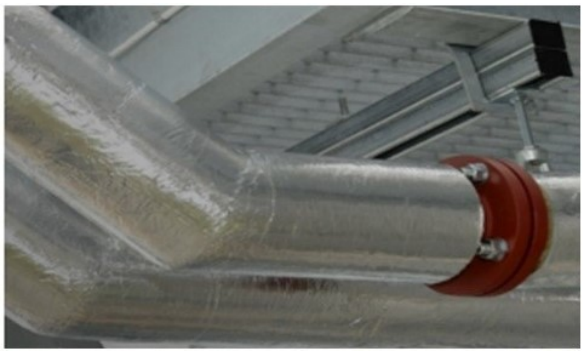


Fig No. 32. Flamebar BW11 Fire Resistant Ductwork

FLAMEBAR BW11 FIRE RESISTANT DUCTWORK

Fabricate from galvanized sheet steel to an enhanced standard. It is then degreased and sprayed with a coating using a specially formulated water based compound. The coating contacts selected mineral filters in a low permeability finished product which has been successfully tested for international use under Cellulosic Fire Conditions for 4 hours duration.

The unique BW11 coating has a number of distinct benefits: The provision of in excess of 2 hours insulation when handling internal gas temperatures of 400°C A reduction in base duct construction thickness or gauge Reduction in duct reinforcement



ROCKWOOL STONE WOOL

Tolerate temperatures of up to 1000°C. Kitchen extract ducts, which are subject to separate BS 476-24 requirements, are additionally cover for ½ and 1 hour protection periods.

Fig No. 33. ROCKWOOL Stone Wool



Fig No. 34. CASWELL FIRESAFE® Rectangular and circular



Fig No. 35. Safe4 Fire Duct Systems

THOR DUCT (FORMELY SAFE4 ®) COMPLETE FIRE DUCT SYSTEMS

Thor Duct (Safe4 ®) is a complete fire ductwork system, that has been tested to the latest EN standards. It provided CE marking on products where harmonized standard exists.

Smoke Extraction
Pressurisation
Passive Scenarios
Kitchen Extraction

CompartmentationSafe4® Kitchen Extract is insulated using a calcium magnesium silicate blanket which maintains the duct temperature below 180°C and prevents grease igniting and causing fire to spread throughout the building.

Safe4 ® is installed with two wraps of insulation, each wrap with a depth of 38mm.

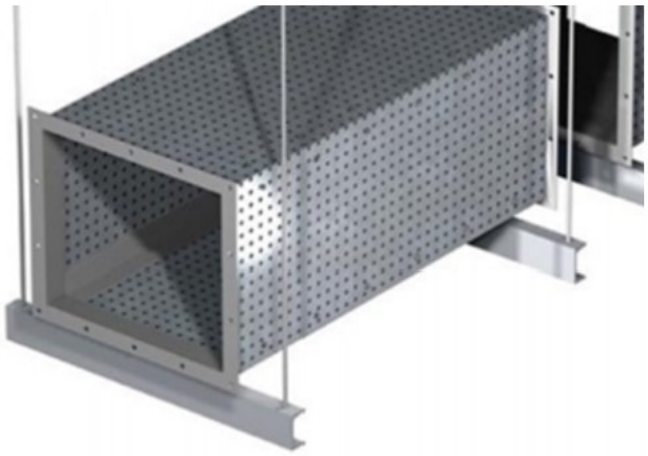


Fig No. 36. Durasteel Fire Resistant Ducting

DURASTEEL®

Offers high levels of blast and fire resistance

DURADUCT® is ideal for particularly onerous conditions e.g. where high impact strength is required or for use in aggressive environments.

30-340 minutes fire resistance

WARNING—Pre 1978 **contains** Asbestos
Post 1978 **Do not** contain Asbestos
Information from AIC (Asbestos Information Centre)

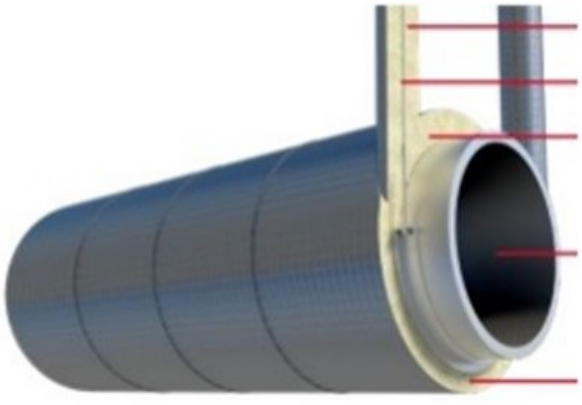


Fig No. 37. FIREPRO Fire Duct Systems

FIREPRO ® FIRE DUCT SYSTEMS

Fire Duct Section must be glued with ROCKWOOL FIREPRO® Glue at the joints and in the grooves. Steel bands or wired must be fitted circumferentially to the system at 300mm nominal centres to hold all joints and grooves tightly closed while the glue cures.



Fig No. 38. Firmac ducting

FIREMAC

Product is a self-adhesive glass fibre fabric, bonded both physically and mechanicaly onto steel ductwork to give the required fire resistant. The fabric is applied directly to your ductwork by our workshop engineers, there is no curing time, and the finish is neat and aestheically pleaseing while still achieving the required fire resistance period. By using Ventilation Design Services to bring you your Fire Rates Ductwork you have the following benefits.

Self-adhesive fabric so no need for sprays or chemical No tack or cruing time Lightweight but extremely robust and flexible Environnental benefits

Testing is required to prove compliance with fire compartmentation requirements for fire Resistant ductwork and to check their retnetion of cross sectional area or smoke extracts requirements. In the UK British Standars BS476: Part 24: 1987/EN1366 are used for this purpose.

CAUTION:

For Fire Resisting ductwork do not attempt to fit standard access doors as these will fail in the event of a fire. It will also invalidate the client's insurance.

Always refer to the manufacturer's instruction for the installation of access doors and fixing, as they may differ from each product.

See BESA DW172 for further information. See Appendix 1 Page 59.

12.9 FAN SYSTEMS

12.9.1 FAN WITH HOUSING

An integral part of the grease extract system designed to draw air or vapour though a ductwork system. In a grease system the fan is used to extract fumes towards the point of exhaust. There are many types of fans utilized and these will be detailed in later sections of this guidance. Safety advice: The fan housing is normally labelled with two numbers that indicate if wet cleaning methods can be used. It should be readily accessible for cleaning and maintenance under British and European law.

12.9.2 FAN MAINTENANCE

Fans, motors and drives may be heavily contaminated especially if oil or grease has leaked. Impellers may have heavy deposits on the blades. Fans must be kept clean and dust-free. The windings of a motor are closely wrapped and separated only by a thin layer of insulating lacquer. This lacquer can deteriorate due to age, weather changes and heat. The insulation generally lasts a life cycle but can lose its properties more quickly if there is a lot of grease, dirt and dust. Kitchen extract fans operate under increased strain and are therefore particularly prone to burn-out due to the heat, grease-laden and oily environment they operate within. The likelihood of this occurrence increases with age. This is particularly so where there is a significant build-up of heat modified oil due to a lack of regular cleaning. A clean motor will dissipate heat more effectively than a dirty motor, therefore lasting longer. Regular cleaning can prevent imbalance which leads to increased vibration.

It is essential to ensure fans are electrically isolated and locked off before carrying out inspection or cleaning works.

For full in-situ cleaning, partial dismantling and, possibly, the creation of extra access panels in fan casings, subject to manufacturer approval, may be required. Fans can vary in size greatly. The types typically found within ventilation plant are axial flow, centrifugal or bifurcated.

CAUTION:

Cleaning may knock off fan blade balancing weights and lead to excessive vibrations

12.9.3 SELECTING A FAN FOR KITCHEN GREASE EXTRACT

Taking time to install the correct fan and maintaining it properly, e.g. by proper cleaning, minimises a variety of operating problems. Axial fans and centrifugal fans are more suited for extracting clean air at normal operating temperatures i.e. up to 100°C. Contaminated air, such as in a kitchen, necessitates using an extract fan where the motor is isolated from the airstream.

Bifurcated, MUB and KBT fans are more suitable for kitchen extract because they can withstand high temperatures i.e. up to 200°C. These fans, having motors out of the airstream, prevent grease build-up and provide easier access for cleaning and maintenance.

NB The cleaning of fans in kitchen/restaurant ventilation which are not suited to the high temperatures and grease-laden environment in kitchen extract carry a risk associated with cleaning. They can be subject to burn-out as described previously and centrifugal fans can also be prone to imbalance causing vibration if not cleaned fully – **Do not partially clean.**

We strongly recommend that design engineers specify that all fan housings should have large removable cleaning plates installed in the fan casings for cleaning of impellers and internal housings. These plates could be double skinned, so the inner skin sits flush with the inner housing. On bifurcated fans, a panel is required on both sides.

12.9.4 IP RATING

IP stands for Ingress Protection. Electrical equipment such as motors in fans often have an IP rating which tells you how Resisting it is to foreign bodies such as dust, fluid, moisture. The IP Rating is a simple encoding that covers a range of international standards. See **Appendix 4 Page 63 for full explanation.**

12.9.5 DIFFERENT FAN TYPES



Fig No. 39. MUB (Multibox) Fan

MUB (MULTIBOX) FANS

MUB fans can handle the demanding requirements of a kitchen/restaurant environment. Panels on all sides can be easily disassembled for inspection, cleaning and maintenance. This fan generates higher static pressure and the motor is located out of the air stream. IP54 rating.



Fig No. 40. Bifurcated Fans

BIFURCATED FANS

Bifurcated are inline axial flow fans specifically developed to meet the need for an axial fan which can handle atmospheres normally detrimental to the life of the fan motor. They are ideal for extracting: hot; greasy; dusty; corrosive or contaminated air applications as the motor must be isolated from the air-stream. By isolating the motor from the system airstream, the bifurcated fan can handle a wide variety of saturated and dust-laden atmospheres, heated air and hot gases. The motors are specially selected to operate at higher temperatures. They are suitable for medium to high volume applications with low pressure development. IP55 rating.



Fig No. 41. KBT Fan

KBT FANS (SWING OUT FANS)

KBT fans also have motors located outside the air stream as well as a swing-out door for easy inspection, cleaning and maintenance. The direction of the door opening can easily be changed from left to right at site. To protect the motors from overheating the KBT fans have integral thermal contacts with external leads for connection to a motor protection device. IP54 rating.



Fig no. 42. Centrifugal Fan



Fig No. 43. Standard Curve Fan



Fig No. 44. Axial Flow

CENTRIFUGAL FAN

Centrifugal fans are by far the most prevalent type of fan used in the HVAC industry today and are better served in a clean air environment. They are usually cheaper than axial fans and simpler in construction. They are also used commonly in central heating/ cooling systems and are designed to move air over longer distances. Impeller balancing is done by small weights on a balancing machine. The centrifugal fan is used where the principal requirement is for both flow and higher pressures.

The impeller and internal surfaces of the fan casing should be periodically inspected for deposits which can adhere, reducing efficiency and possibly causing imbalance and vibration. Any such deposits should be carefully removed, but on no account should the impeller be subjected to harsh treatment, which will result in damage to the surface finish, airflow surfaces and disturbance of the balance. Cleaning procedures are dependent upon the degree and type of contamination. The minimum amount of cleaning is therefore recommended.

Standard backward or curved centrifugal fans are preferred, as they tend to be self-cleaning. See **Fig 43.**

NB Centrifugal fans can be subject to imbalance, causing vibration. Care must therefore be taken regarding the balancing weights whilst cleaning the impeller.

AXIAL FLOW FAN

This type of fan is used in a wide variety of applications. In general, axial fans are used where the principal requirement is for a large volume of flow and is designed to move air over short distances.

Under normal circumstances handling clean air, axial fans will require cleaning only about once a year. However, axial fans in kitchen extract may need more regular cleaning. See **Table 2 Page 11** for more information.

The following diagrams show location of a fan in an extract system and air flow.

Fig No. 45. Fan Airflow Sensors

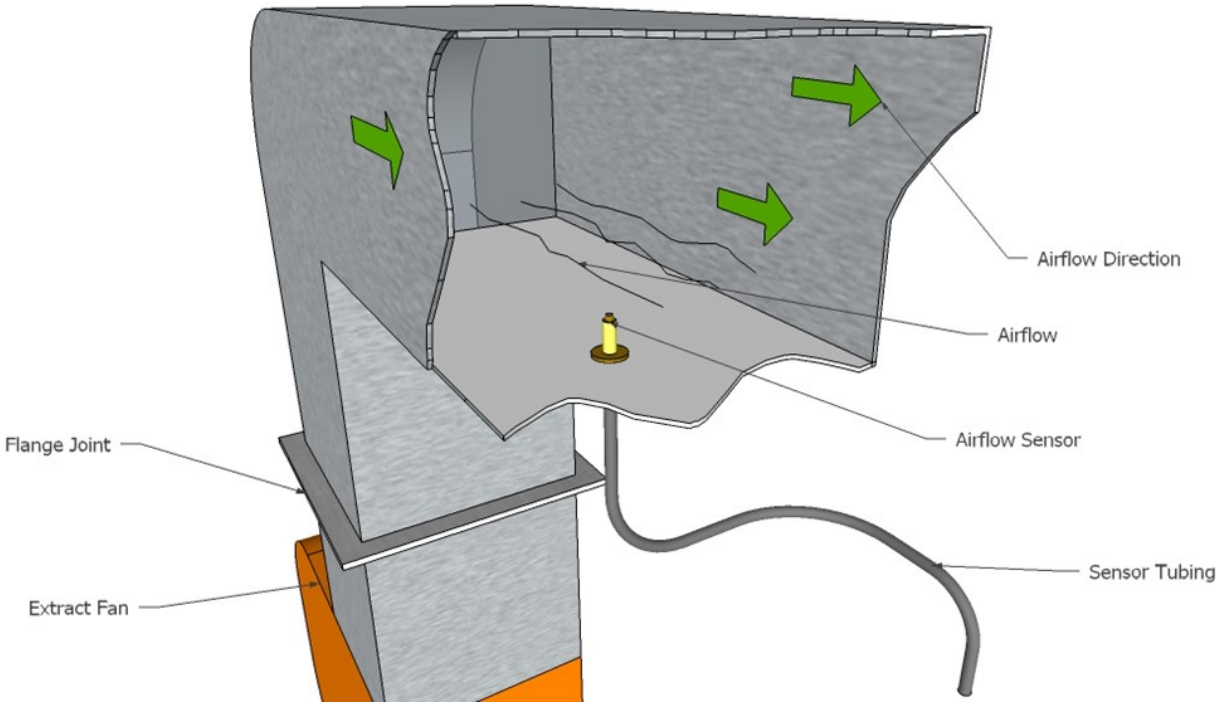


Fig No. 46. Airflow inlet & Discharge

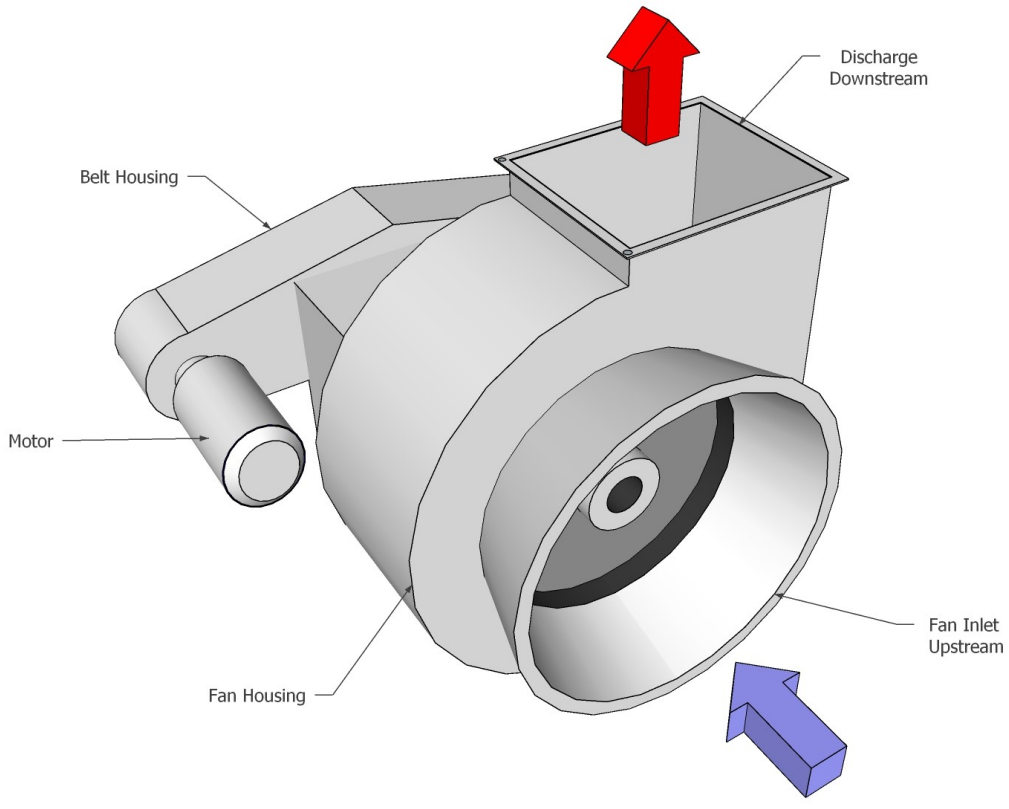
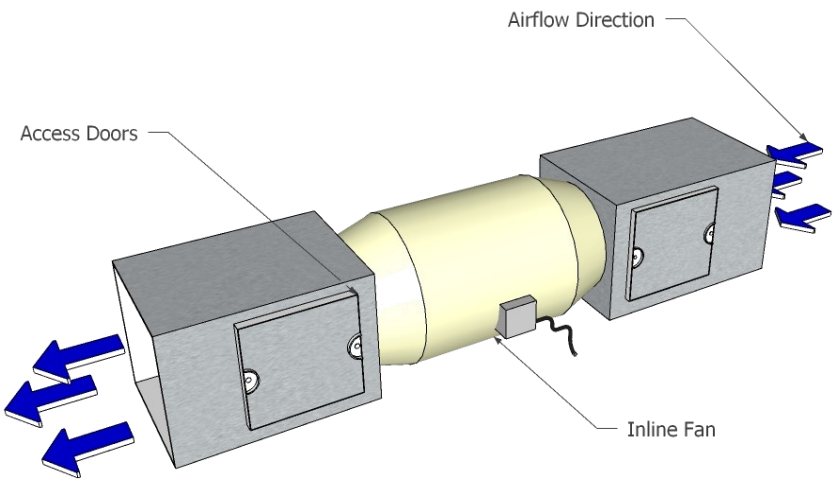


Fig No. 47. Fan Access Panel Installation



As shown in the drawing, access panels must be sited so as to allow cleaning from either side. Some fans are constructed so that additional access is provided from the fan housing.

TIP:

If the construction or siting of the fan provides limited access it may advantageous for the client to arrange for a service engineer to remove the fan to provide greater access for cleaning. Always remember to isolate, lock and sign the fan isolator prior to commencing any work.

CAUTION:

Care must be taken not to get cleaning chemical onto the motor electrics as this could lead to electrical injury and cause motor failure.

12.10 ACCESS PANELS

12.10.1 GENERAL - ACCESS PANELS

Hatches fitted into the duct which provide access for cleaning and maintenance. They are either curved for round duct, although saddles can be fitted, and rectangular doors installed or square for square duct. They must be airtight and to the same integrity or fire rating as existing ductwork.



Fig No. 48. Ceiling Tile Access Panel



12.10.2 FIRE RESISTING ACCESS PANELS

Fire Resisting access panels must only be fitted by approved and competent contractors in accordance with the manufacture's instructions.

Fig No. 49. Fire Resisting Access Panel

12.10.3 ACCESS PANEL INSTALLATION

When installing access panels into a grease extract system, they should be fitted at intervals not exceeding 3metres, unless adequate load testing has been carried out on the ducting itself. As per the recommendations BS EN 15780 at the time of this publication. This is for both horizontal and riser ducts.

CAUTION:

For Fire Resisting ductwork do not attempt to fit standard access doors as these will fail in the event of a fire. It will also invalidate the insurance.

Always refer to the manufacturer's instruction for the installation of access doors and fixing, as they may differ from each product.

See BESA DW172 for further information.

12.11 EXHAUST GRILLES

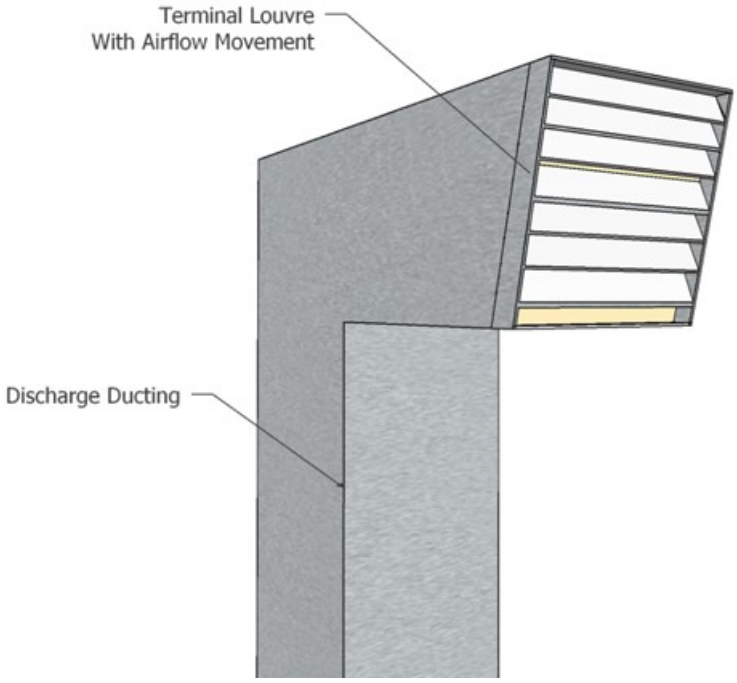
12.11.1 GENERAL

These are, the last point of exit of expelled air, fumes, or vapour from a kitchen grease extract system. They can be a sign of fouling within the ductwork if they show signs of heavy accumulate.

Some grilles are riveted and without replacement screws may prohibit some cleaning. At least one access panel should be fitted prior to the grille for cleaning subject to distance from fan.

TIP: Deposits on the exhaust grille may give an indication of grease / accumulate fouling further back into the ductwork system

Fig No. 50. Exhaust grille/Terminal Point



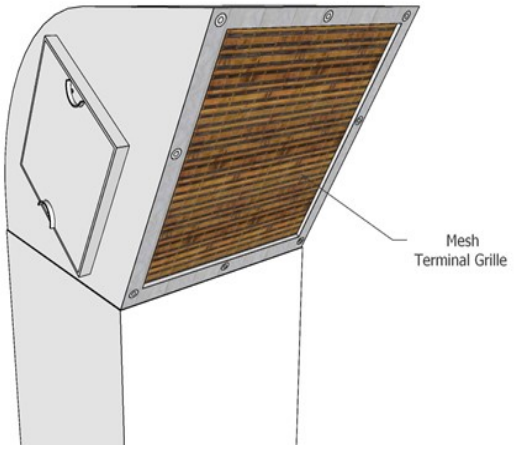


Fig No. 51. Exhaust Grille

12.12 ATTENUATORS/SILENCERS

12.12.1 GENERAL

This is where the external size of the ductwork increases for that section. Normally found near the fan the main principle of the attenuator is to reduce sound. The sound absorbing material may be fiberglass or rock wool. Access panels cannot be fitted in an attenuator

As shown in the drawing the minimum requirement for cleaning is from either side of the attenuator. It must be noted that in many cases the outer or second skin of the attenuator may not be accessible but may still accumulate grease.

Fig No. 52. An Attenuator

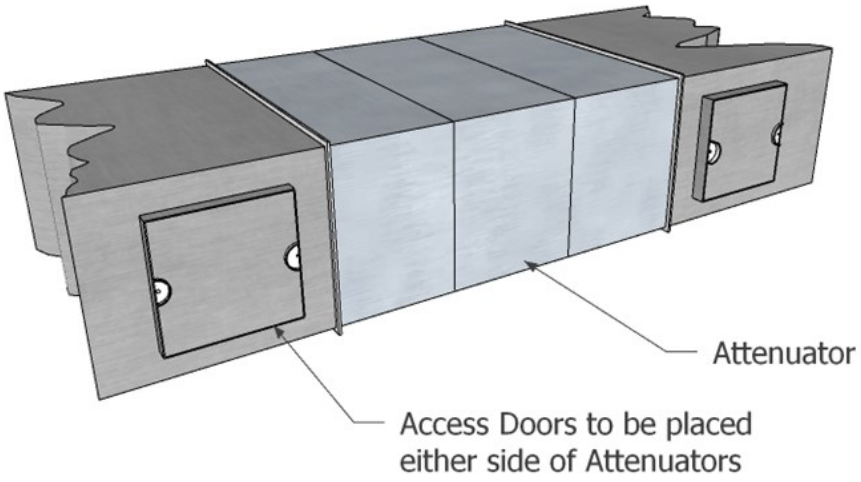
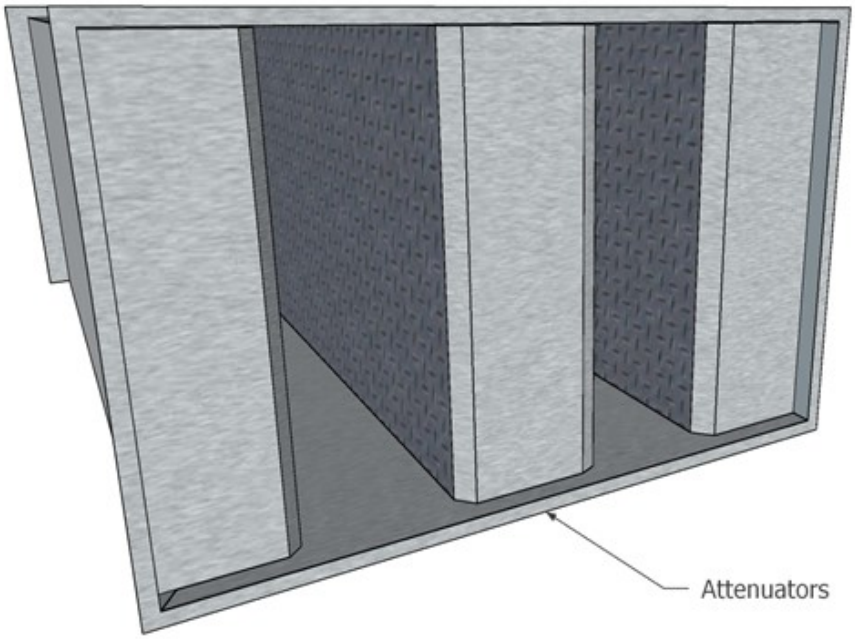


Fig No. 53. Attenuators



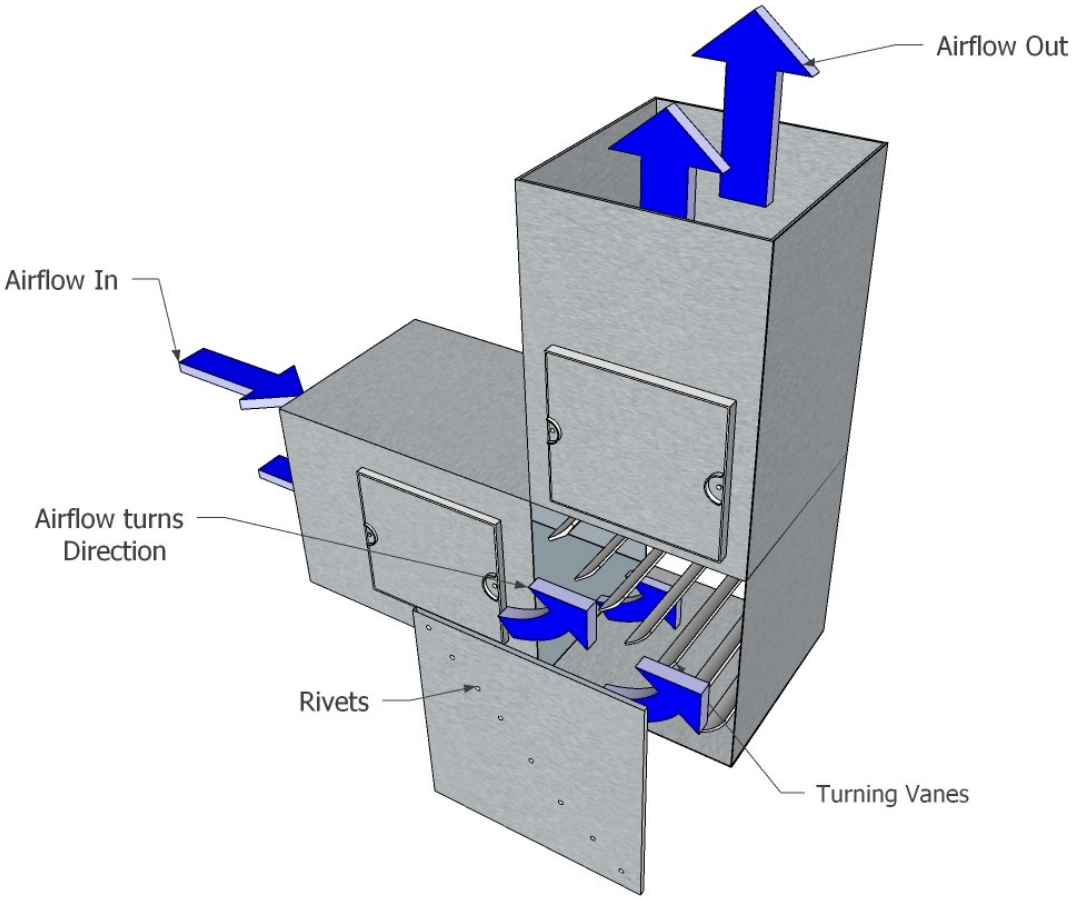
TIP: Bang on the outside of ductwork to make sure it is hollow and does not contain an attenuator

12.13 TURNING VANES

Marked by rivets on the outer surface of the ductwork. These vanes are used to change the direction of air flow and can prevent the installation of access doors, these areas are prone to blocking with grease.

Turning vanes are only found on square or rectangular ductwork.

Fig No. 54. Turning Vanes & Airflow



12.14 ANCILLARY COMPONENTS

12.14.1 WATER WASH/MIST SYSTEMS

The plenum or extract system chamber is sprayed with hot water under pressure that is collected and flows through a drainage channel. These systems have various degrees of automation. Continuous mist systems operate in a similar way using a spray of cold water which runs continuously capturing grease-laden air. They are designed to extinguish any embers or sparks.

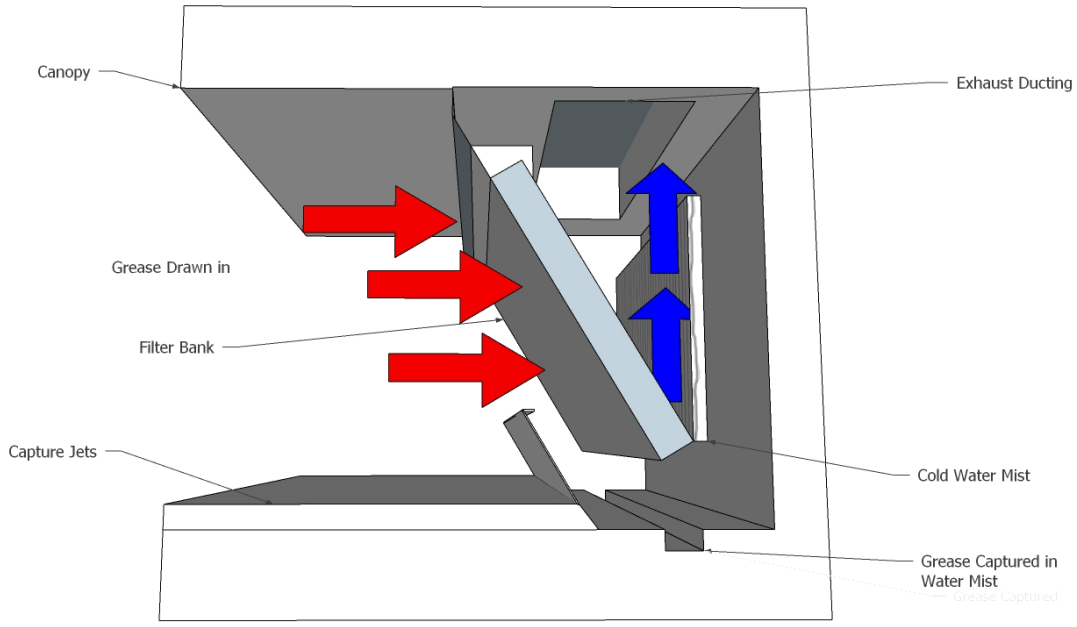


Fig No. 55. A Water Wash/Mist Systems

12.14.2 FIRE DAMPERS

A fire damper is a component that makes up part of the duct defenses. When triggered it closes to stop hot air or flame passing through further sections of duct. Normally found in the plane of structural and fire barriers such as walls and floors. These are not installed in Kitchen Grease Extract Systems.

However, Fire Dampers may be found in Kitchen Extract systems which may be obsolete. Please refer to **Part 2—Air (IAQ)** for full details and description of fire dampers.

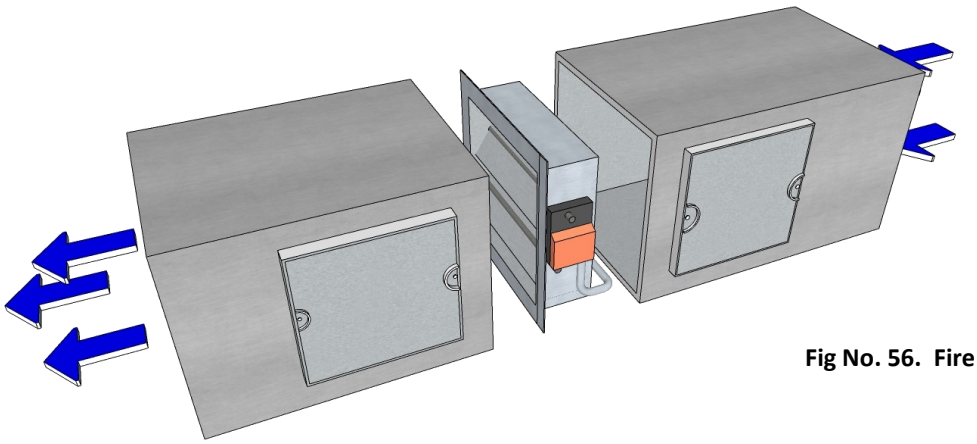
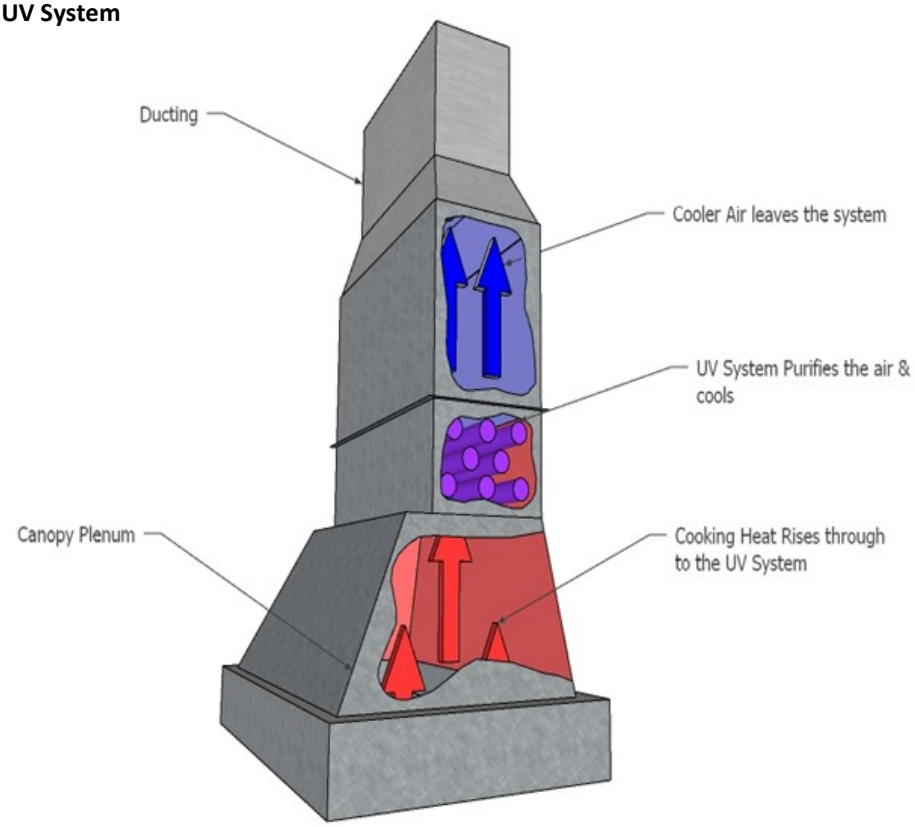


Fig No. 56. Fire Damper

12.14.3 UV-C/OZONE SYSTEMS

These systems use UV-C lamps located in the plenum and work by introducing oxygen or ozone ions. These inline oxidation systems neutralize contaminants using chemically bonded ions which are then drawn to the system exhaust via the grease extract fans.

Fig No. 57. UV System



CAUTION

Key Safety Note The UV-C light can cause damage and must be switched off before the removal of the filters.

CAUTION

Key Safety Note Before removing any access panels the ozone must be expelled from the ductwork by running the fans with the UV system switched off for at least 5 to 10 minutes.

TIP: On a pre-clean toolbox walkthrough please ensure the UV-C light cannot be seen through the filter or the housing during normal operation. If the technician can see UV-C light escaping, please ensure a safety note is recorded on the post clean report or advisory note.

12.14.4 HIGH TEMP DUCTS PIZZA OVEN

Pizza & solid flue systems normally require more aggressive and more frequent cleans. Check with manufacturers for standard maintenance, to ensure they are within the Catering Equipment Distributors Association (CEDA) guidelines. Anyone cleaning this type of duct should ensure they are fully aware of the difficulty in fitting access panels to it and the action of specialist chemicals to clean these ovens.

Fig No. 58. Special High Temp Ducts (Twin wall systems)



13 THE FUTURE OF KITCHEN GREASE EXTRACT SYSTEMS

13.1 LEGAL CHANGES AHEAD

Looking to the future, it is inevitable that the landscape will change due to environmental and economic challenges. NAADUK highlights some of the changes that will take place in the future, due to Government directives and legal requirements.

One of the major changes is reducing the use of gas operated equipment and eventually a total ban.

In Feb 2019 a BBC News reported in an article "Will my gas hob be taken away?" That the Committee on Climate Change are recommending that "no new homes are connected to the gas grid by 2025 at the latest. Government advisers want gas hobs to be banned from being installed in new homes within six years." The article goes on to say that " the Dutch government introduced regulations which prevent new homes connecting to the gas grid. It wants all residential buildings to be off gas by 2050, reducing CO2 emissions from all residential buildings. Large cities like Amsterdam, Rotterdam and Utrecht have signed a Green Deal, hoping that over the next few years gas-less neighbourhoods will emerge." https://www.bbc.co.uk/news/uk-47320673

Modern day environmental standards and the various cooking procedures today, raise many problems for users and Environmental Officers around the UK. When standards were first set, Restaurants were not working to the capacity that they are today. The proliferation of restaurants, takeaways, and fast food outlets, mean that hundreds of tons of carbonic and other pollutants are discharged to atmosphere every year. If this continues to rise at the present rate, this will add significantly to Air Pollution problems. In the future this will not be tolerated, in fact, changes are already here and will lead to less duct cleaning . These changes will also obviously reduce the risk of fire.

Any future Pandemics and other mass infections, will lead to more reliance on takeaways or factory produced food being sent directly to many takeaways, thus reducing restaurant market share, as we are already seeing on our sites.

13.2 OTHER FUTURE TECHNOLOGIES IN THE MARKEPLACE

Hood sensors automatically detecting a maximum set temperature then automatically reduce the temperature of cooking equipment to avoid flash fire.

Sensors in the filtration equipment determine the condition of the filters and the housing. These sensors are sometimes combined with processes which automatically shut down the fan and catering equipment where cleaning frequencies are breached. In addition, the sensors may be linked to the internet to communicate accumulate level data and to automatically schedule service maintenance and cleaning.

TIP: BIOTECHNOLOGY: Where there are multiple outlet sources of high levels of aerosol content this will result in undertaking many cleans, i.e. every one or two months, the use of a biological technology such as Ecofix/Provent or similar should be considered. This would be beneficial by saving on costs, and reducing the fire risk. This type of technology should be considered if the extract ductwork cannot be replaced with a ductless system.

13.3 DUCTLESS KITCHEN EXTRACTION AND FREE-STANDING SELF-CONTAINED RECIRCULATION UNITS

The use of ductless kitchen extract systems is increasing. Units in the marketplace provide improve filtration in kitchens with no external ventilation. This has obvious advantages for where a kitchen is located in a building. Most units are suitable for electric equipment only which counters any gas regulations. The manufacturers claim that ductless ventilation hoods and recirculation units can be used where planning permission is difficult to obtain.

Fig No. 59. Ductless System

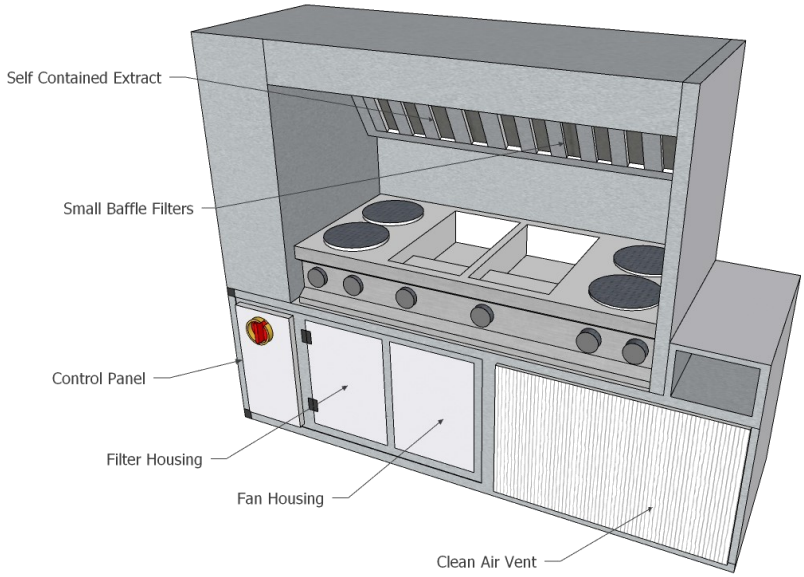


Fig No. 60. Single Reco-Air Unit

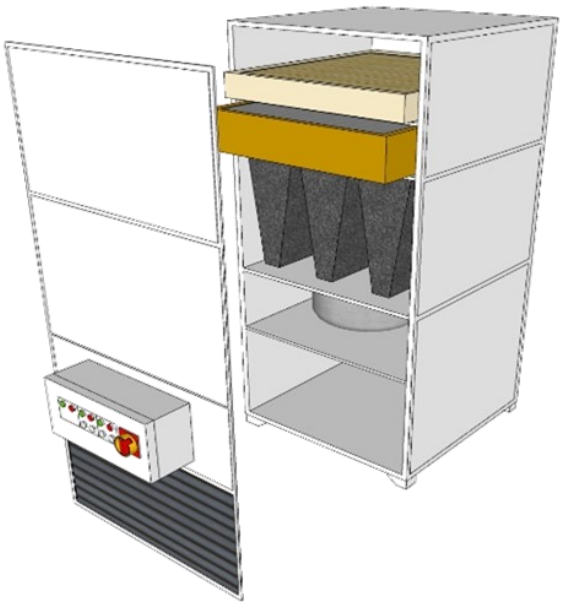
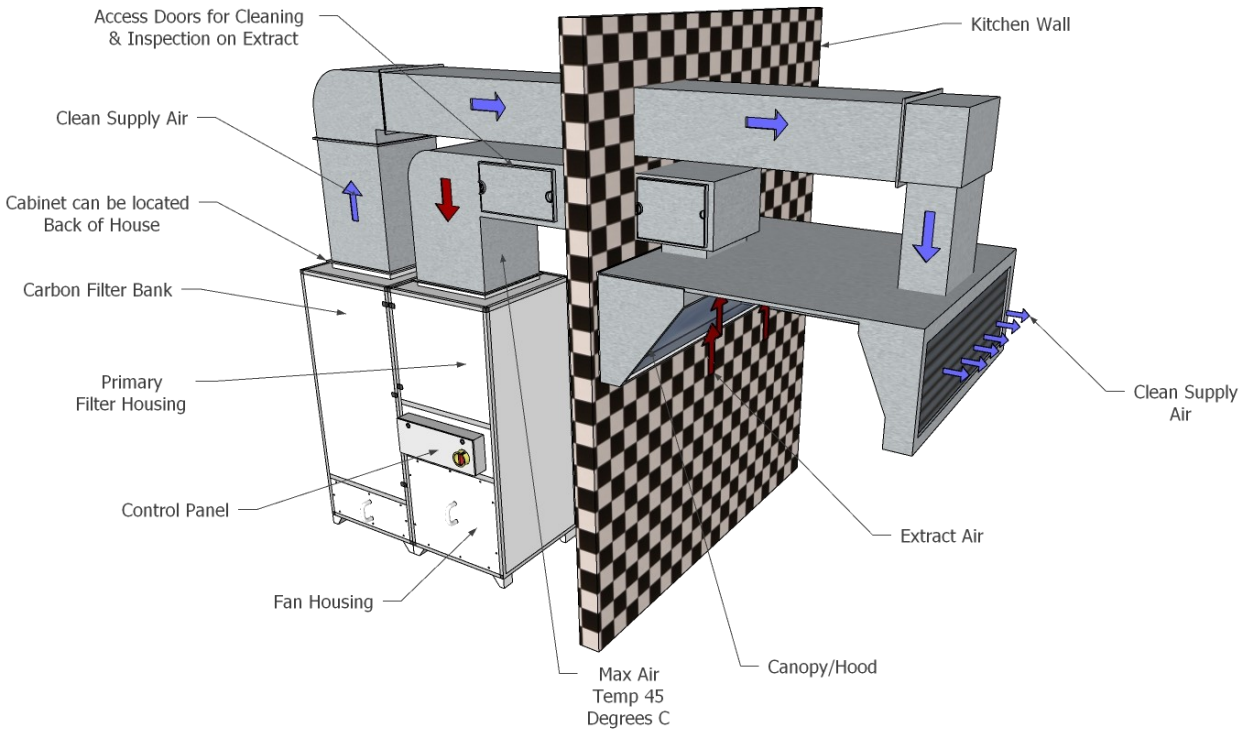


Fig No. 61. Double Full Reco-Air self Contained unit



Potential benefits of such system are:-

Table No. 13. Benefits of a ductless kitchen extraction and free standing self-contained recirculation units

BENEFITS
The reduction of ductwork to atmosphere
Self-contained recirculation unit to increase capacity in existing kitchens
Enable the creation of a new cooking area
Enable Menu changes
A multiple stage filtration process to remove fine particulate, smoke, grease and smells
The capture of contaminants that would normally be expelled to atmosphere
Systems utilising a filtration tower normally include a filter's module, fan and motor,
Some configurations can be fitted with fire suppression equipment
Some solutions can be retro fitted, for example cooling coils.

Table no. 14. Considerations for installing ductless kitchen extraction and free-standing self-contained recirculation units

CONSIDERATIONS
Many units do not control air temperature, so consideration for alternative methods of room temperature control should be considered. It must be stated that some service
To be used with electrical catering equipment, as most units do not remove carbon
Variable fan speeds to maintain a constant rate of extraction
Whilst some units do not require a direct duct connection to exhaust to atmosphere,
Any filters, other than the baffle filters, will need replacement (subject to operators manual specific instructions). Some manufacturers state that the frequency of filter changes will depend on the intensity and type of cooking. They further state that if a filter change is needed it can be determined easily by visual inspection as part of general maintenance checks. Other systems use sensor technology with full servicing
Filters found in these systems are likely to include baffle filters, grease filters, HEPA
System configurations may vary

The potential is almost unlimited when locating these types of systems/products as they can be installed almost anywhere. For example, in such locations as:-

- Airports
- Listed buildings
- As an alternative to locating ductwork through a fire break in order to reduce fire risk.
- Railway stations
- Basement kitchens.
- Areas where planning consent has been restricted.
- Any commercial kitchen requiring increased production without extensive modification.

CAUTION:

Some manufacturers include a warranty period which could be invalidated if filter media, housing interiors and sensors are damaged during the cleaning period. Multi layered filtration produced by some companies, contain pressure tube sensors, which could be damaged as a result of cleaning. Furthermore it is argued that layers of filtration which may include G4 (typically this standard will remove 80% of the air-borne particles larger than 10 micron size and may be made from replaceable synthetic material), M6 (High performance fine grade filter(s) and HEPA filters (fine mesh made of borosilicate glass fibres or plastic fibres bound together with up to 5% acrylic binder) will protect the fan from accumulates and hence stop the need for cleaning. Such systems have a further layer of filtration, post fan, made of food grade carbon /activated charcoal media to remove smells prior to exhaust / returning air back to the workspace.

Fig No. 62. The drawing below shows an integrated recirculation system. (relates to Fig 63)

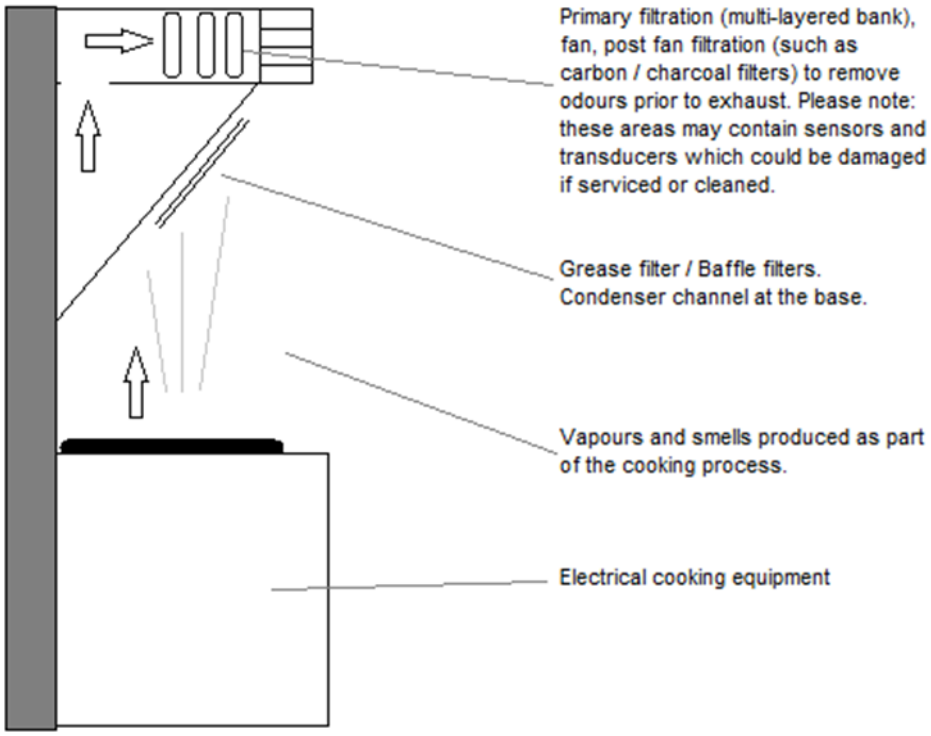


Fig No. 63. The picture below shows a separate recirculation unit. In this case the model shown is manufactured by Reco-Air. (www.reco-air.com)



APPENDIX 1

REFERENCE OF REGULATIONS/STANDARDS/GUIDANCE PERTAINING TO COMMERCIAL KITCHEN EXTRACT SYSTEMS

A brief overview of the regulations, standards and good practices recognised in the UK. in relation to ventilation system and IAQ. A reference list of the various organisations who have produced the documents are catalogued.

REGULATION/LAW	SOURCE	TITLE
EC852/2004 *	Leg Gov	Industry Guide to Good Hygiene Practice. Catering Guide. Regulation ISBN 9780955595394
L24 * Regulations 5 & 6	HSE	Workplace Health, Safety and Welfare Regulations 1992. Approved Code of Practice and guidance. Revised 2013 ISBN 9780717665839
COSHH Reg 2002	HSE	The Control of Substances Hazardous to Health ISBN 978 0 7176 6582 2
RFRO 2005 *	Leg Gov	The Regulatory Reform (Fire Safety) Order 2005 1541 PT 2 17
STANDARDS	**SOURCE**	**TITLE**
LPS 2084: Issue 1	bre LPCB	Standard for Inspection, Cleaning & Maintenance of Ductwork Systems
LPS1223 Issue 2.3	bre LPCB	Requirements and testing procedures for the LPCB certification and listing of fixed fire extinguishing systems for catering equipment
UL300 Standard	Underwrites Laboratories (UL)	Standard for Fire Testing of Fire Extinguishing Systems for Protection of Commercial Cooking Equipment ISBN 978-1559899406
17A	NFPA	Standard for Wet Chemical Extinguishing Systems
DIN18869-5	DIN	Equipment for Commercial Kitchens—Components for ventilation—Part 5: Aerosol separators, requirements and testing
BAFE Scheme SP206 V1 Rev) Sep 2018	BAFE	For the Design, installation, Commissioning, Recharge & Maintenance of Kitchen Fire Protection Syatems
GUIDANCE	**SOURCE**	**TITLE**
FPA RC 44	RISC Authority	Recommendations for fire risk assessment of catering extract ventilation
FPA RC 68 V1 2020	FPA/BSRIA/ InFires	Recommendations for fire safety in catering establishments
NAAD21	NAADUK	Grease (Kitchen Extract) Regulation Standards and Legal Requirements Guidance applicable to the risk management of the fire and reduction of grease levels within commercial kitchen extract systems.
TR19 Grease	BESA	Guide to Fire Risk Management of Grease Accumulation within Kitchen Extraction Systems ISBN 0-903783-29-0
DW172	BESA	Specification for Kitchen Ventilation Systems ISBN 0-903783-29-0
	CEDA	Guidance on the safe installation, operation, and maintenance of Solid Fuel Fired Catering and Food Service Equipment.
Catering Information Sheet No 10	HSE	Ventilation of kitchens in catering establishments (rev3) 07/17
March 2017	Eurovent	Air Filters for General Ventilation

A list of regulations, standards and guidance for Air can be found in Part 2

APPENDIX 2

LPS 2084: ISSUE 1 STANDARD FOR INSPECTION, CLEANING & MAINTENANCE OF DUCTWORK SYSTEMS

(EXTRACT TAKEN FROM LPS 2084 *WITH PERMISSION)*

1. Scope

- Meet the requirements of the client contract:
- Document and report correctly
- Identify and record areas of limited access where inspection, cleaning and maintenance are impractical and communicate these limitations to the client:
- Give recommendations for access improvements to better facilitate the ongoing cleaning and maintenance of the ductwork system

2.6 The Company

A company that meets the requirements of this standard

2.7 Workmanship

The ability to carry out the activity within the stated tolerances specified to meet performance requirements

3.1 Records and supporting documentation

The LPCB approved company shall maintain documentation and records of the activities that fall under the requirements of this standard. The purpose of these records is to demonstrate that:

a) The requirements of this standard have been met and:

b) The procedures employed are such that the contract requirements have been met.

Specifically, the company shall maintain (at least) the following records:

i) Client

ii) Site address

iii) Unique reference for the job of work

iv) Names of the individuals undertaking the work

v) Project supervisor's name (where applicable)

vi) Contract review

vii) The requirements of the contract

viii) Details of in-process inspections/checks carried out prior to, during and after the contract

ix) Details of problems and any additional work carried out

x) Details of recommendations for improvements

xi) Certificate of conformity

3.10 Certificate of conformity

The company shall issue an LPCB certificate of conformity for each contract covered by the standard. A copy shall be supplied to the client on completion of the works, a copy shall be retained by the company, and a copy forwarded to BRE Global Ltd

Appendix A – Kitchen Extract Ductwork must comply with Regulation EC852:2004 & TR19 or NAAD 21 Guidelines.

Kitchen extract ductwork has been shown to be a contributory factor in the spread of fire due to the build-up of grease and oil deposits during use. This is also an important factor when considering compliance with European Regulation 852/2004 of Hygiene of Foodstuffs chapter 5. Because of this it is particularly important that a planned maintenance and cleaning program is in place, in order to keep the build-up of grease and oil within accepted industry guidelines such as BESA TR19 or NAAD 21 Duct Cleaning – Guide to good practice.

Cleaning Process

Initial inspection report of kitchen extract ductwork system shall include:

- Survey of level of grease present throughout ductwork, in line with accepted industry guidance, including photographic evidence
- Status of filters
- Details of existing cleaning/maintenance regime
- Typical usage levels of ductwork system
- Identification of fire suppression systems and their maintenance regime
- Identification of restricted access areas
- Proposal to address restricted access, in order to improve future cleaning and maintenance of the ductwork system

Post Cleaning Report of Kitchen extract ductwork system shall include:

- Survey of the cleaned ductwork system, in line with accepted industry guidance, to include photographic evidence
- Status of cleaned filters
- Detailed schematic of the ductwork system, showing areas of restricted access
- Suggested remedies for areas of restricted access, in order to improve the ongoing cleaning/maintenance regime
- Details of the agreed on going cleaning/maintenance regime in line with industry guidance



APPENDIX 3

RESEARCH PROJECTS

THE IMPACT OF DUCTWORK CLEANING ON A FIRE RESISTING KITCHEN GREASE EXTRACT SYSTEM

Detailed below is research project carried out by **NAADUK** in collaboration with the Association for Specialist Fire Protection – **ASFP** on the effects of chemicals on intumescent seals. The cleaning process and chemicals used can have a profound effect on the fire rating of a system.

The testing was carried out scientifically with materials supplied from various manufacturers. Products were unmarked, so that the testing was unbiased.

Items tested

10 x type of fire Resisting ductwork test

12 x Intumescent seals tested

Method of Testing

All seals were applied to test plates for 3 months before testing took place. Initially standard 3mm bristle brushes were used, but these were found to be too aggressive for surface mounted sealants.

Special 2mm + 1mm brushes were made and all testing took place using these. It was observed from the twelve sealants tested, a third showed signs of softening and was starting to deteriorate.

It must be noted that not all specialist caustic users would allow their products to be used. It was concluded that the levels of caustic is likely to be far higher than the max 8% strength used by the general public.

Chemicals application was between 10- 20 minutes, to simulate 3 years general clean on panels and ductwork, kindly supplied by 3 manufacturers. From the testing cleaning solutions containing 5% - 8% caustic all caused damage to the galvanising, if left in contact without thorough rinsing with cold water.

It was assumed that much higher levels of caustic, which some cleaners used, may affect more sealants, because of safety issues our lab technician was not happy to use these higher levels, as he felt these levels could cause serious burns to the user.

Conclusion

NAADUK would recommend that a maximum of 8% caustic with thorough rinsing or better still a detergent chemical used more frequently should be recommend by the manufacturers.

NEW AND ON-GOING PROJECTS

Investigation and testing of foam based products and ductwork

Feasibility of access panels in foam products and ducting

Testing and evaluation of Fire Extract Valves

APPENDIX 4
IP RATING FOR FANS

What Does it Mean?
IP stands for Ingress Protection. Electrical equipment such as motors in fans often have an IP rating which tells you how Resisting it is to foreign bodies such as dust, fluid, moisture. The IP Rating is a simple encoding that covers a range of international standards.

IP Rating Code
The rating code commonly consists of 2 numbers (e.g. IP54). Each digit represents the degree of protection against an environmental factor. The first indicates the level of protection against solid objects and the second describes the level of protection from liquids.

What the Numbers Mean

IP First Number—Protection against solid objects

0	No special protection
1	Protected against solid objects over 50mm e.g. accidental touch by persons hands
2	Protected against solid objects over 12mm e.g. persons fingers
3	Protected against solid objects over 2.5mm (tools & wires)
4	Protected against solid objects over 1mm (tools, wires and small wires)
5	Protected against dust limited ingress (no harmful deposit)
6	Totally protected against dust

IP Second Number – Protection against liquids

0	No protection
1	Protected against vertically falling drops of water e.g. condensation
2	Protected against direct sprays of water up to 15o from the vertical
3	Protected against direct sprays of water up to 60o from the vertical
4	Protected against water sprayed from all directions – limited ingress permitted
5	Protected against low pressure jets of water from all directions – limited ingress
6	Protected against temporary flooding of water e.g. for use on ship decks – limited ingress permitted
7	Protected against the effect of immersion between 15cm and 1m
8	Protected against long periods of immersion under pressure

TIP: What Rating for Kitchen Extract Fans
A rating of IP54 or greater will ensure the fan is suitable for the cleaning process using spray applications. Care should be taken not to flood the fan with water as malfunction can be caused due to ingress of too much water.

APPENDIX 5

REFERENCE OF TABLES— PART 1: GREASE

PART 1 - GREASE		
Table No.	**Description**	**Page No.**
1	Law & Guidance for Commercial Kitchen Extract Systems	7
2	Initial Cleaning Frequency Chart or 1st Clean	11
3	History, Test, Frequency (HTF)	12
4	Example of methodology of HTF in practice	12
5	Cleaning Methods and Contamination	15
6	Checklist of Cleaning Contractors Responsibilities	17
7	An example of a Checklist for Client's Use	18
8	Suggested details to be noted on a Schematic	19
9	Sequence of Events	23
10	Components of a Grease Extract System	28
11	Colour Coding Chart	28
12	Types of Fire Resisting Ductwork	37
13	Benefits of a ductless kitchen extraction and free standing self-contained recirculation units	56
14	Consideration for installing ductless kitchen extract and free-standing self-contained recirculation units	56

BLANK FOR YOUR OWN NOTES:

Part 1: GREASE (Kitchen Extract)

END

NAAD UK
National Association of Air Duct Specialists UK

Creating safer & healthier environments



AIR – Part 2

Part 2: AIR (Indoor Air Quality)

Regulation Guidance standards for Indoor Air Quality in occupied zones

SECTION	CONTENTS	PAGE
1	**Introduction to Indoor Air Quality -The Air That You Breathe**	68
2	**Purpose of an Air Supply & Extract System**	68
3	**Law & Guidance for Ventilation Air Supply & Extract Systems**	69-74
3.1	General	60
3.2	Legal Requirements	70-71
3.3	Guidance Documents	72
3.4	Insurance Requirements	73
3.5	Competency in Cleaning Air Conditioning Systems	73
4.	**Indoor Air Quality (IAQ)**	74-77
4.1	Indoor Air Quality	74-76
4.2	Air Quality Zones	77
5	**Risk Assessments of Air Conditioning Systems**	78-79
5.1	General	78
5.2	Explanation of Levels	78-79
6.	**Levels of Acceptable Contamination**	80-81
6.1	New Ductwork	80
6.2	BS EN 15780:2011 5.1 General	80-81
6.3	Monitoring and Testing Procedures	81
7.	**Testing methods for Dust Contamination**	82-84
7.1.	General	82
7.2	Vacuum Test (VT)	82-83
7.3	Deposit Thickness Test (DTT Test)	84
7.4	List of Evaluation Methods Including Reliability Factor as Suggested in BS EN 15780:2011	84
8.	**Testing for Microbiological Contamination—Supply Only**	85-86
8.1	General	85
8.2	Extract from CIBSE TM26 10.2.2. Assessment of surface sampling results	85
8.3	Classification of microbial limits	86
8.4	Actions to take after analysis results	86
9.	**Methods Used in Cleaning Ventilation Systems**	87
9.1	General	87
9.2	Different Cleaning Methods for Contractors	87
10.	**Selection of a Contractor**	88
10.1	General Points to Consider	88
11	**Components of a Supply and Extract Ducting System**	89-105
11.1	General	89
11.2	Graphic Examples of Ducting within a Building	90
11.3	Inlet Louvres	91
11.4	Air Handling Unit (AHU) Components	92
11.5	Humidifiers	93
11.6	Heat Recovery	93

SECTION	CONTENTS	PAGE
11.7	Thermal Wheels	93
11.8	Heat Pipes	93
11.9	Fixed Plate Heat Exchangers	93
11.10	Filters	94
11.11	Attenuators/Silencers	95
11.12	Control Dampers	95
11.13	Volume Control Dampers (VCDs)	95
11.14	Fire and Smoke Control Dampers	96
11.15	Fan Coils	97
11.16	Chilled Beams	97
11.17	Terminal Equipment Units	98
11.18	Air Terminal Devices	98
11.19	Ducting/Ductwork	99-102
11.20	Access Panels	103-105
12	**Filtration**	106-110
12.1	General	106
12.2	The Importance of Air Filtration	106
12.3	Benefits from using Air Filters	106
12.4	Maintenance of Air Filters	106-107
12.5	Transport and Storage	107
12.6	Disposal of filters	107
12.7	Examples of Commonly Used Filters	108-110
13	**Hospital Ventilation**	111-113
13.1	General	111
13.2	Sources of Contamination	111
13.3	Working in a “Live” Hospital	112
13.4	Notes for the Contractor Working In Hospitals	112
13.5	Hospital Designers Point of View	113
13.6	NAADUK’s View	113
14	**Virus Detection and Precautions**	114-116
14.1	Virus	114
14.2	Methods Used to Control a Virus in an Indoor Environment Setting	114-116
14.3	Sources of Information	116
	APPENDIX	
Appendix 1	Reference of Regulations/Standards/Guidance Pertaining to Ventilation and Air Conditioning	117-118
Appendix 2	Acronyms of Organisations	119
Appendix 3	Reference of Tables Part 2: IAQ	120
Appendix 4	Regulations relating to ventilation and air conditioning systems	121-123
Appendix 5	Constraints Resolutions ot Access and Implications	124-125
Appendix 6	Different guidance documents for relevant building type	126-127
Appendix 7	Schematic Abbreviations Symbols for Schematic Drawings	128-131
	Acknowledgments	132

1 INTRODUCTION TO INDOOR AIR QUALITY THE AIR THAT YOU BREATHE

Never before has the importance of breathing clean air and indoor air quality been so prominent in the our day to day lives as it is today. The well-being of occupants of a building, reducing pollution and environmental care is the duty of us all.

This document will be the ultimate use for a variety of users and occupiers of a building, such as the following:

- Designers of systems
- Environmental Officers
- Planning Officers
- Health & Safety Inspectors
- Fire inspecting officers
- Contractors
- Clients
- End users
- Facilities Managers
- Technicians
- Chartered Engineers

Since COVID 19, the efficiency and cleanliness of mechanical ventilation of buildings has been recognised as an important function in the fight against pandemics. The World Health Organisation (WHO) and virologists around the world now emphasise the necessity for a clean and efficient running ventilation system.

We hope the following information in this document will assist in this aim.

2. PURPOSE OF AN AIR SUPPLY & EXTRACT SYSTEM

Supply ductwork is used to distribute clean air conditioned throughout the building. Extract ductwork is used to remove particulate and contaminated air from the building. Sometimes Exhaust Air is used to reheat incoming air to save on energy but needs careful consideration of its use during a pandemic situation.

Air conditioning systems tend to be made up of a number of components. Details can be found in **Section 11**

3. LAW & GUIDANCE FOR VENTILATION AIR SUPPLY & EXTRACT SYSTEMS

3.1 GENERAL

This flow chart depicts the current legal requirements and guidance that is available for Ventilation Air Supply & Extract Systems in the UK. All buildings are governed by H&S 1992 L24 Section 5 & 6 .

In addition, it is imperative that adhering to the regulations and guidance documents is a requirement by many insurance companies. A full explanation of the various regulations, guidance and standards referred to in this flow chart is shown overleaf.

This flow chart depicts the legal requirements and guidance that is available for ventilation supply and extract systems in the UK.





3.2 LEGAL REQUIREMENTS

There are many legal requirements and standards that pertain to the maintenance of ventilation systems and a quick guide is listed below. For full list of guidance documents see **Appendix 1** The standards which relate to ventilation systems as shown in the chart previously and a short synopsis is given to each.

3.2.1 L24 Workplace Health, Safety and Welfare Regulation 1992 (Revised 2013)

Approved Code of Practice (ACOP) and guidance

Regulation 5 Maintenance of workplace, and of equipment, devices and systems Paragraph (1) states:-

"The workplace and the equipment, devices and systems to which this regulation applies shall be maintained (including cleaned as appropriate) in an efficient state, in efficient working order and in good repair."

Paragraph (3) states:-" (b) mechanical ventilation systems provided pursuant to regulation 6 (whether or not they include equipment or devices within sub-paragraph (a) of this paragraph); and (b)

Regulation 6. Ventilation

Paragraph (1) states:- Effective and suitable provision shall be made to ensure that every enclosed workplace is ventilated by a sufficient quantity of fresh or purified air"

ACOP 47 "Enclosed workplaces should be sufficiently well ventilated so that stale air, and air which is hot or humid because of the processes or equipment in the workplace, is replaced at a reasonable rate.

ACOP 52 "Mechanical ventilation systems (including air-conditioning systems) should be regularly and adequately cleaned. They should also be properly tested and maintained to ensure that they are kept clean and free from anything which may contaminate the air."

3.2.2. Regulatory Reform (Fire Safety) Order 2005 Pt2 17 Maintenance

This Order requires the appointment of a responsible person to assess fire risk and consideration on the methods of prevention. Any ventilation system should be included in this assessment identifying risk, hazards and control measures to ensure protection and the prevention of fire risk. It is also important to the maintenance of fire and smoke dampers. This document is under review by the Government. Always check for updates.

3.2.3 Construction (Design and Management) Regulations 2015 (CDM) - New Build

PART 3 HEALTH AND SAFETY DUTIES & ROLES Regulation 9 sets out the duties placed on designers. These include the duty to eliminate, reduce or control foreseeable health and safety risks through the design process, such as those that may arise during construction work or in maintaining and using the building once it is built.

Regulation 9 - Duties of Designers
"(2) When preparing or modifying a design the designer must take into account the general principles of prevention and any pre-construction information to eliminate, so far as is reasonably practicable, foreseeable risks to the health or safety of any person—

carrying out or liable to be affected by construction work;
maintaining or cleaning a structure; or
using a structure designed as a workplace. "

PART 4 GENERAL REQUIRMENT FOR ALL CONSTRUCTION SITES Regulation 33 - Fresh air
"(1) Suitable and sufficient steps must be taken to ensure, so far as is reasonably practicable, that each construction site, or approach to a construction site, has sufficient fresh or purified air to ensure that the site or approach is safe and without risks to health or safety.

(2) Any equipment used for the purpose of complying with paragraph (1) must, where necessary for reasons of health and safety, include an effective device to give visible or audible warning of any failure of the equipment. "

Please refer to **Appendix 4 Page 123** for a more detailed information on CDM 2015.

3.2.4 ADDITIONAL LEGAL REQUIREMENTS APPLICABLE IN THE UK

Management of Health and Safety at Work Regulations 1999 REV 2013

Occupiers Liability Act 1984

Workplace Health and Safety Regulation 1997

Control of Substances Hazardous to Health Regulations (COSHH)

3.3 GUIDANCE DOCUMENTS

In addition to the Regulations which are a legal requirement, there are a raft guidance documents which should be considered.

3.3.1 LPS 2084 –Issue 1—Standard for Inspection, Cleaning & Maintenance of Ductwork Systems

This standard defines the requirements for the LPCB approval of companies carrying out inspection, cleaning and maintenance of ductwork systems that may be contaminated with combustible deposits. The standard ensures that companies engaged in the above activities, meet the requirement of the client contract, document and report correctly, identify and record areas of limited access where inspection, cleaning and maintenance are impractical and communicate these limitations to the client, give recommendations for access improvements to better facilitate the ongoing cleaning and maintenance of the ductwork system. Full details of this document are shown **Part 1 Grease Appendix 2 Page 60-61.**

3.3.2 BS EN 15780 :2011 Ventilation for Buildings—Ductwork—Cleanliness of Ventilation Systems

This European Standard applies to both new and existing ventilation and air conditioning systems and specifies the assessment criteria of cleanliness, cleaning procedures of these systems, and the validation of the effectiveness of cleaning applies. also to products, which conform to EN 1505, EN 1506, EN 13053, EN 13180 and EN 13403, used in air conditioning and ventilation systems for human occupancy defined in the scope of CEN/TC 156. Always check for updates.

3.3.3 BS9999-2017 TC Appendix W Fire safety in the design, management and use of buildings. Code of practice

BS 9999 gives recommendations and guidance on the design, management and use of buildings to achieve reasonable standards of fire safety for all people in and around them. It also provides guidance on the on-going management of fire safety within a building throughout its entire life cycle, including guidance for designers to ensure that the overall design of a building assists and enhances the management of fire safety. Always check for updates.

3.3.4 NAAD21— Part 2 Air (Indoor Air Quality) - Regulation guidance standards for Indoor Air Quality in occupied zones based on NOS standards.

3.3.5 BESA TR19 —Guide to Good Practice Internal Cleanliness of Ventilation Systems.

3.3.6 ADDITIONAL GUIDANCE DOCUMENTS FOR OTHER TYPES OF BUILDINGS

BESA DW 144—Specification of Sheet Metal Ductwork—New Build
CIBSE TM26 2000— Standard Building
HTM 03—Hospital
BS1464441:1999 –Clean Room

See **Part 1 Grease Appendix 1 Page 59** for full details of regulations and guidance standards for Commercial Kitchens.

Whether a member of **NAADUK** or not, we urge all parties to accept these standards as the absolute minimum.

We expect and check to see that all **NAADUK** members adhere to these standards**.**

3.4 INSURANCE REQUIREMENTS

All insurance companies rely on information, therefore any variation of the use of the building should be reported to Insurers. Since COVID 19, several insurance companies have reissued advice on air conditioning safety compliance.

Over the past few decades, the Law has often been neglected. Health and Safety Policy 1992 Rev. 2013, Section 5 & 6 states all internal parts of a mechanical air conditioning system must be clean. The guidance on this is BS EN 15780:2011 and it gives recommendations on the measurement of cleanliness. Also, DW144 states all internal ventilation systems should be cleaned Before handover. If the law above is enforced this would mean all leaseholders/rental premises should have the systems cleaned before handing back leases. Therefore, new tenants can be assured the system is compliant with all current regulations.

If owners of a building ignore this regulation, the implication is that Insurers could refuse to pay out on any claim for any medical claims, possibly caused by poor or contaminated air supplied through badly maintained ventilation systems. The Occupier needs to be able to prove that they have complied with the Regulations to prevent the above happening.

Leading virologist and the World Health Organization (WHO) are now expressing the importance of ventilation hygiene in buildings, and the huge cost implication of defaulting. Expect many more Insurance companies to be asking for Risk Assessments and proof of compliance of the building system. Insurance companies will expect to see reports conducted by competent personal with proven experience in this field i.e., either IAQ/Fire Damper.

3.5 COMPETENCY IN CLEANING AIR CONDITIONING SYSTEMS

BSEHV11 National Occupational Standards (NOS) Clean Industrial and Commercial Ventilation Systems

This standard is for people who clean industrial and commercial ventilation systems. The person performing this work must be able to comply with the correct procedures and practices for cleaning industrial and commercial ventilation systems.

NAADUK recommend that technicians should be compliant with BSEHV11 with relevant qualifications i.e. NOS as SQA—NAADUK/Paddeco certification.

4. INDOOR AIR QUALITY (IAQ)

4.1 THE IMPORTANCE OF INDOOR AIR QUALITY

Indoor air quality must be kept to the best standards, as prevention is better than cure.

Dirty streaks on ceilings along diffusers facings, excessive dust build-up of dust on surfaces could all be signs of incorrectly specified, badly fitted, or unsuitable filter media for the environment that the building is located in.

Indoor Air Quality (IAQ) can be improved by designers giving careful consideration to the different levels and types of pollutants when construction takes place in these areas. Consideration should also be given to filtration, and there is a wealth of information available from quality filter manufacturers on this subject. Filtration can massively improve indoor air quality and benefit the occupying environment for all. Care must be taken in filter selection and regular maintenance is a must. It is imperative that the environment conditions are taken into account when selecting the first line of defence and make it fit for purpose. We give an example selection of filters on the following few pages as a guide:

Whilethe recent worldwide spread of Coronavirus has shown the importance of air conditioning and its important role of helping to prevent the spread of the virus inside buildings. It is a warning shot of much worse to come if we do not improve systems.

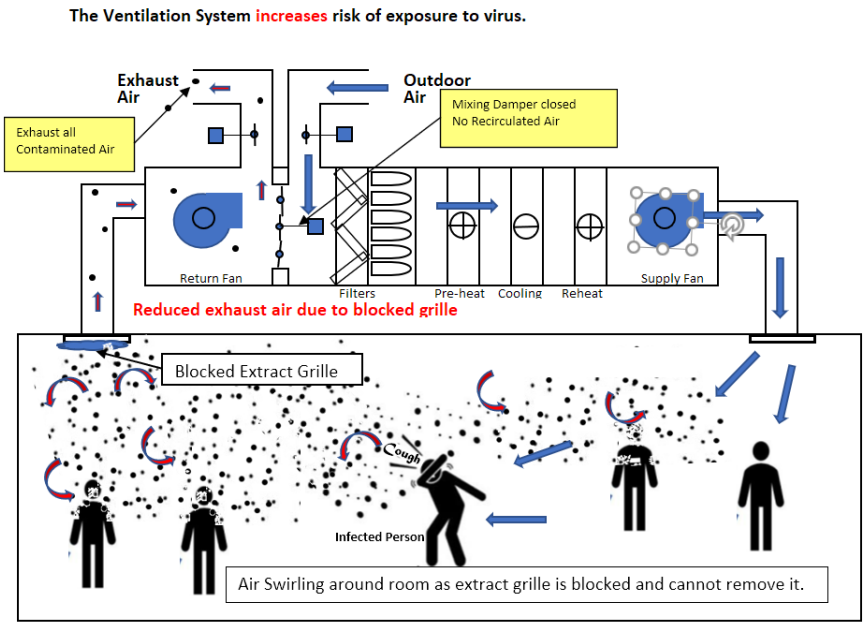
The following diagrams depict the various scenarios of how air is distribute through different ventilation systems and can cause the spread of diseases.

This information has been taken from the NAADUK COVID-19 Guidance for Ventilation Hygiene April 2021.

Fig No. 1. Several Conditions Which May Effect the environment



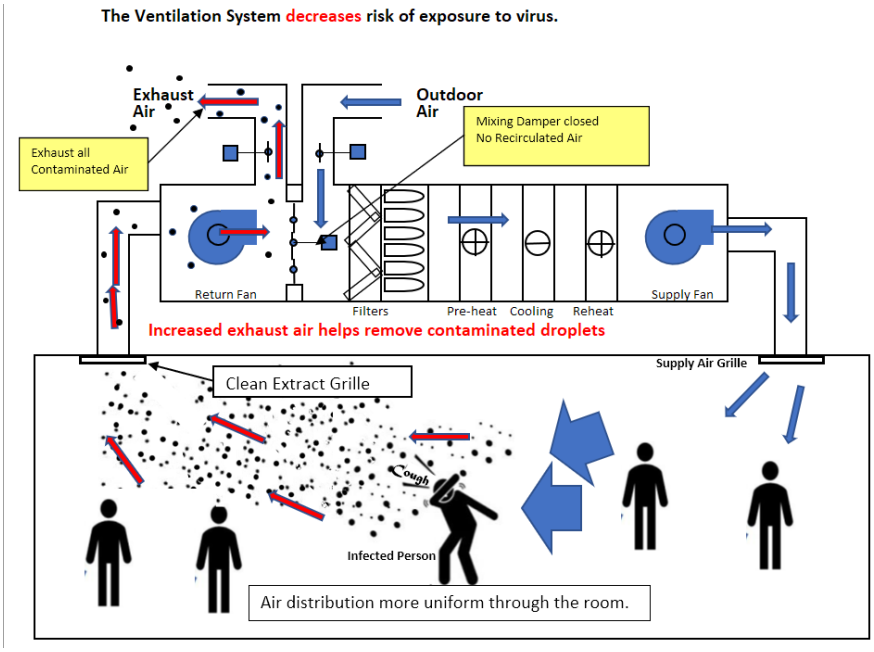
Fig No. 2. Effect of soiled extract/return air grilles in ventilation systems



Increased Risk of Infection due to:

- Reduced air change rate
- Reduced or no extraction through the grille.
- Increased number of contaminated droplets in contact with people.
- Increased number of contaminated droplets depositing on surfaces and work stations.
- Longer exposure time of occupants to virus and bacteria.

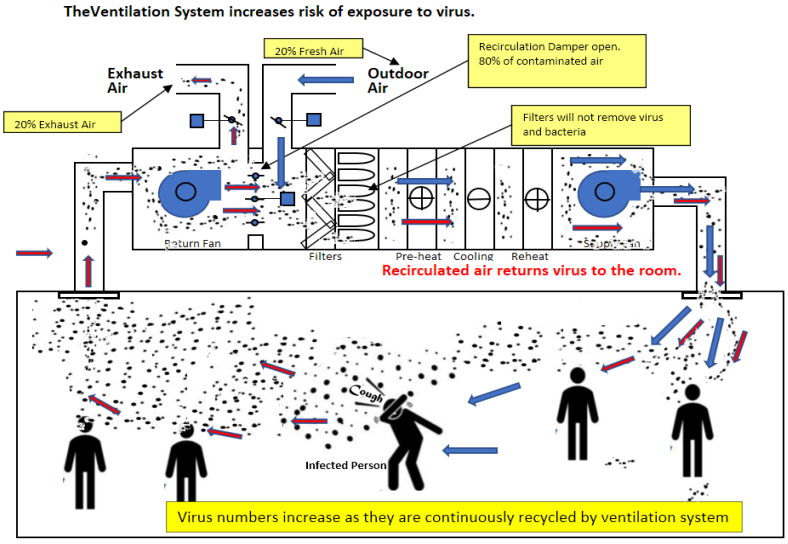
Fig No. 3. Effect of clean extract/return air grilles in ventilation systems



Reduced Risk of Infection due to:

- Air distribution more uniform and extract grille is removing contaminated air.
- Air flow rates as per system design.
- Contaminated droplets taken away from occupants by airflow.
- Reduced number of contaminated droplets depositing on surfaces and work stations.
- Minimum exposure time of occupants to virus and bacteria.

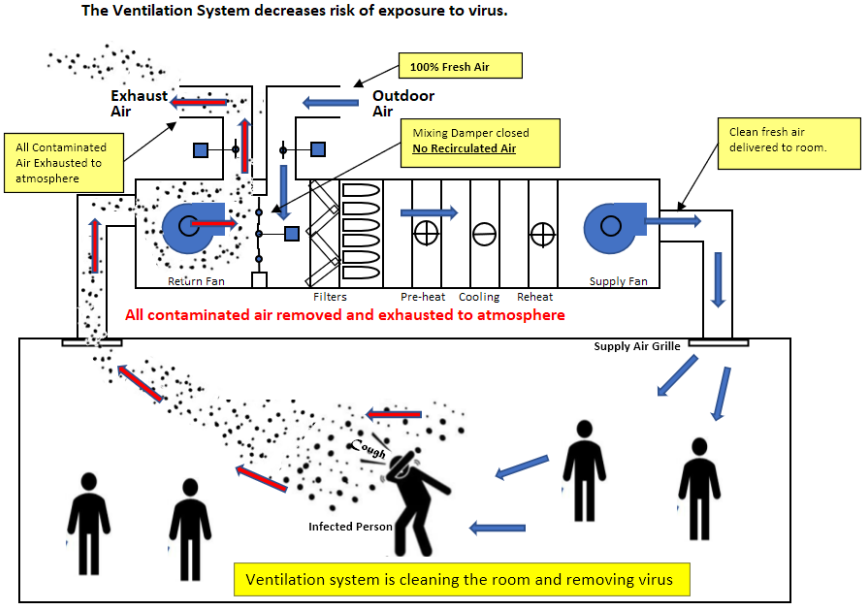
Fig No.4. Effect of 100% Recirculation in a Building



Increased Risk of Infection due to:

- Ventilation system is **increasing risk of infection** in the room.
- 80% Air containing virus re-introduced to the room.
- Filters will not remove virus and bacteria.
- Increased number of contaminated droplets in contact with people.
- Increased number of contaminated droplets depositing on surfaces and work stations.
- Contact with infected person **not necessary** to be exposed to virus or surface contamination.
- Longer exposure time of occupants to virus and bacteria.

Fig No. 5. Effect of 100% Fresh Air in a Building



Reduced Risk of Infection due to:

- Ventilation system is cleaning air in the room.
- Most or all contaminated air being removed from the room.
- 100% Fresh Air being supplied to the room.
- Contaminated droplets taken away from occupants by airflow.
- Reduced number of contaminated droplets depositing on surfaces and work stations.
- Minimum exposure time of occupants to virus and bacteria.

Note: On a system with an average velocity of 5m/s, 50 metres of supply duct and 50 metres of return duct, it would take approximately 20-30 seconds to re-introduce virus back into the room. Not knowing the lifespan of Covid-19, it is possible it could multiply in a recirculated air environment.

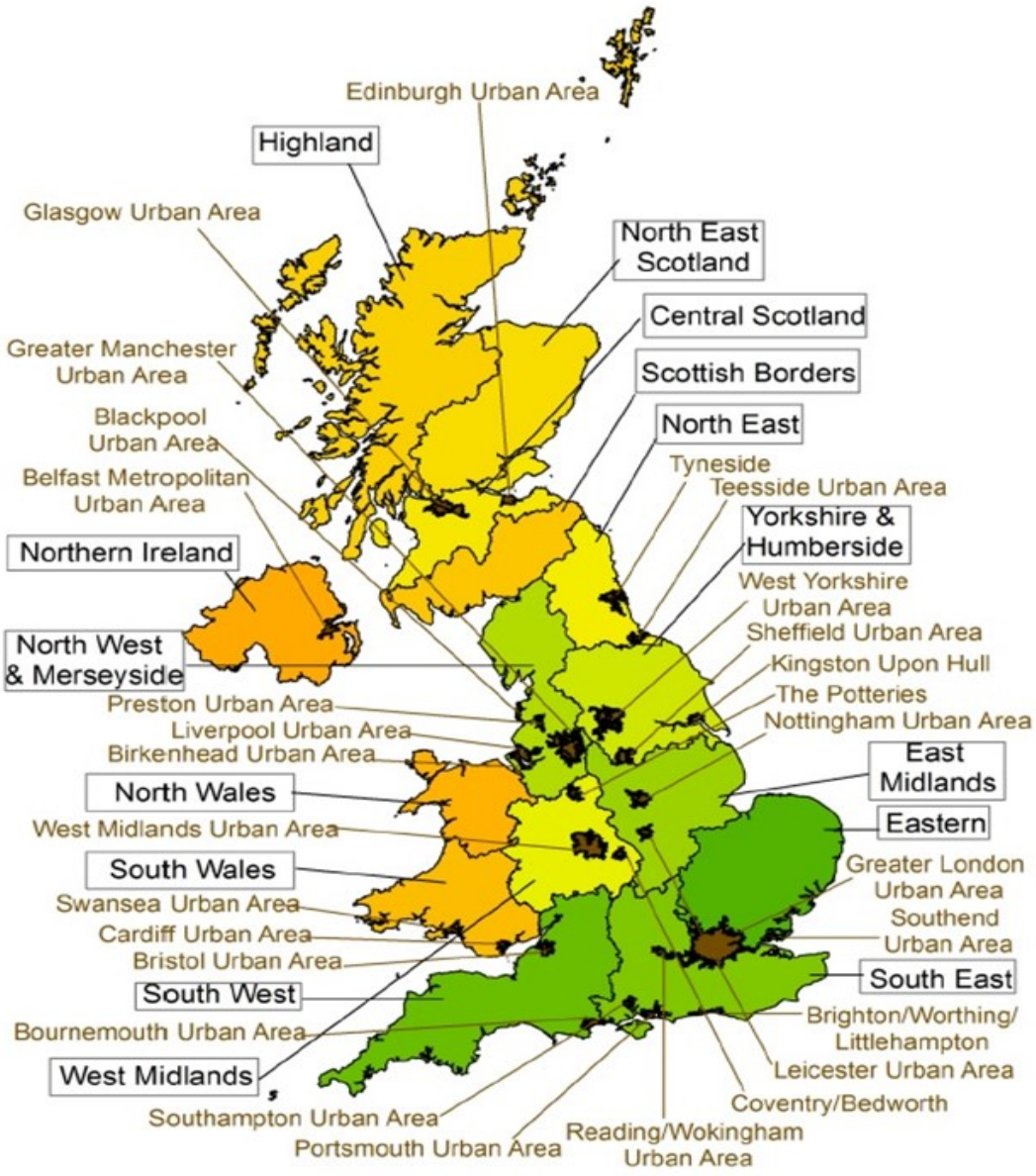
Fan coil units could be fitted with UV-C germicidal lights but this would be expensive and sizing of the germicidal lights critical to their effectiveness.

4.2 AIR QUALITY ZONES

The quality of the air that is drawn into a building can depend upon the siting of the building in relation to its surroundings. For example, countryside, urban, city centres, industrial areas, will all generate different levels of pollutants as shown by the DEFRA map **Fig No 6** below **.**

Fig No. 6. Taken from DEFRA showing UK Zones and Agglomerations for Ambient Air Quality

Figure 2-1 UK Zones and Agglomerations for Ambient Air Quality Reporting 2013



Agglomeration zones (brown)
Non-agglomeration zones (yellow/green)
© Crown copyright. All rights reserved Defra, Licence number 100022861 [2014]

5. RISK ASSESSMENTS OF AIR CONDITIONING SYSTEMS

5.1 GENERAL

Ventilation systems control the air that we breathe inside buildings. The quality of the air can be influenced by maintenance or lack of and the local environment. In many cases BS9999 has recognised that heavy build-up of dust and debris with the system can be a fire risk. The Health & Safety Law, 1992 Regulation 5 & 6, 1999 Duty of Care, The Regulatory Fire Reform Order 2005 – are all standards that are legal requirements that are interlocked & cover most eventualities.

BS EN 15780:2011, BS9999, NAAD 21,TR19, – Are all guidance documents on how to comply with the above.

The following is a quick check compliance chart to ensure clients are aware of their responsibilities

These are recommended periods for inspections.

5.2 EXPLANATION OF LEVELS

Under current standards clients' air conditioning should be maintained to the new British

Table No. 2. Quick check guide as to frequency of inspection and testing – taken from BS EN 15780:2011

	Low	Medium	High
AHU	24 Mths	12 Mths	12 Mths
Filters	12 Mths	12 Mths	6 Mths
Humidifiers	12 Mths	6 Mths	6 Mths
Ductwork	48 Mths	24 Mths	12 Mths
Air Terminal Devices	48 Mths	24 Mths	12 Mths

Standards, failure to do so would leave them open to litigation from anyone claiming their respiratory problems were made worse by the air conditioning.

By inspecting and taking action to the relevant British Standards you will prevent most spurious claims and ensure that you have taken all possible precautions to prevent problems caused by the air conditioning.

Table No. 3. Taken from BS EN 15780:2011 - Table A.2 – Typical applications of cleanliness quality class

Quality Class	Typical Examples
LOW	Rooms with only intermittent occupancy e.g. storage rooms, technical rooms
MEDIUM	Offices, hotels, restaurants, schools, theatres, residential buildings, sports buildings, general areas in hospitals and general working areas in industries
HIGH	Laboratories, treatment areas in hospitals and high quality offices

5.2.1 Acceptable levels of contamination of existing duct

Place and decide on what level the particular areas of the project are, Low – Med – High as the following guidelines advise.

Table No. 4. Taken from BS EN 15780:2011 - Table A.3 — Acceptable cleanliness levels

Cleanliness quality class	Acceptable cleanliness level Supply ductwork	Acceptable cleanliness level Recirculation or secondary air ductwork
LOW	< 4,5 g/m2	< 6,0 g/m2
MEDIUM	< 3,0 g/m2	< 4,5 g/m2
HIGH	< 0,6 g/m2	< 3,0 g/m2

It should be noted that from this chart there are higher standards for HTM03 , SHTM 0301 & WHTM 0301, i.e. hospitals on the frequency of cleaning ATD in general parts of hospitals every 12 months. In acute high-risk areas, every 3 months.

A risk assessment must cover the whole of the ventilation system from intake to extract, covering all aspects from dry areas and wet.

There are now legal requirements to cover all these areas and the person carrying out this risk assessment must have proven capabilities, to undertake this work.

Table No.5. Major Components Found in Air Conditioning Systems

Areas Covered	Ductwork
Fresh Air Intake	Main
Filters	Supply
VCD	Extract
Fire Dampers	Secondary Systems
VAV Boxes Vertical (as well as Horizontal)	Fan Coil Units
Plenums	Heat Recovery
Attenuators	Including Terminal Devices i.e. Grilles / Diffusers
Coils	Heating or Cooling
AHU	Plant room

6. LEVELS OF ACCEPTABLE CONTAMINATION

6.1 NEW DUCTWORK

DW144:2016 now states unless specified ductwork does not need to be sealed, unless specified for particular applications i.e. clean rooms and that all ductwork should be cleaned prior to commissioning on handover.

Contamination will occur if major works are still in progress on site, capping of ductwork is costly and in many cases pointless because of these works.

States 3 Levels of duct condition ex works

DW144:2016 states all ductwork to be cleaned after installation and prior to commissioning (H.2.2)

6.2 BS EN 15780:2011- 5.1 GENERAL

The key issue is to design, build and maintain the whole ventilation system so that it can be kept clean enough during the whole lifetime of the installation. The following requirements, as well as the methodology described in Clause 5, applies to the ductwork but can be also applied to air handling units (according to EN 13053) and entire systems (see EN 13779:2007, Annex A)
Therefore it is necessary to specify the cleanliness quality class from the beginning and include in the specification both design and installation issues and means to maintain a sufficiently clean ventilation system for its whole lifetime.

The design and installation issues shall include (as a minimum):

- cleanliness quality class;
- cleanliness criteria and measurement method;
- production of the system components;
- delivery to site;
- site storage;
- installation;
- protection of components after installation;
- handing over the system according to BS EN 12599:2012

NOTE: Annex A presents, as a common classification, three classes of cleanliness, application examples for ductwork, and recommendations for the frequency of regular inspections in accordance with BS EN 16798-1:2019 Energy performance of buildings. Ventilation for buildings. Indoor environmental input parameters for design and assessment of energy performance of buildings addressing indoor air quality, thermal environment, lighting and acoustics. Module M1-6

Table No. 6. Extract from BS EN 15780:2011 - Table A.4 — Acceptable dust accumulation levels in new ductwork

Cleanliness quality class	Acceptable dust accumulation level Supply, recirculation or secondary air ductwork	Acceptable dust accumulation level Extract ductwork
LOW	< 0,9 g/m2	< 1,8 g/m2
MEDIUM	< 0,6 g/m2	< 1,8 g/m2
HIGH	< 0,3 g/m2	< 0,9 g/m2

6.2.1 EXTRACT FROM BS EN 15780:2011 - C.1 GENERAL

In manufacturing and construction, special attention should be paid on the following aspects:

- complete cleaning before shipment;
- during transportation and storage, sealing of the AHU in such a way that contamination is avoided;
- preserve units during installation in such a way that contamination is avoided;
- inspection and cleaning after installation.

6.3 MONITORING AND TESTING PROCEDURES

Like most associations NAADUK use guidelines issued by the two leading organisations in this field TM26 and BS EN 15780:2011.

An integration of the two, give a world recognised standard of testing and monitoring. The procedures used should determine the need for compliance with the relevant ACOP and whether cleaning is necessary. These tests are designed to check the quality of the air leaving the ventilation system, i.e. contaminants that may affect the wellbeing of those in the environment being tested. These tests do not test air quality in the space as this can be constantly varied by contaminants from personnel entering and leaving the environment. Test for the quality of the room space are normally restricted to clean room and other specialist areas.

Regular monitoring as suggested by BS EN 15780:2011 chart can be used to project a frequency of testing dependent on results or a change of filter to suit local conditions. **See Table No. 2 Page 78**

7. TESTING METHODS FOR DUST CONTAMINATION

7.1 GENERAL

There are several types of testing methods for sampling for dust contamination. NAADUK recommend the use of the Vacuum Test (VT) as the most scientific test to carry out dust sampling.

The various dust sampling methods and were reviewed by the Imperial College, London in 2015 and stated:-

> **NADCA Test—** scientifically proven for square, rectangular duct, but not round ducting on non porous surfaces.
>
> **PVT—** not repeatable, therefore not scientific. This is now called European Test.
>
> **Imperial College's** preferred test is the **VT** test with NAADUK adaptation is repeatable and scientific and approved by them for square, rectangle and round ducting.

7.2 VACUUM TEST (VT)

In light of the information above, NAADUK would recommend the **Vacuum Test (VT)** test to be used for dust sampling

When using the VT test, NAADUK recommends pre-weighed filter cartridges, Pre-Barcoded to prevent mistakes or wrong attributed figures and always recommend an independent laboratory to UKAS standards.

It should also be noted that if there is a covering of dust however light, covering the internal surfaces of the duct, then this test is unnecessary as from BS EN 15780:2011 a visual evaluation with or without a reference scale this supply duct would fail anyway, you would just be charging the client an unnecessary cost. **Remember,** these tests are for non impacted dust, i.e. loose dust that may become transient in air flow, not staining etc.

However, for more advanced levels i.e. Cleanrooms etc., refer to ISO 14644-1:2015 guidance on CIBSE TM 26 and CIBSE TM26 for further relevant guidance.

Please check the chart from BS EN 15780:2011 to utilise other methods if required . See **Page 84 Fig No. 12 Hi Scale.**

Fig No. 7. Vacuum Pump



Fig No. 8. Dust Cartridge & Template



CAUTION: A competent company should have the ability and equipment to carry out any sampling required and should use a nominated UKAS laboratory for analysis.

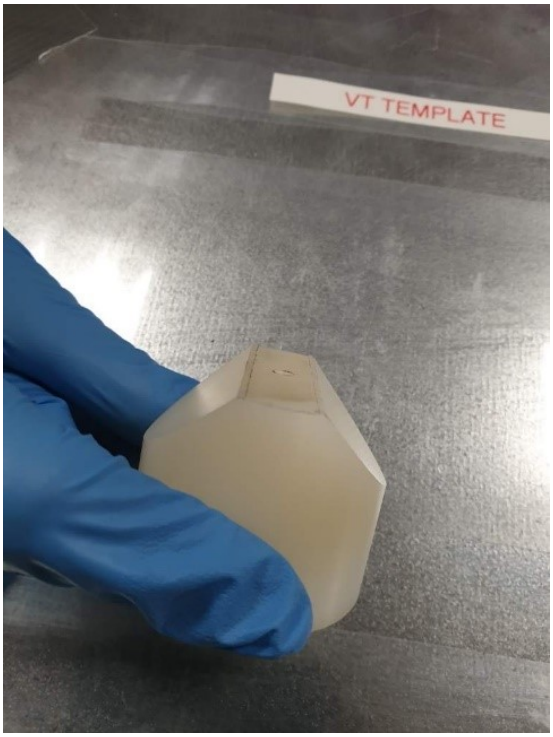
7.2.1 ADAPTOR FOR CIRCULAR DUCT

When taking samples on circular ducting an adaptor should be used to ensure that there is direct contact with the ducting. These adaptors were tested, evaluated and approved by Imperial College London February 2015.

Fig No. 9. Adaptor—top view



Fig No. 10. Adaptor—side view



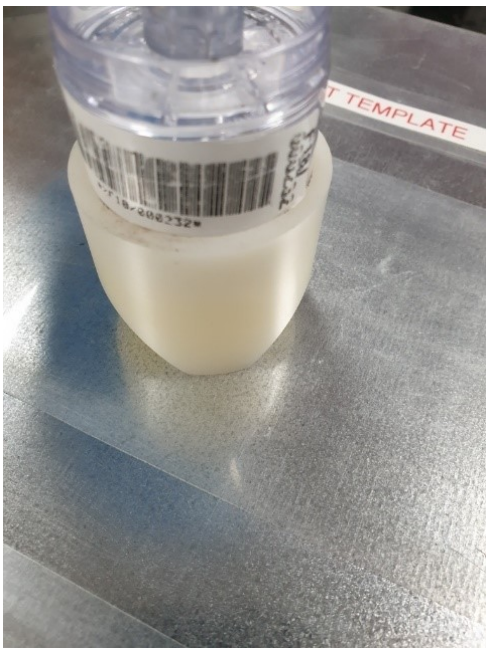


Fig No.11. Adaptor fitted to filter capsule

These adaptors can be used in circular ducting as well as flat ducts.

7.3 DEPOSIT THICKNESS TEST (DTT TEST)

NAADAUK cannot recommend this test, as BS EN 15780:2011 state this is typically not sensitive enough to be used for post clean verification.

A competent company should have the ability and equipment to carry out any sampling required and should use a nominated UKAS laboratory.

7.4 LIST OF EVALUATION METHODS INCLUDING RELIABILITY FACTOR *AS SUGGESTED BY BS EN 15780:2011*

Top vacuum sampling filter / dust with cloth

SE – Gravimetic Tape

3 – Evaluation with Optical Gel tape

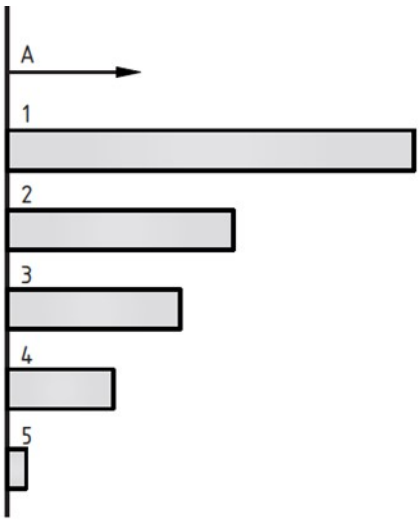
4 – Visual evaluation with reference scale

5 – Visual survey without reference scale.

Fig No. 12. Figure taken from BS EN 15780:2011—Annex H H.1—

The reliability level of the results by different evaluation methods for dust

HI SCALE



Key

A reliability
1 vacuum sampling on filter, or wiping the dust with a cloth
2 gravimetric tape method
3 evaluation with optical gel tape
4 visual evaluation with reference scale
5 visual survey without reference scale

The Vacuum Test is recommended by NAADUK, as proven by Imperial College London

8. TESTING FOR MICROBIOLOGICAL CONTAMINATION SUPPLY ONLY

8.1 GENERAL

It's the air that we breathe so it must be clean and healthy, wrong! Many circumstances from poor hygiene standards, poor maintenance or non-maintenance could all lead to potentially harmful organisms and in some cases pathogenies growth as shown in the illustration below:

Fig No.13. Agar Plate





Fig No. 14. DIFCO Contact slide

TM26 published by CIBSE is considered by most, to be the leading authority in this area. and NAADUK are grateful to CIBSE for permission to reproduce some tables along with their comments.

Anyone wanting to forge a career in this area of Ventilation Hygiene should obtain the whole document of TM26 Standards.

8.2 EXTRACT FROM CIBSE TM26 10.2.2 ASSESSMENT OF SURFACE SAMPLING RESULTS

For samples obtained and processed using the protocol described in section 9

- Surface disposition of microbes is seldom uniform and a single high count should not be considered sufficient to trigger recommending cleaning of the ducts
- Should the microbial counts from a particular general areas (such as in the AHU) indicate localised microbiological contamination, i.e. more than 50% of samples in the 'high' category, then cleaning of that area should be considered as an appropriate action.
- It is considered that cleaning of the entire system should be recommended where, on average, more than 25% of the sample is in the 'high' category.

8.3 CLASSIFICATION OF MICROBIOLOGICAL LIMITS

The individual fungal and bacterial counts for each location should be converted to counts per 10 centimetres (cfu per 10 $cm^{2)}$. At any point in the ductwork system six counts (three fungal and three bacterial) should be available and these should be compared with the classification given in **Table 8** which is taken from TM26. (Table 3).

Table No. 7. Extract taken from CIBSE TM26 Table 3 – Classification of surface sampling microbial limits

Category	Colony forming units (cfu per $10cm^2$)
Low	<10
Medium	>10 but <20
High	>20

8.4 ACTIONS TO TAKE AFTER ANALYSIS RESULTS

Table No.8. Actions to be taken following sample analysis

Air sample microbial levels	Surface microbial levels	Comments	Actions
Unacceptable	Unacceptable	Microbial contamination is demonstrated in both ductwork and supply airstream	It is recommended that the system is cleaned as a priority: that is within 3 months
Acceptable	Unacceptable	There is an increased probability that the supply airstream will become contaminated by microbes from within the ductwork	It is suggested that monitoring of the air supplied by this system should be conducted on a more regular basis or that cleaning the ductwork should be programmed into the maintenance programme
Unacceptable	Acceptable	The ductwork system is unlikely to be the source of microbial contamination in the occupied space	Seek to identify other sources of microbes such as damp patches in basements and heavily soiled carpets. Conduct suitable cleaning, removal or repair
Acceptable	Acceptable	Microbiologically clean system	No specific microbial action is needed

9. METHODS USED IN CLEANING VENTILATION SYTEMS

9.1 GENERAL

Before commencing any works it is the responsibility of the contractor to check the asbestos register.

9.1.1.All cleaning in ductwork should be undertaken in the direction of air flow, contractors should isolate zones where possible by utilising the open/shut operation of VCD

WARNING : mechanically mark position to enable correct rest

9.1.2 Ensure the correct type and correct placement of the access panel to enable operations to be carried out. Check if the ducting is fire rated before fitting any panels.

9.1.3 On all dry-cleaning methods, make sure a suitable (negative air) air mover machine is in place with suitable filtration appropriate to the standard of cleaning.

9.1.4 Wet cleaning methods should be avoided if possible, as it could if it is incorrectly applied lead to an increase of microorganisms, if needed the system must be thoroughly dried before commissioning. Other problems, such as leaks on to the ceilings and if containing corrosive chemicals, could damage lead to other adjacent services.

9.2 DIFFERENT CLEANING METHODS FOR CONTRACTORS

Table No. 9. Cleaning Methods

Most Common Methods	Description of Method
Hand Vacuuming	The most common using a high efficiency filtered vacuum unit, with appropriate attachments.
Rotary brushing	With reversing directional brush machine pneumatic or electrical powered. Using an assortment of brushes and in all cases the use of a negative air machine (air mover) with appropriate filtration.
Air lance	A flexible airline with attached gun and regulator, to lower or increase pressure, to clean off delicate areas i.e. linings or increased pressure to dislodge build-up of dust in difficult areas should be used with negative air machine (air mover).
Air whip / Skipper balls	Can be several multi tubes of a nozzle or a faced nozzle with multipool predrilled holes angled to drive air whip and lead down the duct, dislodging the dust. Must be used with a negative air machine (air mover).
Hand wiping	Either in the dry form using lint free or a form of antistatic dust cloths. Some cleaning agents can be sprayed on to the duct to assist cleaning on stubborn areas providing all COSHH standards are applied.
Hand brushing / Sweeping	Used mainly on very large ducts and then debris bagged for collection and disposal.

In all the above cases a negative air machine (air mover) should be used to prevent dust debris being projected into the occupied environment.

Always ensure the filters in the units are suitable for operations being carried out.

10. SELECTION OF A CONTRACTOR

10.1. GENERAL POINTS TO CONSIDER

When selecting a contractor the following criteria should be taken into account:-

10.1.1 Number of years operating as ventilation hygiene specialists.

10.1.2 Demonstration of project reference in size and value.

10.1.3 Total number of Field Technicians employed full time.

10.1.4 Qualification of staff and quality of instructions by qualified instructors and independence of Auditors, this should be, but not restricted only to CITB, CITBNI, SQA Dipolma to NOS Standards, BESA Greenbook, NAADUK Approved, BRE LPS2084 or RESET.

10.1.5 Quality assurances should be ISO9001 or independent auditors such as LPS2084 or equivalent.

10.1.6 Training centres should be CITB ATO or equivalent.

10.1.7 Health and safety policy by contractor, specific to work carried out. Full RAMS.

10.1.8 Recognised awards CPD etc.

10.1.9 Memberships, Approved or H&S Organisation, such as, SSIP CHAS, Safecontractor, RESET, BRE or equivalent

10.1.10 Insurance of Professional Indemnity, Public Liability, clearly stating extent and limits of cover.

10.1.11 Financial statements appropriate to carrying out the project in full and have resources and assets to cover costs related to project.



11. COMPONENTS OF A SUPPLY AND EXTRACT DUCTING SYSTEM

This section deals with all the different types of components that can be found in Ventilation Air Systems

11.1 GENERAL

The components that make up Ventilation Air Systems are:-

Table No. 10. Components of Ventilation Air Systems

COMPONENTS	SECTION NO.
Inlet Louvres	11.3
Air Handling Units (AHU)	11.4
Humidifiers	11.5
Heat Recovery	11.6
Thermal Wheels	11.7
Heat Pipes	11.8
Fixed Plate Heat Exchangers	11.9
Filters	11.10
Attenuators/Silencers	11.11
Control Dampers	11.12
Volume Control Dampers (VCDs)	11.13
Fire and Smoke Dampers	11.14
Fan Coils	11.15
Chilled Beams	11.16
Terminal Equipment Units	11.17
Air Terminal Devices	11.18
Ducting/Ductwork	11.19
Access Panels	11.20

In the following pages a description is given of the various components making up the ductwork system.

11.2 GRAPHIC EXAMPLES OF DUCTING WITHIN A BUILDING

Fig No. 15. Skeleton view of air conditioning system in a building

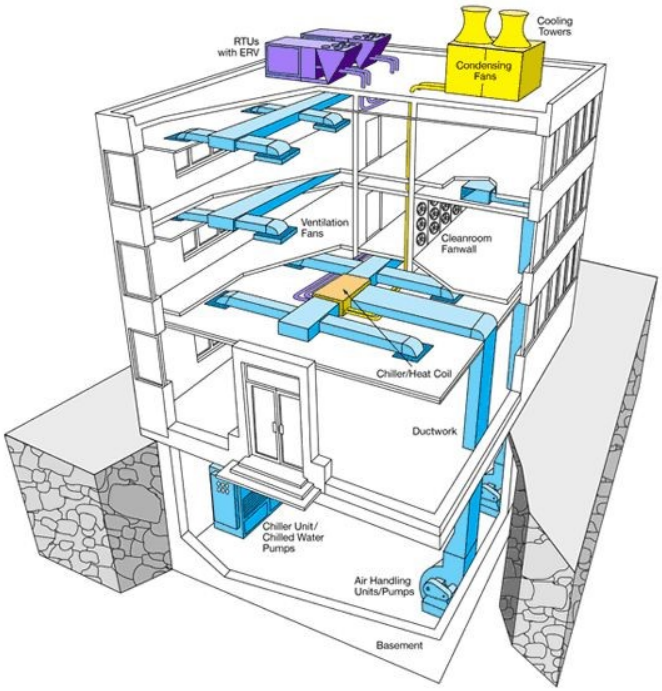
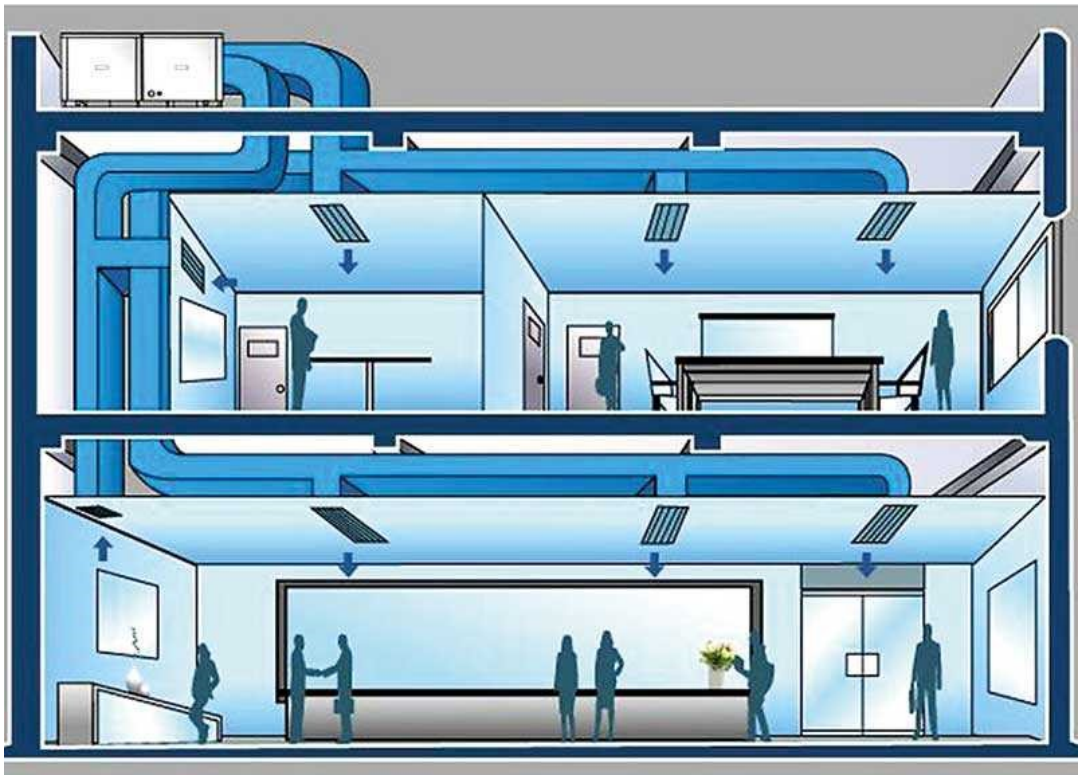


Fig No. 16. Side view of basic principles of air flow



11.3 INLET LOUVRES

Inlet Louvres allow air in and exhaust air out. Earlier inlet louvres are usually located at ground level. The position of the inlet louvre brings about different contamination problems.

Ground level - susceptible to traffic and track

Mid Level—susceptible to bird infestation

Roof Level - susceptible to bird infestation

Fig No. 17. Inlet Louvres inset in a building



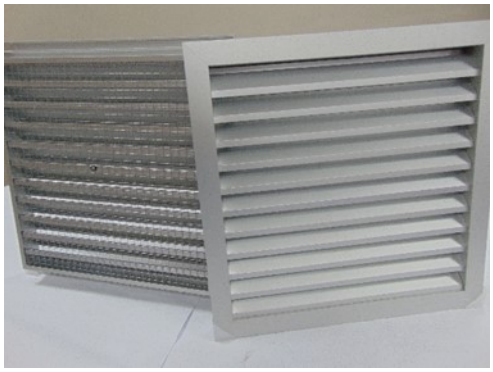


Fig No. 18. Inlet Louvres

Many are constructed of aluminum with standard 13mm mesh at the rear which over time corrodes and allows ingress of not just litter, but also rodents, birds etc. Any failure should be reported and dealt with immediately, also the first one metre of duct should have a bitumen style coating to give extra waterproof to protect against corrosion. Heavy bird contamination should be disinfected, and all Technicians suitably protected during this cleaning operation. Whilst cleaning checks should be made to ensure other parts are not loose i.e. blades and fixings.

11.4 AIR HANDLING UNIT (AHU) COMPONENTS

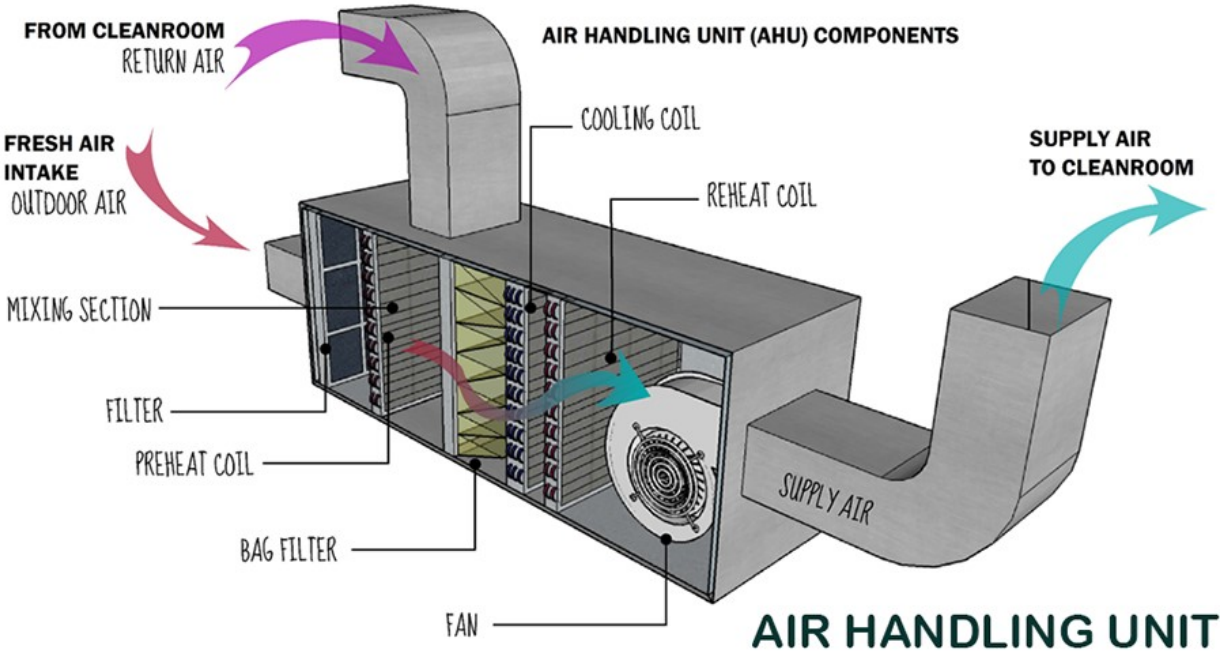
The heart of a heating, ventilating and air conditioning system the AHU conditions and re-circulates air. It is an self contained single unit which is connected to a duct system. A cabinet containing all other components. These systems take outside air, re-condition it and then supply air to zoned areas in a building. These vary in size and configurations to suit applications.

If possible, get the manufacturers main specification. There should be room all the way around to allow for proper maintenance, i.e. filters, drive belts, heating and cooling coils, door seals and latches. Mountings for fans perish overtime, and internal fittings and fixtures are susceptible to rust. They should be inspected 6 monthly / Yearly as detailed in the standard, BS EN 15780:2011, or more frequently still if the condition deems necessary.

Internal linings of AHU and even some ductwork dependent on age maybe fiberglass (MMMF). Tests carried out in the 1980's have shown considerable harmful amounts released into the system improvements in linings and the replacement of some by foam is now common, but they should be carefully cleaned using vacuum and soft brush or low-pressure air blast. If too badly decomposed then they will need replacing before cleaning takes place. A microbiological test should be carried out especially if damp is present.

Since the COVID 19 pandemic, it is expected that there will be many changes to design and maintenance regimes to enable a better and easier switchover to all fresh air or better extra filtration when required.

Fig No. 19. Air Handling Unit Basic Principle



11.5 HUMIDIFIERS

Humidifiers increase humidity for cold weather conditions. Types include steam grid, steam pan and spray type.

11.6 HEAT RECOVERY

Mechanical ventilation heat recovery or heat recovery ventilation involves utilizing the recovered residual heat coming from the inside environment by transfer of thermal energy from one fluid to another or from a fluid to a solid. Improved building regulations has highlighted the need to save Energy & has led to a considerable increase in energy recovery systems incorporating cross over coils, thermal wheels, and other devises to recover unusable energy in the form of heat transfer plates or fins etc.

These will all attract varying levels of contamination over a period of time and will require regular maintenance and cleaning, following manufacturing guidelines.

11.7 THERMAL WHEELS

Mechanical heat recovery by means of a rotating metallic porous wheel transferring thermal energy from the air to the cooler air stream via the wheel. Types: Enthalpy wheels and heat wheels

Fig No.20. Thermal Wheel example



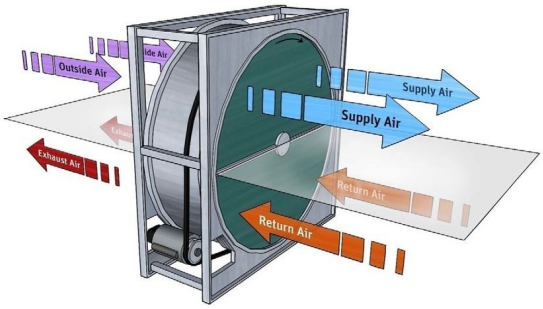


Fig No. 21. Thermal Wheel example

11.8 HEAT PIPES

Heat transfer using an evaporator or condenser via a sealed pipe containing a fluid which changes to a gas in the evaporator section from the warm air. A condenser section is then used where the gas condenses back into a liquid and the heat generated is transferred to a colder airstream.

11.9 FIXED PLATE HEAT EXCHANGERS

Plates of thin metal very close together with two airstreams passing between the plates adjacent to each other. Heat transfer occurs via the plate between the two airstreams.

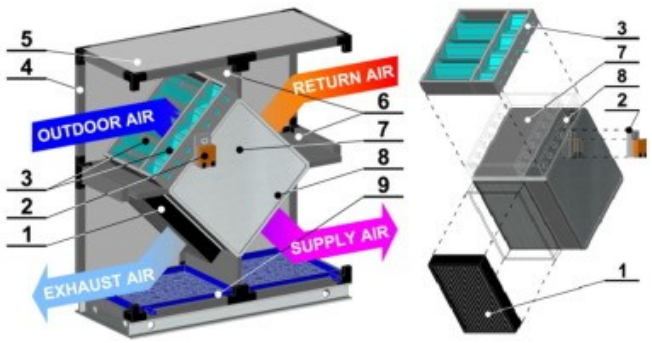


Fig No. 22. Heat Exchanger

11.10 FILTERS

Please refer to our filter guide **Section 12 Pg 105—109.**

Badly fitted or incorrect filters, lack of frequency in changing are the biggest contributor to duct contamination, therefore, it requires a strict regime of inspection to be instigated to ensure hygiene standards within the building. Refer to **Section 12** for an in-depth view of filtration units. HEPA filters, Panel filters and electrostatic filters designed to remove particulate from the air.

Fig No. 23. An array of different types of filters



There may be changes to much higher and more combination filter systems, that would include maybe electrically charged, charcoal and filter combination including UV light systems, all perceptions of what is acceptable in new designs will now be under review because of the COVID 19 virus, and possible future pandemics.

Table No. 11. Taken from EUROVENT - SELECTION OF EN ISO 16890 RATED AIR FILTER CLASSIFICATION FOR GENERAL VENTILATION APPLICATIONS

COMPARISON OF EN 779 AND EN ISO 16890 RATED FILTER CLASSES

As stated in chapter 3, the direct conversion of EN 779 and EN ISO 16890 classes is not possible. To facilitate an indicative comparison, particularly for the purpose of replacing existing filters, the Eurovent Association has developed a table matching both EN 779 and EN ISO 16890 classes for the same filters.

The comparison shows the actual overlapping of EN 779 and EN ISO 16890 classes and was developed based on real test data of 91 filters provided by Eurovent Certita Certification.

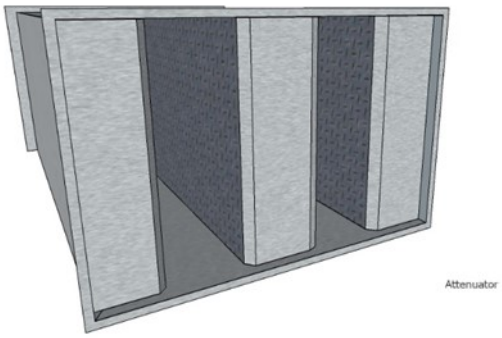
EN 779: 2012	EN ISO 16890 – range of actual measured average efficiencies		
Filter class	ePM_1	$ePM_{2,5}$	ePM_{10}
M5	5% - 35%	10% - 45%	40% - 70%
M6	10% - 40%	20% - 50%	60% - 80%
F7	40% - 65%	65% - 75%	80% - 90%
F8	65% - 90%	75% - 95%	90% - 100%
F9	80% - 90%	85% - 95%	90% - 100%

Table 5: EN 779 – EN ISO 16890 comparison

11.11 ATTENUATORS/SILENCERS

This is where the external size of the ductwork open increases for that section. Normally found near the fan the main principle of the attenuator is to reduce sound. The sound absorbing material may be fiberglass or rock wool or similar

Fig No. 24. Attenuator



Access panels cannot be fitted in an attenuator.

To acceptable levels, they have linings of MMMR, which have often collapsed over a period of time and will have to have major repairs or replacement before

cleaning using soft brushes, vacuum and low pressure air.

Always check for condition at the survey stage as cleaning damaged units will not result in a clean systems.

11.12 CONTROL DAMPERS

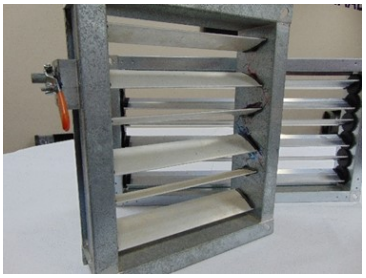
A device to regulate air flow like a valve for climate control. These can be calibrated to control how much air flows through the system. .These are often referred to as OBBs, also see VCD below. Control dampers can be used to stop cold or warm air travelling into an unoccupied room.

11.13 VOLUME CONTROL DAMPERS (VCDs)

A Volume Control Damper or VCD regulates the air flow and temperature in a heating ventilation air conditioning system like a valve. These systems tend to be zoned and calibrated and are often used to isolate an area for cleaning.

Volume control dampers and Turning vanes, because they are an obstruction in the air flow dirt tends to accumulate on them more readily. They come in many forms from fixed Turning vanes in square or rectangular duct to pneumatically, electrically or manual operated volume control dampers, as these VCD's are critical to the system balance, all manual operated VCD's should have their setting marked before cleaning to ensure balance is retained.

Fig No. 25. Volume Control Damper



TIP: It is essential that cleaning operatives / technicians mark and record the calibration setting of the VCD prior to performing any maintenance activity.

11.14 FIRE AND SMOKE CONTROL DAMPERS

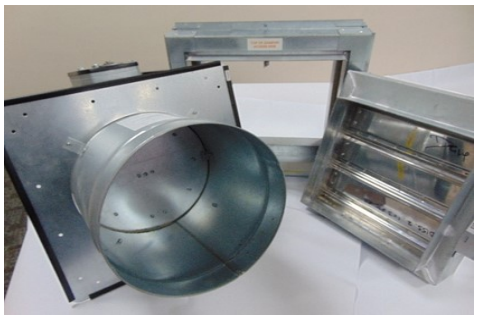
Driven by an actuator or motor a probe or sensor detects smoke causing the damper to close. Gravity operated systems are known as vertically mounted spring powered fire dampers. These systems use a fusible link which breaks or melts in order to operate the damper. The aim of these systems is to block or contain fire or smoke.

Fire dampers or smoke control fire dampers are used to prevent the spread of fire and or smoke to ensure compartmentation. To contain fire or to protect adjacent compartments BS9999 2017 states all fire dampers should be inspected annually and more frequently if conditions require.

These need to be carried out to current approved standards to comply with Regulatory Reform (Fire & Safety) Order 2005 RFRO 2005. These will require a separate schedule for record keeping, check with manufactures documents for correct installation and testing procedures refer to testing and inspection section. The manufacturers tested fixing instructions must be followed on all installations.

CAUTION: As this is a critical part of the air conditioning systems, all fire and smoke dampers must be inspected by a competent person who has been trained to the National Occupational Standards (NOS), and can give full detailed reports with photograph proof. This applies to every damper including faulty units. All dampers should be identified by an asset number and location.

Fig No. 26. Fire Dampers



CAUTION: If a technician spots any breach in a partition of a compartment they are legally obliged to report it.

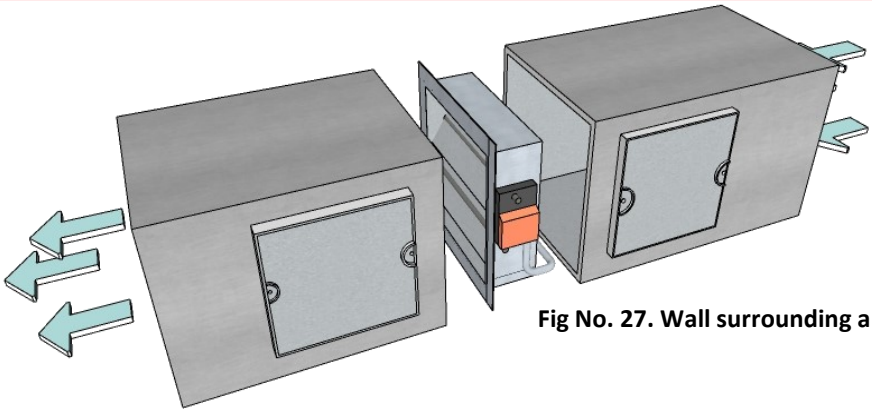


Fig No. 27. Wall surrounding a fire damper

A separate guidance manual is available from **NAADUK** on Fire and Smoke Dampers

TIP: Operatives and maintenance technicians should ensure that the damper has inspection / access panels on both sides to enable maintenance auditing and cleaning of system.

11.15 FAN COILS

Used to control the temperature. Recycled air passes over the coils which are either used for heating or cooling. A fan coil re-circulates the air and tends to be a separate unit not connected to a duct system. Units have a fan and individual filters on some units.

Fig No.28. Fan Coil Unit Examples







11.16 CHILLED BEAMS

Multi service are relatively easy to clean and are low maintenance, but some older installs are prone to contamination. Air is recirculated from the work area unfiltered, then dust etc, can accumulate or reduce efficiency and in some earlier systems prone to condensation.



Fig No. 29. Chilled Beams

11.17 TERMINAL EQUIPMENT UNITS

Terminal equipment units, such as fan coil units, mixing boxes, VRV (Variable Refrigerant Volume), CAV (Constant Air volume), VAV (Variable Air Volume) induction units, maybe included in cleaning schedule.

CAUTION:

Many VAV systems incorporate factory set terminal devices which have to be returned to manufactures for dismantling and reassembly often outside the UK. Fan coil units in the ceiling cassette units may require filter changes, consult with the Manufacture before starting project. Some plenums may be lined and require careful and gentle cleaning, just like the air silencers and other AHU's etc.

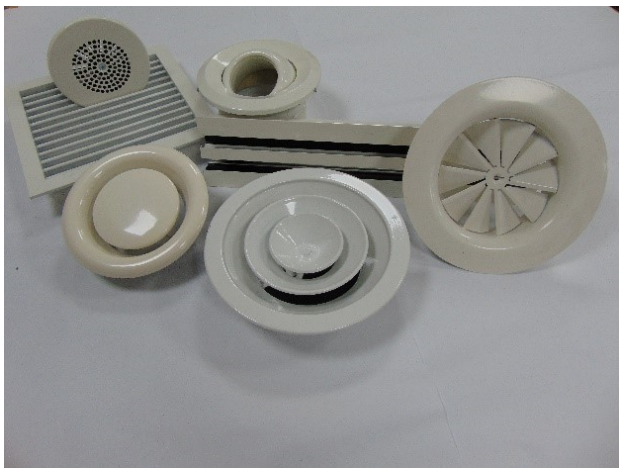
11.18 AIR TERMINAL DEVICES

These devices are designed to direct the supply and extract air flow.

Air terminal devices called grilles and diffusers are used to direct air into occupied areas at the correct volume and in the right direction to enable correct airflow into the work environment. Modern grilles are designed to have removable cores to enable cleaning, if not then complete removal may be necessary. Many long linear type grilles will have release springs and alignment pins to enable removal and allow access to the plenums at the rear, but this is time consuming. Refer to maintenance instructions.

Dampers on grilles or in the duct should be marked beforehand to ensure correct balance after cleaning has taken place and refitted.

Fig No. 30. Air Terminal Devices



Different types to be installed in various locations to ensure efficient air flow into selected environment.

11.19 DUCTING/DUCTWORK

The conduit for delivering or expelling air. Supplying air, exhaust air, ventilating air forming enabling indoor air quality. It can be manufactured from a combination of aluminum, galvanized steel, flexible duct, polyurethane, phenolic duct, PVC and even fabric (air socks).

11.19.1 DUCTWORK

Most ductwork is hidden above ceilings although in some modern usage it is actually coloured and made a feature of the materials – Steel, Stainless Steel, GRP, Air Sock Cloth, Phenolic ductwork.

Steel Galvanised – Most Common
Stainless Steel – Food Production / Factories
Air Socks – Lightweight / Short life
GRP - Laboratories

Phenolic Ductwork– Very lightweight ductwork, ideal for very tall buildings to reduce weight. Cleaning advice direct from **NAADUK** who have tested methods with Kingspan for cleaning without damaging substrate

Fig No.31. Ductwork



Fig No. 32. Phenolic Ductwork



11.19.2 METAL FLOOR AND CEILING PLENUMS

Metal floor and ceiling plenums are integral part of the distribution system and is subject to some hygiene standards.

Be warned many may be fitted with acoustic or thermal lining which will require gentle cleaning. Check cleaning regime.

Brick or concrete plenums retain excessive amounts of dust, advise client to seal surface with an approved non flammable sealant or other methods, i.e. plastering or rendering face to ensure smooth surface. If concrete duct is underground be wary and test for gas i.e. methane etc, that may permeate through cracks

Fig No.33. Galvanised Ductwork



CAUTION: The above could be classed as a confined space and the use of Oxygen Metres required.

11.19.3 FLEXIBLE DUCTING

Flexible ducts retain dust and debris in the corrugations which can be difficult to remove. Soft brushing or low air ball blasting with an air mover in operation are normally successful.

However, on older or damaged flexibles then it may be cheaper to replace. A good contractor should be able to advise.



Fig No. 34. Flexible Ducting

11.19.4 FIRE RESISTANT DUCTWORK

Fire resistant ductwork some pictured, require access doors of the same material and should be fitted with access panels at time of installation.

Bearing in mind HS 1992 RFRO 2005, BS EN 15780:2011 and BS9999 all make reference to the importance of testing and cleaning for IAQ standards. These panels often require certification of fitting at a later date. Some very old system may still contain asbestos, so check the asbestos register, if still in doubt call in a specialist asbestos contractor.



Fig No. 35. Fire Painted Fire Resistant ductwork



Fig No. 36. Fire Resistant Ductwork

Some unit will be painted to give required fire resistance.

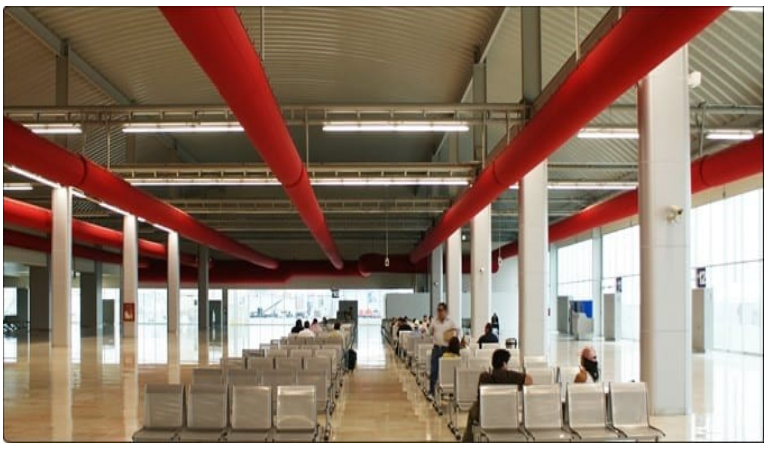
11.19.5 DUCTWORK—FLAT OVAL WITH STRENGTHING BARS

Care needs to be taken when cleaning, not to structurally damage support bars

Fig No. 37. Flat Oval with internal strengthening bars



11.19.6 CLOTH DUCTWORK



WARNING: Cloth ducting should not be laundered, except by manufacturer, as shrinkage will occur.

Fig No. 38. Sock Ducting

11.19.7 REQUIRED SEALING OF DUCTING IN TRANSIT

Guidance is given below regarding to the preparation and protection of ductwork during manufacture and installation with a view to minimising unnecessary contamination of duct systems.

Table No. 12.
Extract from BS EN 15780:2011 - Table F.2 – Recommendations concerning protection, delivery and installation

PDI Level	Factory seal	Protection during transit	Protection during site storage	Site clean	Cap off on site	Post – installation clean
Basic PDI	No	No	No	No	Risers only	No
Intermediate PDI	No	No	Yes	Yes	Yes	Not unless shown to be necessary
Advanced PDI	Yes	Yes	Yes	Yes	Yes	Yes

DW144 2013 recommends and states all systems should be cleaned before handover.

Fig No. 39. Ducting delivered to site sealed

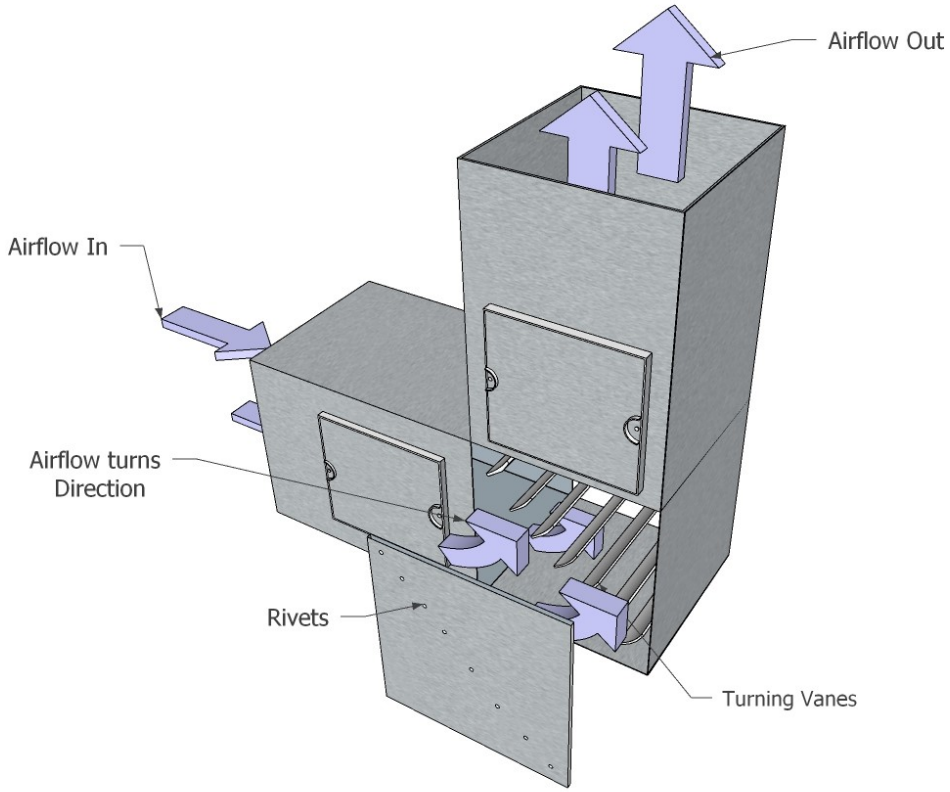


11.19.8 CHANGES OF DIRECTION IN DUCTWORK

As shown in the drawing a change of direction may include directional turning vanes. Access must be provided either side of these.

TIP: Look out for a series of rivets on the outer side of the duct that may indicate a turning vane.

Fig No. 40. Direction of air flow



11.20 ACCESS PANELS

11.20.1 GENERAL

Access panels should be to BSEN12097 specification, and not obstructed by other services. They should have quick release panels and should not be riveted or screwed on panels. This view has been seconded by London Fire Brigade representative, who has advised that all access panels should be labelled and accessible.

Access panels should be installed every 15m. This may not be necessary if there are already openings i.e. grilles or diffuser openings.



Fig No. 41. Variety of Access Panels

Access panels as per **Table 14 & 15 Page 104** should be fitted no more than 500mm from the component requiring access and service. Change of direction, panels are not normally required on circular ductwork. Vertical ductwork passing through different floor levels would require an access panels at each level that should be accessible as diagram:

11.20.2 STANDARDS FOR ACCESS PANELS

BS EN 12097:2006

Ventilation for buildings – Ductwork – Requirements for ductwork components to facilitate maintenance of ductwork systems

- Requirements for the shape, dimension and location for access panels for cleaning and service in ductwork systems.
- An access panel to this standard can be closed and opened repeatedly, without damage or additional cutting into the duct. It refers to “Door and inspection panel” in EN 12792
- Access components must match the performance of the ductwork in terms of strength and air tightness and allow cleaning.
- Easy opening panels
- 4.2.2 “Access components shall be provided to ensure the whole of the ductwork system can be cleaned”. It further states that access must be unobstructed.
- Table 1 Access panels in circular ducts, minimum dimensions.
- Table 2 Access panels in rectangular duct, minimum dimensions.
- In 4.3 it states that ductwork mounted components that prohibit cleaning must have a point of access from both sides.
- Sharp pointed screws are not to be used near opening within 1m due to potential operative injury.

11.20.3 ACCESS PANEL LOCATION

Table No. 13. Access Panel Location

In-line equipment	Location
Control dampers	Both sides / Up-stream panel
Fire dampers	Both sides / To suit damper maintenance
Heating/cooling/re-claim coils	Both sides / Panel on both sides
Attenuators (rectangular)	Both sides / Up-stream panel
Attenuators (circular)	Both sides / Up-stream panel
Filter sections	Both sides / Up-stream panel
Air turning vanes	Both sides / Up-stream panel
Changes in direction	One side
In-duct fans/devices	Both sides / Up-stream panel
Inlet/exhaust louvre	One side / One panel to suit
Intermediate cleaning panels	As and Where Required

Flat Oval ductwork with rods may require more access panels, dependant on size and location.

In some cases where components are closer together i.e. fire damper, VCD etc then access panels may be much nearer than the 500mm of distance from components and much less than 15m spacing between Access Panels.

BS EN 12097, where human access is required as ductwork is too large to be cleaned mechanically, then human access should be allowed for cleaning and maintenance, subject to a risk assessment. (Subject to fixings, age of installation, handover documents, loading, design and installation, height of system, additional supports & rescue plan etc.)

CAUTION: Get Expert advice before undertaking Manned Entry

Table No 14. Opening sizes suggested for access to rectangular & flat oval

Duct size up to longest size major axis	Recommended dimension of opening	
200mm	300mm	150mm
300mm	300mm	200mm
400mm	450mm	300mm
>500mm	450mm	450mm

Table No. 15. Opening sizes suggested for access to circular duct

Duct size up to	Recommended dimension of opening	
310mm	250mm	150mm
450mm	400mm	300mm
550mm	400mm	300mm
>600mm	500mm	400mm

Ventilation cleaning should incorporate all components within the system

11.20.4 FITTING ACCESS PANELS IN HORIZONTAL OR VERTICAL RUN OF DUCT

Access panels must be sufficient in number to allow cleaning of all surfaces. Previous guidance BS15780/11 advises 15 metre spacing max.

Also utilise openings already in place i.e. Grille / Diffuser openings.

Note: Design where possible place OBD, Control dampers on grille / diffuser unit, so when removed allows access for maintenance through aperture.

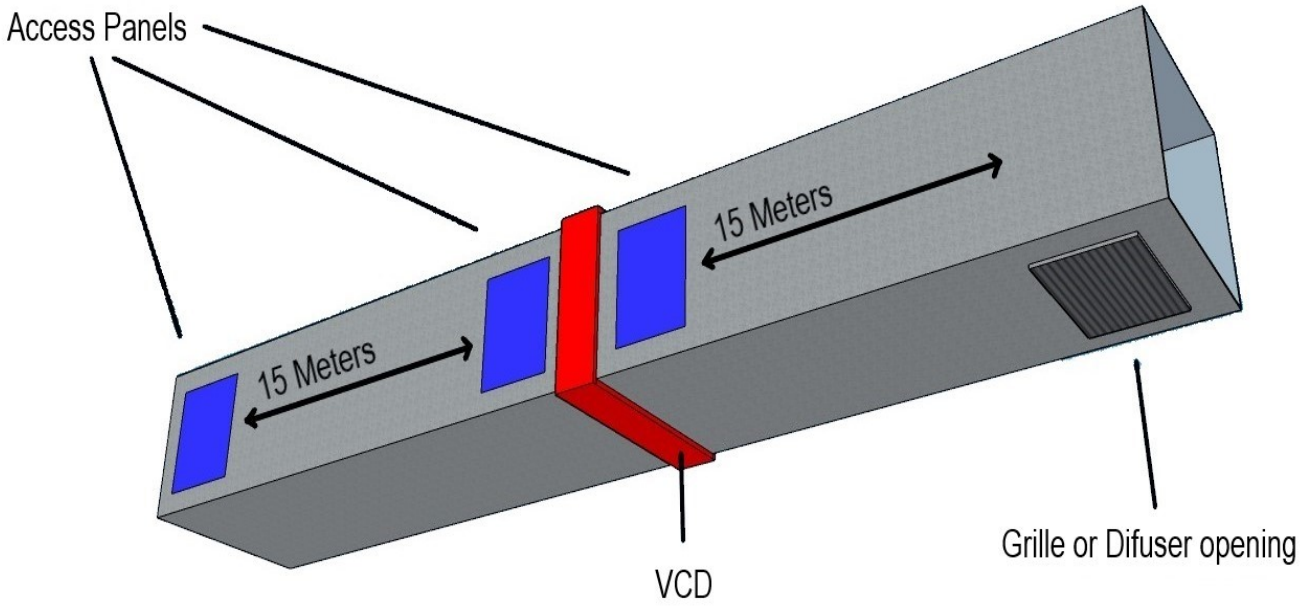


Fig No. 42. Access Panel Spacings

CAUTION:

Some manufacturers may not recommend large access panels are located at too closer intervals as this may interfere with structural integrity. Further testing may be required by NAADUK or the manufacturers.

12. FILTRATION

12.1 GENERAL

Air filters play an essential role in all kinds of indoor climate areas. Not only are they essential for a good and healthy indoor climate, but they can also have a strong impact on the energy performance of buildings as well as air handling equipment. The use of ineffective air filters or a lack of filter maintenance and replacements can even nullify the efficiency gains of the entire product in which filters are incorporated.

12.2 THE IMPORTANCE OF AIR FILTRATION

Controlled air quality is crucial in many processes today. Besides many technical applications, building ventilation is a key area. Here, air filters ensure healthy indoor air by removing harmful fine dust including pollen, bacteria, yeasts and moulds, along with other organic and inorganic material. Air filters also serve to keep the air handling equipment itself clean. By doing so, they ensure its hygienic and efficient operation.

Air purity requirements are continuously improving. This is due to increasingly sophisticated and sensitive industrial processes, stricter environmental legislation and rising comfort and health conscious attitudes. At the same time, the need to reduce energy consumption and carbon dioxide emissions is evolving along with the pressure on costs. Thus, buildings are more and more restricted from natural ventilation. Energy-efficient mechanical air handling and, in particular, air filtration solutions, are more in demand than ever.

12.3 BENEFITS FROM USING AIR FILTERS

The aim of using air filters is to protect people's health by maintaining a good hygiene level in the ventilation system and clean indoor air quality (IAQ). It is commonly known that air pollution is unhealthy, but it is not so well known that the smallest particles are the most dangerous. The aspects could be different depending on the outdoor air quality and the indoor activities.

The urban air quality is nowadays polluted by small PM_1 particles and gases coming from combustion and diesel engines **(See Figure 1 taken from DEFRA map Page 77)** which city centres are crowded with. Additionally, for hygiene reasons, bacterial and fungal spores must be removed from the air stream, which are typically in a size range between 1 and 10 µm (**see Figure 1**). Therefore, for the human health and indoor hygiene, it is important to clean the inlet air with sufficient air filters.

The most common air filters in comfort ventilation are ePM1, ePM2,5 and ePM10. ePM1 is recommended in buildings such as schools, hospitals, office buildings, apartments, and residential facilities.

12.4 MAINTENANCE OF AIR FILTERS

The filter service life is defined as the operating period between filter installation and filter replacement. It is determined by the following factors:

- Hygiene issues e.g. microorganisms, fungal spores, odours,
- Optimisation of economic efficiency,
- Reaching of the final pressure drop specified for the filter system in the ventilation system
- Defective filter.

Filters should be changed considering the above-mentioned factors and the supplier's maintenance plan. When replacing filters, it needs to be ensured that all filters across the entire duct cross-section are changed at the same time. Filters may only be changed with the system at standstill and by using personal protection equipment (clothing, gloves, class-P2 respirators). The used filters should be transported in big plastic bags. Particularly when mounting new filters, utmost care shall be taken to prevent filter damage due mostly to the sharp edges of the slot. Contaminated filters should be handled with care, transported in a suitable, lockable package and disposed according to local legislation. The connections between filter frames and partitions shall be cleaned, checked and repaired, where required. The filter frames or the filter housing of the new filter as well as the sealing faces should be cleaned carefully prior to assembly. The new filter should be careful assembled as per assembly instructions. Visual inspections of coarse and fine dust filters and particle measurements on particulate air filters of classes H and U must be performed at regular intervals to detect such defects. During maintenance, optical and/or electrical differential pressure gauges and indicators shall be checked for proper functioning. If testing a filter is impossible, it should be replaced after the period specified by the manufacturer.

Care should be taken with replacing an air filter as many are replace incorrectly the wrong way round.

12.5 TRANSPORT AND STORAGE

To protect filters from contamination, they should be transported and stored only in their original packaging, preferably on pallets. Transportation should be done with care, avoiding any abrupt movement. Filter storage must be indoors according to manufacturer's instructions (not out-doors), protected against rain and moisture, and at temperatures above freezing point. The filters should be brought to the assembly site in their original packaging and should not be unpacked until immediately before assembly. The packaging must not be pierced with sharp objects. When removing a filter from its packaging, avoid touching the delicate filter medium. Prior to assembly, each filter should be checked visually for any transport damage. Damaged filters should not be used.

12.6 DISPOSAL OF FILTERS

Filters should be disposed of in a suitable environmentally friendly way, they must be bagged up in order to contain any spread of contamination when transporting. Many sites have suitable disposal on site. PPE must be worn when changing filters.



Fig No. 43. Changing filters wearing appropriate PPE

12.7 EXAMPLES OF COMMONLY USED FILTERS:

Fig No. 44.
Panel Filter



M7 Energy Saver Pleated Panel Filters, Classified ISO16890-Course 75% EN779 G4

Fig No. 45.
Panel Filter



VLX – Hi-Capacity Panel Filters, Classified ISO16890-Coarse 85%, EN779 G4

Fig No. 46.
Metal Filter



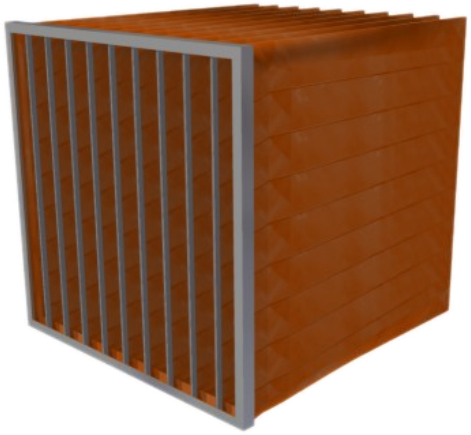
PLM – Fire Rated metal Frame Pleated Panel Filters, Classified Coarse 60% to ISO16890, G4 to EN779:2012

Fig No. 47.
Reloadable Filter



Re-loadable Galvanised Steel frames and a range of cut media pads

Fig No. 48 .
Bag Filter



Jay flow – Glass bag filters, Classified ISO Coarse, ISO ePM10, ePM2.5, ePM1Classified M5 -F9 to EN779:2012

Fig No. 49.
Bag Filter



Clean pack – Synthetic bag filters, Classified ISO Coarse, ISO ePM10Classified G4-M6 to EN779:2012Classified G4-F8 to EN779:2002 Economy focus

Fig No.50.
Compact Filter



Ultimapleat Rp Compact Minipleat Filters With 25mm Header And Microfine Glass Fibre Media, Classified M6 En779:2012

Fig No. 51.
Compact Filter



H-Utimpleat – UPH6 compact minipleat panel filters with header frames, Classified M6 to F9 to EN779:2012. Depths 100mm and 150mm as standard

Fig No. 52.
HEPA Filter



UHVH – UHV High volume HEPA Filters with steel case, Classified H13-H14 to EN1822.

Fig No. 53.
HEPA Filter



UMPW laminar flow HEPA panel filters with wooden frame, Classified H13-H14 to EN1822. For use in controlled contamination environments.

Fig No. 54.
Molecular Filter:



JBA – The Carboflow range of combination filters are essentially two filters in one. Activated carbon media combined with microfine glass fibre classified F7 EN779:2012

Fig No. 55.
Sitesafe Filter Unit:



DCS – ACMO – SITESAFE Units – Grade ACMO for removal of formaldehyde and other low boiling point aldehydes. Used in Mortuary, Hospitals, Undertakers etc

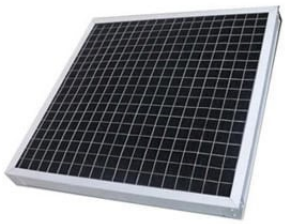
Fig No. 56.
Carbon Filter:



Enviropleat Carbon Filter Odour Reduction Panel

Enviropleat Panel Filters 26-50mm deep The Enviropleat panel filter is a synthetic disposable product which is coated in highly active powdered activated carbon. This filter can be used in any existing panel filter application where some odour reduction and fume adsorption is desired. Typical applications would include air supply which is drawn from busy road areas, car parks or from under flight paths.

Fig No. 57.
Carbon Filter:



C-Loose – Loose fill panels. A range of carbon activated carbon panels used for a wide variety of applications. Grades available: ACS – Standard performance, general usage AC – Enhanced performance, general usage AÇU – Treated carbon for museums, archives etc

13. HOSPITAL VENTILATION

13.1 GENERAL

Hospital Ventilation Systems, by their very nature lead the way in excellence and even under review **HTM-03-01 2021,** Scottish **SHTM 03-01** and Welsh **HTM 03A** Standards**,** it takes into account what many people don't acknowledge. For example: filter standards must reflect and take into account local pollution standards so it is imperative correct filters are used for which ever department they are specified for. Unlike a normal commercial environment, hospitals by use, i.e. general areas, operating theatres, pharmaceuticals and research, isolation, critical care etc. all require specific filters to protect various areas to various standards. For any companies carrying out work in these areas, an understanding of HTM-03-01 standards are imperative, with specific reference to filter requirements for different facilities, these can be found in section eight of HTM-03-01, other references, CIBSE B2 & BS EN 15780:2011.

13.2 SOURCES OF CONTAMINATION

Once the supply air duct is clean, air filters changed as required and air handling units well maintained, the supply air system presents minimum risk to the hospital.
Listed below are some of the risks:-

- The main risk of contamination and performance issues arises from the extract air systems. Here are some of the risks:

- Grilles, grille dampers and grille boxes become heavily laden with contamination generated in the hospital rooms comprising of hair, skin, lint and bacteria.
  This can reduce airflow and in turn affect the airflow patterns in the room. Rather than the supply air flowing into the room at one side and exiting the room at the other side (or low level) after picking up any virus or bacteria that was airborne, it might swirl around the room and increase the risk of infection to all room occupants.

- Once contamination builds up to a high level on extract grilles, it can become heavy and fall from the grille into the room.

- Blocked dampers and grilles change the room pressure profile in the room and possibly render the room not fit for purpose.

- Years of dirt in extract ducts can be classified as a fire hazard and fall under RFRP 2005.

13.3 WORKING IN A "LIVE" HOSPITAL

Hospitals are very dynamic work environments containing sick and unwell people, the general public, hospital staff and service staff. There are strict protocols that must be adhered to before working in a hospital.

- All service staff should be specifically trained to work in a hospital environment.
- Service staff should present themselves in clean uniforms, especially footwear, well groomed with special attention to hand hygiene. ID badges should always be worn.
- Discuss work procedures with the point of contact in the hospital and the infection control department.
- A detailed method statement and risk assessment should be prepared covering all aspects of the work, particularly infection control, containment of contaminants, waste management and signing off. The hospital will deal with moving patients, etc. to facilitate the work.
- Ensure all tools are cleaned and sanitised before entering and when leaving the hospital. Conduct a tool check before leaving the work area and leave nothing behind. Lock away tools during breaks or if leaving the work area.
- Work in a quiet manner. Speak in a low voice and do not engage in any horseplay. Patients are trying to recover from illness and must not be unnecessarily disturbed.
- NEVER enter a room without instruction from the ward supervisor. Always have a hospital staff member check the room before entering. Patient dignity and visitor time must be respected at all times.

13.4 NOTES FOR THE CONTRACTOR WORKING IN HOSPITALS

- All equipment should be cleaned prior to entry on site
- Always carry and display ID
- Never enter an area without official approval. Get permission and clearance for all areas to be cleaned.
- Never switch or lock off equipment without official permission
- Always appraise level of cleanliness required for specific area
- This is a hospital, snagging notes are not acceptable, the clean must be 100% the first time.
- Allow longer for ensuring every tiny crevasse is cleaned.
- Make notes of every asset you are working on and record any faults
- Do not move from one area to another without clearance
- Always dispose of material taken from ducts in yellow bags
- Do not leave used filters anywhere – remove them and dispose of correctly
- Ensure tool check – all recovered
- Do not eat or drink whilst cleaning
- Remove coveralls before entering canteens or other general areas

13.5 HOSPITAL DESIGNERS POINTS OF VIEW

HTM-03-1 2021 & SHTM 03-01 Pats A & B, gives excellent guidance on new hospital builds and standards that are very comprehensive in their nature, however at the design stage, NAADUK believe a few other points may assist in future design. Where solid ceilings are incorporated use circular duct to enable efficient rotary brushing, if not, have ceiling panels to allow crawl space for duct and component maintenance. Use sweep bends to eliminate turning vanes, on risers ensure access to each floor. On all ductwork install access panel to DW144 not TR19, as DW144 takes into account cleaning requirements. All air terminal devices should have removable core and damper for cleaning, so as not to disturb masonry screws.

Egg crate type grilles or extract should not be used as edge catchment is too high with increased risk of debris detachment.

13.6 NAADUK's VIEW

COVID 19 occurred during the release of HTM-03-1 and is ongoing. **NAADUK** recognised the importance of ventilation systems in a building from the beginning of the pandemic. We recommend several critical areas: -

1. The cleanliness of system
2. Maintaining good extraction rates
3. Clean supply air ducts
4. Utilising fresh air vents (windows and doors
5. Halting recirculating air systems
6. Shutting down fan coil units or alternatively running 24/7
7. Monitoring filter integrity, including the frequency of filter changes
8. Testing all ductwork for leakage.

We expect huge improvements in AHU design and configurations in the future, to prevent the spread of viruses, as pandemics are now a constant threat in our lives.

Leading virologist all now agree with NAADUK's earlier statement "good ventilation is critical."

Remember hospitals must be compliant with all current legal regulations, Health and Safety 1992 Policy (Rev 2013) and The Regulatory Reform (Fire Safety) Order 2005

14. VIRUS DETECTION AND PRECAUTIONS

14.1 VIRUS

A virus is a small sized infectious agent that can multiply only in the living cells of bacteria, animals and plants. According to the Encyclopaedia Britannica “most viruses vary in diameter from 20 nanometres (nm; 0.0000008 inch) to 250–400 nm”.

Transmission routes can include:-

14.1.1 AIRBORNE TRANSMISSION - microbes found in droplet nuclei particles in the air existing for long periods of time that can be transmitted to another person over a distance beyond 1m.

14.1.2 DROPLET TRANSMISSION - where a person within a 1 m distance with someone who has respiratory symptoms such as sneezing or coughing potentially infective respiratory droplets. Such transmission can be through cross contamination (indirect contact) or direct contact with a person who is infected.

14.2 METHODS USED TO CONTROL A VIRUS IN AN INDOOR ENVIRONMENT SETTING

The World Health Organisation state that “Ventilation is the intentional introduction of clean air into a space while the stale air is removed. Ventilation moves outdoor air into a building or a room and distributes it within the building or room. If local outdoor conditions require, e.g. high particulate matter (PM) concentration, treatment of the outdoor may be needed before introducing it into the building.” (3)

If HVAC systems are used, they should be regularly inspected, maintained, and cleaned. Rigorous standards for installation and maintenance of ventilation systems are essential to ensure that they are effective and safe. Attention should be given, as in normal circumstances, to monitoring the condition of filters and, if possible, increasing the central air filtration as high as possible without significantly diminishing design airflow. In the UK to BS EN 15780:2011 standard.

14.2.1 INCREASING RATES OF MECHANICAL VENTILATION

Mechanical ventilation via the use of fans and ducts to bring outside air into an enclosed environment.

Switch ventilation to operational speed at least 2 hours before the building usage time and switch to lower speed 2 hours after the building usage time. This will clean the air before use and after use by utilizing higher air change rates. At nights and weekends, do not switch ventilation off, but run systems at lower speed.

The UK government advises: “ventilation can also be increased by leaving extractor fans in bathrooms, toilets and kitchen areas running for longer than usual, with the door closed, after someone has been in the room” in a home setting. NAADUK would further advise the lid of the toilet seat be put down before flushing to prevent the escape of potentially contaminated vapour in the aerosol.

It is recommended that new builds or refurbished buildings should install vacuum sealed toilet units.

14.2.2 RECIRCULATION SYSTEMS SET TO DELIVER FRESH AIR

Switch all air handling units with recirculation to 100% outdoor air with the recirculation damper closed and ensure the fresh air and exhaust air dampers are open.

14.2.3 PASSIVE VENTILATION

Natural ventilation through windows and doors. Advice is to open windows for regular airing (even mechanically ventilated buildings). The HSE have released guidance under the current pandemic. It is energy efficient, but not so good for pandemic conditions.

"Ventilation reduces the aerosol risk but has minimal impact on:

droplet transmission (where people are within 2 metres of each other)

contact transmission (touching surfaces)"

Link: https://www.hse.gov.uk/coronavirus/equipment-and-machinery/air-conditioning-and-ventilation/index.htm

14.2.4. FILTRATION—i.e. HEPA FILTERS

Smart air on a recent Blog state that "The coronavirus, SARS, and influenza A viruses typically die in under 48 hours, across a range of surfaces. A hardy, non-enveloped virus (MS-2 coliphage) was able to survive up to 6 days on HEPA filters. However, the coronavirus – being a non-enveloped virus – is unlikely to last this long. A reasonable estimate for the survival of the coronavirus on HEPA filters is 48 hours, with 72 hours being a conservative number."(2).

As a consequence safety protocols and risk assessments need to be considered for the safe changing and disposal of used filters. PPE must be worn at all times whilst carrying out this task.

14.2.5 UV AND UV-C

Inactivating pathogens using UV light depends upon variables such as the intensity of the light, the exposure time, and the relative humidity of the environment, against the fact varying pathogens need different exposure times and light intensities.

UV-C irradiation produced from a monochromatic light at 254 nm which UV Tech state is the optimal wavelength for germicidal irradiation. UV-C light deactivates the virus DNA and thus destroys it's ability to multiply. As Ozone generation has been found to be an issue mitigation via the use of low-pressure emitters that do not produce ozone are used to generate short-wave UV-C light. These emitters exhibit a particularly high level of UV-C radiant efficiency.

The above notes were compiled by NAADUK in light of COVID 19 2019-2021. There are several guidance notes including documents that have been circulated worldwide by the IHEEM.

However, NAADUK take Covid as a warning that the next pandemic could be much worse, and that there is a need to design and prepare now. It is the technicians duty to keep up to date on all new guidance as issued.

PLEASE NOTE:
UVC lamps used for disinfection pose potential risks depending on the UVC wavelength, dose, and duration of radiation exposure. These risks may increase if the unit is not installed properly or used by untrained individuals. Risks may include:-

- **Ozone inhalation**
- **Injury to skin and eyes**
- **UVC lamps are likely to contain mercury which is toxic. Caution when cleaning.**
- **UVC can degrade certain dyed textiles and plastic**

For further information please see the World Health Organisation Roadmap to improve and ensure good indoor ventilation in the context of COVID-19 March 2021.

Advice from the UK Government: "Make sure mechanical ventilation systems are maintained in line with manufacturers' instructions. Set ventilation systems to using a fresh air supply and not recirculating indoor air, where possible. Assessing the requirement and performance of ventilation systems in many environments requires engineering expertise. In addition, ventilation design may be specific to the setting. For some existing and older buildings, ventilation systems may not have been designed to meet current standards and additional mitigations may be needed. If you are unsure, seek the advice of your heating, ventilation and air conditioning (HVAC) engineer or adviser."

14.3 SOURCES OF INFORMATION

1. **HSE Guidance for the identification of poorly ventilated areas**

   https://www.hse.gov.uk/coronavirus/equipment-and-machinery/air-conditioning-and-ventilation/identifying-poorly-ventilated-areas.htm

2 **How Long can the Coronavirus Survive on HEPA Filters? – Smart Air (smartairfilters.com)**

   https://smartairfilters.com/en/blog/coronavirus-survive-purifier-hepa-filter/

3. **World Health Organisation Roadmap to improve and ensure good indoor ventilation in the context of COVID-19 March 2021**

   https://www.who.int/publications/i/item/9789240021280

4. **Identifying poorly ventilated areas (hse.gov.uk)**

   https://www.hse.gov.uk/coronavirus/equipment-and-machinery/air-conditioning-and-ventilation/identifying-poorly-ventilated-areas.htm

5. **SAGE-EMG—Potential application of Air Cleaning devices and personal decontamination to manage transmission of COVID-19.** —4th November 2020.

6. **Health and Safety Management of TSEs 2003 Part 2**

APPENDIX 1

REFERENCE OF REGULATIONS/STANDARDS/GUIDANCE PERTAINING TO VENTILATION AND AIR CONDITIONING SYSTEMS

A brief overview of the regulations, standards and good practices recognised in the UK. in relation to ventilation system and IAQ. A reference list of the various organisations who have produced the documents are catalogued.

REGULATION/LAW	SOURCE	TITLE
BS EN 15780: 2011	bsi	Ventilation for Buildings Ductwork – Cleanliness of Vent Systems ISBN 978 0 580 74008 4
BS EN ISO14644-1:1999	bsi	Cleanrooms and associated controlled environments Part 1 Classification of air cleanliness ISBN 0 580 32951 8
BS EN 12097:2006	bsi	Ventilation for buildings – Ductwork – Requirements for ductwork components to facilitate maintenance of ductwork systems ISBN 0 580 49528 0
Construction (Design and Management) Regulations 2015 (CDM)	HSE	Managing health and safety in construction ISBN 9780717666263
L24 Regulations 5 & 6 (Revised 2013)	HSE	Workplace Health, Safety and Welfare Regulations 1992. Approved Code of Practice and guidance. ISBN 9780717665839
HSG 202	HSE	General Ventilation Guidance for Employers ISBN 0 7176 1793 9
COSHH Reg 2002	HSE	The Control of Substances Hazardous to Health ISBN 978 0 7176 6582 2
Clean Air Act 1993	Leg Gov	ISBN 0105411930
Building Regulations 2010 Part J	Leg Gov	Approved document J: Combustion appliances and fuel storage systems ISBN 0 7176 0413 6
RFRO 2005 *	Leg Gov	The Regulatory Reform (Fire Safety) Order 2005 1541 PT 2 17

STANDARDS	SOURCE	TITLE
BS9999-2017-TC Appendix W	bsi	Fire safety in the design, management and use of buildings. Code of practice ISBN 978 0 580 97716 9
LPS 2084: Issue 1	bre LPCB	Standard for Inspection, Cleaning & Maintenance of Ductwork Systems
HTM 03:01:2019, Scottish SHTM 03-01 Welsh HTM 03A	Dept of Health	Health Technical Memorandum Specialised Ventilation for Healthcare Premises 978011322805 8 Part A Design & validation & Part B Specialised ventilation & performance verification
FMS 1/97	BSRIA	Guidance to the standard of Ventilation Hygiene ISBN 9780860224549
BS EN 12236:2002	bsi	Ventilation for buildings. Ductwork hangers, & support. Requirement for strength ISBN 0 580 39457 3
ISO 14644-1:2015	ISO	Cleanrooms and associated controlled environments — Part 1: Classification of air cleanliness by particle concentration ISBN 978 0 580 57297 5
BS EN ISO 14644-3:2019	ISO	Cleanrooms & associated controlled environments. Test methods. ISBN 978 0539 1318 8
GTOF 04 SCQF Level 5	SCQF	Ventilation Hygiene
SCQF Level 5	SCQF	Installation of Fire Resisting Ductwork and Ventilation Systems
SCQF Level 5	SCQF	Fire and Smoke Damper Certificate

GUIDANCE	SOURCE	TITLE
NAAD21	NAADUK	Part 2 AIR (Indoor Air Quality)
TR19	BESA	Guide to Good Practice Internal Cleanliness of Ventilation Systems ISBN 978-0-903783-65-1
DW144	BESA	Specification of Sheet Metal Ductwork ISBN 978-0-903783-64-4
DW143	BESA	Guide to Good Practice Ductwork Air Leakage Testing
DW145	BESA	Guide to good practice for the Installation of Fire and Smoke Dampers ISBN 978-0-903783-63-7
ACR 2013	NADCA	The NADCA Standard for the Assessment, Cleaning, and Restoration of HVAC ISBN
TM26: 2000	CIBSE	Hygiene Maintenance of Office Ventilation Ductwork ISBN 10: 1903287111
	HEVAC	Guide to Air Distribution technology for the Internal Environment Issue 2 2015
	ADCAS	Guide to Ductwork Cleaning & Access Doors
Feb 2016	RCP & PCPCH	Summary impact of air pollution Every breathe we take: the lifelong impact of air pollution
Building Bulletin 101 Version 1 Aug 2018	Education of Skills Funding Agency	Guidelines on ventilation, thermal comfort & indoor air quality in schools

APPENDIX 2
ACRONYMS OF ORGANISATIONS

ACRONYM	ORGANISATION
ADCAS	Association of Ductwork Contractors & Allied Services
ASFP	Association for Specialist Fire Protection
BAFA	British Approvals of Fire Equipment
BESA	Building Engineering Services Association
BRE	Building Research Establishment
BSI	British Standards Institute
BSRIA	Building Services Research
CEDA	Catering Equipment Distributors Association
CIBSE	Chartered Institute of Building Services Engineers
FETA	Federation of Environmental Trade Associations
FPA	Fire Protection Association
HEVAR	Association for manufacturers and suppliers of HEVAC
HSE	Health and Safety Executive
IHEEM	Institute of Healthcare Engineering and Estate Management
ISO	International Organization for Standardization
IWFM	Institute of Workplace and Facilities Management
LPCB	Loss Prevention Council Board
NAADUK	National Association of Air Duct Specialists UK
NADCA	National Air Duct Cleaners Association (USA)
NOS	National Occupational Standards
RISCAuthority	Risk Insight Strategy and Control Authority Research for FPA
SAGE	Scientific Advisory Group for Emergencies
SCQF	Scottish Credit & Qualifications Framework
WHO	World Health Organization

APPENDIX 3

REFERENCE OF TABLES—PART2: IAQ

PART 2 - AIR		
1	Law & Guidance for Air Supply & Extract Systems	69
2	Quick Check Guide as to frequency of Inspection and testing – taken from BS EN 15780:2011	78
3	Taken from BS EN 15780:2011 – Table A.2 – Typical applications of cleanliness quality class	78
4	Taken from BS EN 15780:2011 – Table A.3 – Acceptable Cleanliness Levels	79
5	Major components found in Air Conditioning Systems	79
6	Extract from BS EN 15780:2011 – Table A.4 – Acceptable dust accumulation levels in new ductwork	81
7	Extract taken from CIBSE TM26 Table 3—Classification of surface sampling microbial limits	86
8	Actions to be taken following sample analysis	86
9	Cleaning Methods	87
10	Components of Ventilation Air Systems	89
11	Taken from EUROVENT - Selection of EN ISO 16890 Rated Air Filter Classification for General Ventilation Applications	94
12	Extract from BS EN 15780:2011 – Table F.2 – Recommendations concerning protection, delivery and installation	101
13	Access Panel location	104
14	Opening sizes suggested for access to rectangular and flat oval	104
15	Opening sizes suggested for access to circular ducts	104

APPENDIX 4

REGULATIONS RELATING TO VENTILATION AND AIR CONDITIONING SYSTEMS

General Guide to Legislation Applicable in the UK

All the regulations listed make it abundantly clear that the occupier or owner of the commercial premises is to maintain the ventilation systems to correct standards.

COSHH Regulations

The Control of Substances Hazard to Health (COSHH) regulations require an employer to protect his personnel or visitors from any hazardous substances, dust, human pathogens or chemicals of other substances used by outside contractors working on his property and have the right and do ask for COSHH regulations on products used.

The Health and Safety at Work act 1974 would now involve the above.

Occupiers Liability Act 1984

The Occupiers Liability Act 1984 imposes a duty of care on the occupant, which could and does include the condition of air conditioning as a poorly maintained system could harm occupants and visitors.

Health, Safety and Welfare Regulation 1992 (updated 2013) Reg 6 Ventilation ACOP 6

47 Enclosed workplaces should be sufficiently well ventilated so that stale air, and air which is hot or humid because of the processes or equipment in the workplace, is replaced at a reasonable rate.

48 The air which is introduced should, as far as possible, be free of any impurity which is likely to be offensive or cause ill health. Air which is taken from the outside can normally be considered to be 'fresh'. However, air inlets for ventilation systems should not be sited where they may draw in contaminated air (for example close to a flue, an exhaust ventilation system outlet, or an area in which vehicles manoeuvre). Where necessary, the inlet air should be filtered to remove particulates.

50 Workers should not be exposed to uncomfortable draughts. In the case of mechanical ventilation systems, it may be necessary to control the direction or velocity of air flow. Workstations should be re-sited or screened if necessary.

51 In the case of mechanical ventilation systems which recirculate air, including air-conditioning systems, recirculated air should be adequately filtered to remove impurities. To avoid air be coming unhealthy, purified air should have some fresh air added to it before being recirculated. Systems should therefore be designed with fresh-air inlets, which should be kept open.

52 Mechanical ventilation systems (including air-conditioning systems) should be regularly and adequately cleaned. They should also be properly tested and maintained to ensure that they are kept clean and free from anything which may contaminate the air.

58 Some ventilation systems are water based. Any water system where water is used or stored, and where there is a means of creating and transmitting water droplets that may be inhaled, can create a foreseeable risk of exposure to legionella. Guidance on the necessary measures to prevent or adequately control this risk is available on the HSE website (www.hse.gov.uk/legionnaires/), in the relevant ACOP24 (Approved Code of Practice) and also from CIBSE25.

The number of testing locations are easily defined by areas that access panels are fitted in compliance of HS 1992 (2013) BS EN 15780:2011 guidelines of access panels location requirement and using guidelines of DW144 and NAAD21, TR19.

There should be records in log book paper form or electronical, that includes, installation drawings and any amendments, full set of current maintenance and testing regimes covering filters changes. Fire damper inspections, records should be kept of all cleaning and monitoring actions. Any breaches of regulations or poor condition of any equipment should be recorded

Workplace Health and Safety Regulation 1997

Requires employers to carry and risk assessments, this should be taken into account of previous regulations 1992 (2013)

The Management of Health and Safety at Work Regulations 1999

This regulation imposes a duty on every employer to make a suitable and sufficient assessment of

A - The risk to Health and Safety of his employees to which they are exposed whilst at work (in this quality if air fire safety).

B – The risks to Health and Safety of persons not in his employment arising out of or in connection with the conduct by him of his undertaking (visitors or contractors working in his environment)

C – Regulation 1992 (update 2013) ACOP Para 52, states mechanical ventilation systems (including air-conditioning systems) should be regularly and adequately cleaned they should also be properly tested and maintained to ensure that they are kept clean and free from anything which may contaminate the air.

In addition to the regulations mentioned above, there are a raft of guidance documents which should be considered. To mention a few:-

BS EN15780:2011, BS EN12236, HSGV 132, BS9999, RFRO 2005 & HG 202

A full list of guidance documents see **Appendix 1 Page 118.**

The Construction (Design and Management) Regulations 2015 (CDM)

CDM Regulations L 153 guidance produced by the HSE.

- It looks at the law that applies under CDM 2015 to the whole construction process for all construction projects, from concept to completion. In addition it details what each dutyholder must or should do to comply with the law to ensure projects are carried out in a way that secures health and safety.
- It considers all the different duty holders including clients, domestic clients, designers, principal designers, principal contractors, contractors, workers to ensure construction health and safety through risk management, correct appointment, supervision, instruction and training, communication, cooperation and coordinating and consultation. The aim is the avoidance of risk via prevention.
- Regulation 5 the appointment of the principle designer and the importance of doing this before the construction phase.
- Construction planning, the need for a health and safety file, responsibility for notification and considerations for domestic clients are also reviewed.
- Regulation 8 looks at General duties and requirements for anyone working on a project with certain responsibilities. It is of note that a designer /principal designer "*MUST have the skills, knowledge and expertise necessary to fulfil the role they are appointed to undertake, in a manner that secures the health and safety of any person affected by the project.*"
- Section 63 states that designers and contractors "must be able to demonstrate they have the health and safety skills, knowledge and experience to carry out the work for which they are seeking appointment."
- Further sections look at the duties of a designer including consideration of environmental impact under paragraph 83.
- Paragraph 86. Requires the designer to consider the risks to people "once it is constructed", 86a. quotes the example "can air conditioning plant on a roof be moved to ground level, so work at height is not required for either installation or maintenance?"
- **Paragraph 112 requires the principal contractor to ensure anyone they appoint has the "skills, knowledge and experience to carry out the work in a way that secures health and safety".**
- Further sections include worker involvement, effective worker involvement, phase planning, contractor duties, planning, managing and monitoring construction work.
- **Appointing and employing workers Section 163 "Sole reliance should not be placed on industry certification cards or similar being presented to them as evidence that a worker has the right qualities. Nationally recognised qualifications (such as National Vocational Qualifications (NVQs) and Scottish Vocational Qualifications (SVQs)) can provide contractors with assurance that the holder has the skills, knowledge, training and experience to carry out the task(s) for which they are appointed. Contractors should recognize that training on its own is not enough. Newly trained individuals need to be supervised and given the opportunity to gain positive experience of working in a range of conditions."**

Note: This is a highly detailed document and the above is a very brief summary of some important aspects that potentially could relate to ductwork installation and cleaning.
Please refer to full document.

APPENDIX 5
CONSTRAINTS RESOLUTIONS TO ACCESS AND IMPLICATIONS

CONSTRAINTS TO ACCESS	CONSIDERED RESOLUTIONS (AT THE TIME OF WRITING)	IMPLICATIONS
Duct located behind a solid ceiling with no point of access	Inspection hatches placed into the ceiling which expose the duct at intervals in accordance with industry accepted standards.	COST AND INACCESSIBILITY POSSIBLE DAMAGE
Duct located in a surrounded riser with no point of access. For example, a riser surrounded by wall fabric / brickwork	Inspection hatches fitted into the wall space which expose the duct at intervals in accordance with industry accepted standards. Alternatively locate duct elsewhere.	INACCESSIBILITY
Low level plant, conduit, lighting or other fittings obscuring the duct	Relocate the low-level plant so that the ductwork is accessible.	COST AND INACCESSIBILITY
External riser	Consider internal filtration systems to allow the systems to discharge at low level If there is no alternative consider permanent or temporary access solutions.	COST/UNAUTHORSED ACCESS TO SCAFFOLDING
Pitched roof exhaust	Where possible lower the discharge point or consider internal access to the exhaust.	COST
Horizontally obscured duct. Reasons include other services running alongside, above or below	Services should not be fitted to ductwork or in such close proximity that they obscure access to the duct. Ideally locate elsewhere. Room for access to duct in accordance with industry accepted standards must be maintained. Please see notes below.	COST AND INACCESSIBILITY
False/tiled/suspended ceilings restricting access to void and duct	The distance between ductwork and ceiling grid should be kept to a minimum to reduce the need for working at height. Please see notes below. Design considerations should include larger ceiling tiles to allow person entry without the need for dismantling.	COST POSSIBLE DAMAGE
Fan access	Design should negate the need for an electrician or engineer for cleaning. Access should be afforded via access panels or a plug fan that is easily removed. Ideally fan power should be plug-in.	COST & INACCESSIBILITY

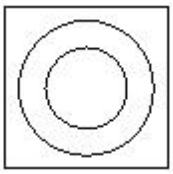
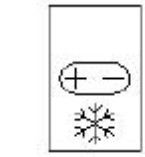
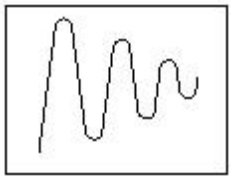
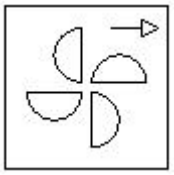
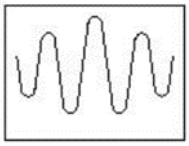
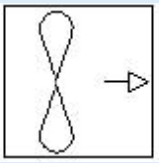
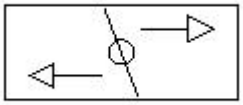
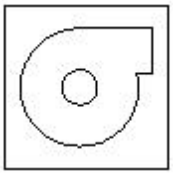
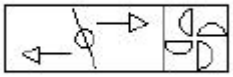
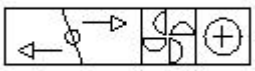
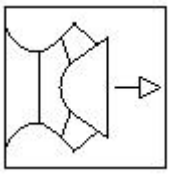
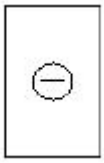
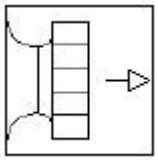
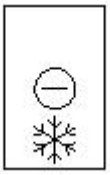
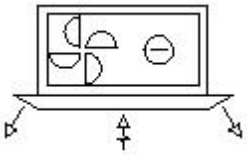
CONSTRAINTS TO ACCESS	CONSIDERED RESOLUTIONS (AT THE TIME OF WRITING)	IMPLICATIONS
Two or more inline components located directly next to each other in a duct system	No two inline components should be fitted next to each other without a suitable cleaning access point. Fan and silencers to have an access panel fitted between them in accordance with industry accepted standards.	COST AND INACCESSIBILITY
Silencer / fire rated duct / insulation/ Suppression systems	Must be designed and fitted with suitable access panels in accordance with industry accepted standards at the time of installation to ensure full access to the system. Designer and installer responsibility.	INACCESSIBILITY
Obscured access panels	Sufficient room must be afforded to allow for the fitting, complete removal of panels and entry for cleaning. Checks at various phases of construction that all access panels can be removed.	INACCESSIBILITY
Flat roof access without edge protection	Considerations to include safety rails, try to keep duct 2 meters from edges or fall hazards.	UNSAFE ACCESS
Welded or riveted exhaust grills preventing easy removal	Release clips or screws to be used instead of rivets.	INACCESSIBILITY
Duct located directly over hoods or canopies which does not support weight for operatives to safely access for cleaning	Safe ductwork, access must be provided.	INACCESSIBILITY, POSSIBLE UNSAFE ACCESS AND COST.
Open ceiling height	Keep the system as low as possible and discharge horizontally if possible.	COST
Data trunking / cabling physically restricting access	Do not run cabling systems alongside, above or below the grease extract ductwork.	INACCESSIBILITY POSSIBLE DAMAGE
Physical obstructions below the duct	Where access is required to ducts kitchen equipment should be easily moveable or duct should be relocated away from items.	INACCESSIBILITY AND COST

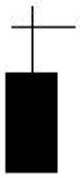
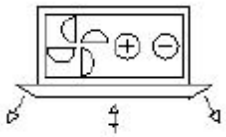
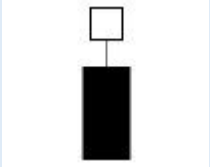
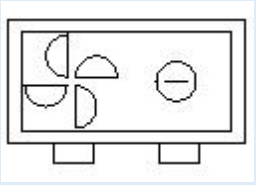
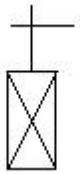
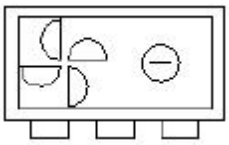
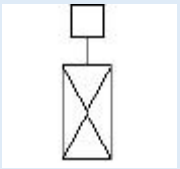
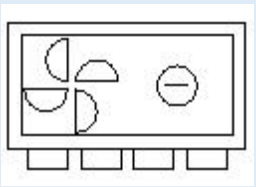
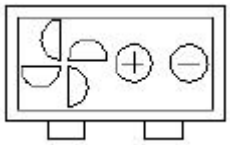
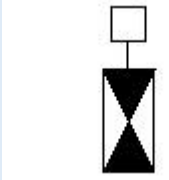
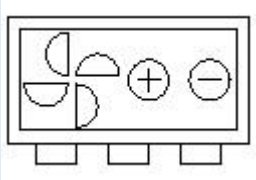
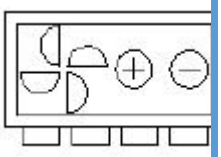
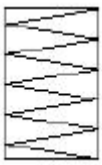
APPENDIX 6
DIFFERENT GUIDANCE DOCUMENTS FOR RELEVANT BUILDING TYPE

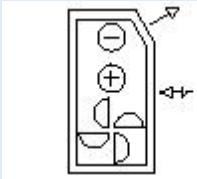
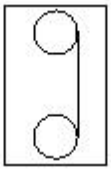
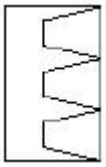
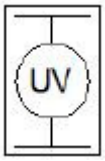
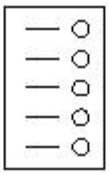
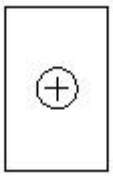
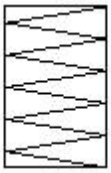
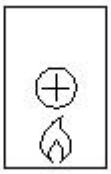
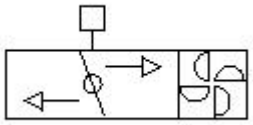
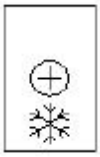
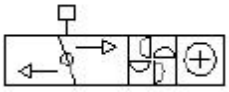
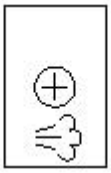
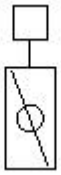
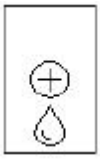
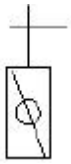
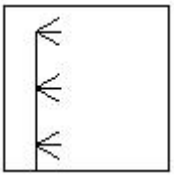
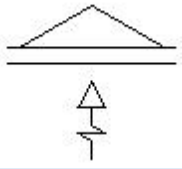
VENTILATION FOR BUILDINGS OTHER THAN OFFICES	
BUILDING/SPACE/ACTIVITY	**REGULATIONS AND GUIDANCE**
Animal husbandry	The Welfare of Farm Animals (England) Regulations SI 2000 No. 1870 London: The Stationery Office 2000. The Welfare of Farm Animals (England) (Amendment) Regulations SI 2002No.1646 The Welfare of Farm Animals (England) (Amendment) Regulations SI 2003 No.299 BS 5502:2003+A1:2013 *Buildings and Structures for Agriculture* See also CIBSE Guide B:2005, Section 2.3.24.1, and CIBSE AM10:2005 if naturally ventilated
Assembly halls	CIBSE guide B:2005, Section 2.3.3 CIBSE AM10 :2005 if naturally ventilated CIBSE AM13:2000 if mixed mode
Atria	CIBSE Guide B:2005, Section 2.3.4 CIBSE AM10:2005 if naturally ventilated CIBSE AM13:2000 if mixed mode
Broadcasting studios	CIBSE Guide B:2005, Section 2.3.5
Building services plant rooms	Provision for emergency ventilation to control dispersal of contaminating gas releases (e.g. refrigerant leak) is given to paragraphs 23 to 25 of HSE Guidance Note 202 *General Ventilation in the Workplace – Guidance for Employers.* *Other guidance is in BS 4434:1989 Specification for safety aspects in the design, construction and installation of refrigeration and appliances and systems*
Call centers	CIBSE guide B :2005, Section 2.3.24.2 CIBSE AM10 :2005 if naturally ventilated CIBSE AM13:2000 if mixed mode
Catering (inc. commercial kitchens)	HSE Catering Information Sheet No. 10, 2000: *Ventilation of kitchens in catering establishments* HSE Information Sheet No.11, 2000: *The main health and safety law applicable to catering* See also CIBSE Guide B:2005, Section 2.3.6, and HVCA DW/172 *Specification for Kitchen Ventilation Systems* EC 852:2004 FSA
Clean rooms	CIBSE Guide B:2005, Section 2.3.7 ISO 14644-1:2015 Cleanrooms and Associated Controlled Environments. Classification of Air Cleanliness by Particle Concentration
Common spaces	The following provisions apply to **common spaces** where large numbers of people are expected to gather, such as shopping malls and foyers. They do not apply to **common spaces** used solely or principally for circulation **Either:** a. natural ventilation by appropriately located **ventilation opening(s)** with a total opening area of at least 1/50th of the floor area of the **common space**; **or** b. mechanical ventilation installed to provide a supply of fresh air 1 litre per section per m^2 of floor area
Communal residential buildings	ES Energy Efficiency Best Practice in Housing, Good Practice Guide GPG 192: *Designing energy efficient multi-residential buildings* See also CIBSE Guide B:2005, Section 2.3.8, and CIBSE AM10:2005 if naturally ventilated or CIBSE AM13:2000 if mixed mode
Computer rooms	CIBSE Guide B 2005, Section 2.3.9 CIBSE AM10:2005 if naturally ventilated CIBSE AM13:2000 if mixed mode
Darkrooms (photographic)	CIBSE Guide B:2005, Section 2.3.24.4
Dealing rooms	CIBSE Guide B 2005, Section 2.3.24.5 CIBSE AM10:2005 if naturally ventilated CIBSE AM13:2000 if mixed mode

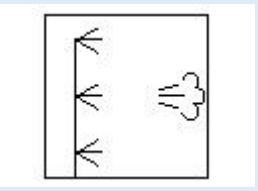
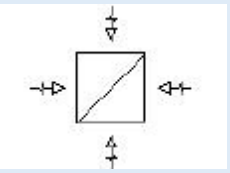
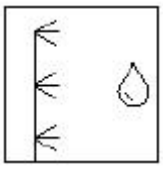
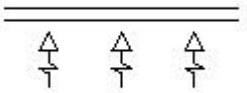
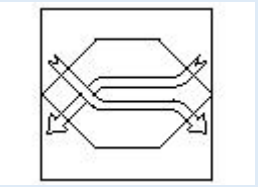
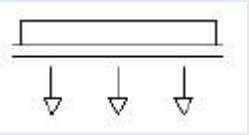
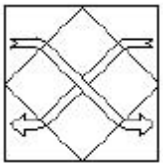
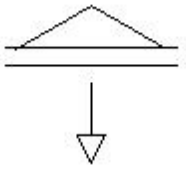
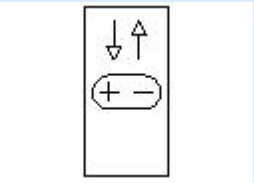
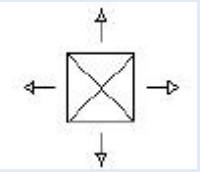
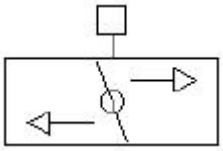
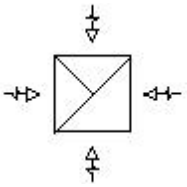
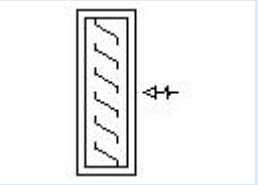
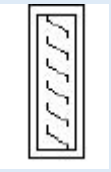
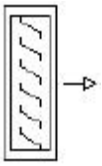
VENTILATION FOR BUILDINGS OTHER THAN OFFICES	
BUILDING/SPACE/ACTIVITY	**REGULATIONS AND GUIDANCE**
Factories and warehouses	Factories Act Health and Safety at Work etc. Act See also CIBSE Guide B:2005, Section 2.3.11, and CIBSE AM10:2005 if naturally ventilated or CIBSE AM13:2000 if mixed mode. Requirements are often exceeded by other criteria such as the ventilation requirements of the particular manufacturing process
High-rise (non-domestic buildings)	CIBSE Guide B:2005, Section 2.3.12, and CIBSE AM10:2005 if naturally ventilated or CIBSE AM13:2000 if mixed mode
Horticulture	CIBSE Guide B:2005, Section 2.3.24.6 CIBSE AM10:2005 if naturally ventilated CIBSE AM13:2000 if mixed mode
Hospitals and healthcare buildings	NHS Activity database Health Technical Memorandum (HTM) 03 Health Building Notes (HBC) – various CIBSE Guide B:2005, Section 2.3.13, and CIBSE AM10:2005 if naturally ventilated or CIBSE AM13:2000 if mixed mode
Hotels	CIBSE Guide B:2005, Section 2.3.24.6 CIBSE AM10:2005 if naturally ventilated CIBSE AM13:2000 if mixed mode
Industrial ventilation	*Industrial ventilation*, 24th Edition, *Manual of recommended practice*, American Conference of Government Industrial Hygienists HS(G) 37 *An introduction to local exhaust ventilation* HS(G) 54 *Maintenance, examination and testing of local exhaust ventilation* HS(G) 193 *COSHH essentials*
Laboratories	CIBSE Guide B:2005, Section 2.3.16
Museum, libraries and art galleries	BS 5454:2000 CIBSE Guide B:2005, Section 2.3.24.6 CIBSE AM10:2005 if naturally ventilated CIBSE AM13:2000 if mixed mode
Plant rooms	CIBSE Guide B:2005, Section 2.3.18
Prison cells	Refer to National Offender Management Service (NOMS). Home Office, NOMS Property, Technical Services, Room 401, Abell House, John Islip St., London, SW1P 4LH
Sanitary accommodation	Same as for offices in Table 2.1a
Schools and educational buildings	Ventilation provisions in schools can be made to comply with the guidance in Building Bulletin 101, *Ventilation of School Buildings* and in the Education (School Premises) Regulations. Building Bulletin 101 can also be used as a guide to the ventilation required in other educational buildings, such as further educational establishments, where the accommodation is similar to that in schools e.g. sixth form accommodation . However, the standards may not be appropriate for particular areas where more hazardous activities take place than are normally found in schools, e.g. some practical and vocational activities that require containment or fume extraction. Building Bulletin 101 can also be used for children's centers and other early years settings, including day nurseries, playgroups etc.
Shops and retail premises	CIBSE Guide B:2005, Section 2.3.24.6 CIBSE AM10:2005 if naturally ventilated CIBSE AM13:2000 if mixed mode
Sports centers (inc. swimming pools)	Sport England – Sports Halls Design and Layouts: Updated and combined guidance (2012) CIBSE Guide B:2005, Section 2.3.21
Standard rooms	CIBSE Guide B:2005, Section 2.3.24.7
Transportation buildings and facilities	CIBSE Guide B:2005, Section 2.3.24.6 CIBSE AM10:2005 if naturally ventilated CIBSE AM13:2000 if mixed mode

APPENDIX 7
SCHEMATIC ABBREVIATIONS SYMBOLS FOR SCHEMATIC DRAWINGS

Product	Abbreviations	Symbol	Product	Abbreviations	Symbol
Access Panel	AP		DX Coil		
Attenuator	Att		Fan - Generic		
Attenuator – Cross Talk	Att		Fan – Axial		
Constant Air Volume Box	CAV		Fan – Centrifugal		
Constant Air Volume Box – Fan	CAV		Fan – Cross Flow		
Constant Air Volume Box – Fan & Reheat	CAV		Fan – Mixed Flow		
Cooling Coil	CC		Fan – Plenum		
Cooling Coil –Refrigerant	CC		Fan Coil Unit – Cassette – 2 Pip	FCU	

Product	Abbreviations	Symbol	Product	Abbreviations	Symbol
Cooling Coil - Water	CC		Fan Coil Unit – Cassette – 2 Pipe – Refri-gerant	FCU	
Damper – Fire – Manual	FD		Fan Coil Unit – Cassette – 4 Pipe	FCU	
Damper – Fire – Motor	FD		Fan Coil Unit – Ceiling – 2 Pipe Outlet	FCU	
Damper – Smoke Manual	SD		Fan Coil Unit – Ceiling – 2 Pipe – 3 Outlet	FCU	
Damper – Smoke – Motor	SD		Fan Coil Unit – Ceiling – 2 Pipe – 4 Outlet	FCU	
Damper – Smoke and Fire – Manual	SFD		Fan Coil Unit – Ceiling – 4 Pipe – 2 Outlet	FCU	
Damper – Smoke and Fire – Motor	SFD		Fan Coil Unit – Ceiling – 4 Pipe – 3 Outlet	FCU	
Fan Coil Unit – Ceiling – 4 Pipe – 4 Out-let	FCU		Filter – Panel	FP	

Product	Abbreviations	Symbol	Product	Abbreviations	Symbol
Fan Coil Unit – Floor – 4 Pipe	FCU		Filter – Scroll		
Filter – Bag			Filter – UV		
Filter – Electrostatic Precipitation			Heating Coil	HC	
Filter – HEPA High Efficiency Particulate Absorbing filter	HEPA		Heating Coil – Electric	HC	
Heating Coil – Gas	HC		Variable Air Volume Box – Fan	VAV	
Heating Coil – Refrigerant	HC		Variable Air Volume Box Fan & Reheat	VAV	
Heating Coil – Steam	HC		Volume Con-trol Damper – Motor Control	VCD	
Heating Coil – Water	HC		Volume Control Damper – Manual Control	VCD	
Humidifier	HUM		Ceiling Grille – Return	RG	

Product	Abbreviations	Symbol	Product	Abbreviations	Symbol
Humidifier – Steam	HUM		Ceiling Grille – Return – Plan	RG	
Humidifier – Water	HUM		Ceiling Slot – Return	RG	
Plate Heat Exchanger – Counter Flow	PHE		Ceiling Slot – Plenum – Supply	SG	
Plate Heat Exchanger – Cross Flow	PHE		Ceiling Grille – Supply	SG	
Run-around Coil			Ceiling Grille – Supply – Plan	SG	
Variable Air Volume Box	VAV		Ceiling Grille – Exhaust – Plan	EG	
External Louvre – Air In	EL		External Louvre EL	EL	
External Louvre – Exhaust	EL				

Acknowledgements

NAADUK would like to acknowledge the following organisations and companies without whose help our standard could not have been compiled:

- British Standards Institute
- CIBSE
- The ASFP
- BRE
- ADCAS
- The London Fire Brigade
- NHS
- Health and Safety Executive HSE
- The FPA
- Eurovent European Industry Association
- Enviro Hygiene Specialists Ltd
- WYG Group
- Bellrock Group

NAADUK are grateful to CIBSE for permission to reproduce some tables along with their comments.

NOTES

NOTES

National Association of Air Duct Specialists UK

Registered Office:-

12a Flightway,
Dunkeswell,
Honiton,
Devon,
EX14 4RD

Tel: 01404 891539
www.naaduk.co.uk

Copyright ©

NAADUK Ltd 2021

Price: FOC

Email: admin@naaduk.co.uk

Printed in England by:
Besley & Copp Ltd., Exeter, Devon.
Tel: 01392 477137