Survey Report

Crystal Café
66 Mansfield Road
Hampstead

Kitchen ventilation and odour control

Douglas Price
CEng FCIBSE
Consulting Engineer and Surveyor

Project Management
Consult : Report : Design : Deliver : Manage

Douglas Price
Trees, Chestnut Avenue
Chichester
PO19 5QD
B: 01243 788534 mob: 07980 239227
doug@dpconsultants.co.uk

16.02.2012 – Rev 3

Item	Description	Action
		08.02.2012
1	I am instructed by Mr Hardesh Bhatti, London Borough of Camden, to inspect premises and supporting documentation to prepare a report upon the present and proposed kitchen ventilation installation, the subject of the complaints received for these premises	
2	My instructions are to give a non intrusive independent opinion on the extract ventilation installation and on the operation of the proposed kitchen ventilation system, and advice upon what is necessary to comply with Environmental control requirements.	
	SURVEY REPORT AND OBSERVATIONS	
3	On the morning of 17th January 2012 I visited to survey the premises and to meet the restaurant owner and officers from London Borough of Camden and get an understanding of the ventilation system and the size, plant and workings of the premise.	
4	The kitchen is a room at the rear of the premises and accessed directly from the shop front, through the café area where customers enter to order and collect food or consume food on the premises from an extensive menu.	
5	Main cooking is carried out with two gas ranges with six rings and ovens, a Tandori type oven and a deep fat fryer. Other appliances, including refrigerator and microwaves are installed in the kitchen.	
6	The kitchen to customer service area is ever open and will allow air movement between the 'front shop cafe' and into the kitchen.	
7	Over the cooking range a nominal 4000mm long x 1000mm deep angled canopy is fitted and suspended beneath the ceiling, with the extract air plenum behind.	

Item	Description	Action
8	Five stainless steel baffle filters are fitted in the canopy plenum through which the extract air is drawn. The baffles collect air borne solids and grease particles. These serve as the first stage of essential filtration incorporated and is required for odour control.	
9	A separate retro-fitted duct runs from the 'Tandori' type oven area of the canopy and runs along the font of the canopy, prior to connecting to the main extract duct and seems to be without baffle filters.	
10	Visual inspection of the baffles and extract ductwork and canopy within the kitchen showed it to be clean and well maintained.	
11	The extract duct then passes from the canopy to the internally located filter plant, powered by the centrifugal fan unit and exits the building through the roof of the kitchen. A short exposed section of ductwork then connects to an attenuator, discharges at ground floor roof level to atmosphere through a sheet metal cone into a confined open area, but with taller overlooking buildings adjacent.	
12	The air handling unit reporting to contain filters was not accessible for our inspection.	
13	The air handling unit framework is in a narrow area off of the kitchen with very poor access for servicing, maintenance or routine checks.	
14	To maintain acceptable kitchen exhaust conditions filter cell assemblies will be necessary to work in conjunction with the canopy first stage baffle filters. These need to be checked and replaced on a regular basis and the current installation does not allow that to happen, due to the restricted access.	
15	From the information provided by the supplier, we have assessed that the existing extract fan (supplied in November 2010, type HEB 355, 5.5kw, 1450rpm, 4 pole, single phase, duty 2.6m3/s x 650pa) has sufficient power to move the necessary volume of air through the system with the resistance to air flow caused by the extended	

Item	Description	Action
	ductwork and both bag and carbon filters.	
16	We have been advised by the supplier that the existing filter set-up incorporates 6 – 600mm x 600mm x 300mm activated carbon cells, 4 – 600mm x 600mm x 100mm V Pleated Filters (F5) and 6 – 450mm x 600mm x 100mm Pleated bag filters (G4). Filters could not be checked on site due to access limitations.	
17	This filter installation should be suitable for controlling the odours and smoke emission from this kitchen and the complaints received are consistent with the inappropriate discharge position to atmosphere provided and the lack of maintenance and care of the filter installation due to inappropriate plant location and access and the difficulties this imposes.	
18	An Inverter type fan speed controller has been retrofitted and this large unit is mounted beneath the canopy above the cooking ranges. The inverter is to provide a choice of fan speed and will also, by reducing the fan speed, reduce the noise emission from the fan.	
19	Reports of vibration and noise from the fan are consistent with method of installation and structure born transmission contact without isolation, but this could not be checked on site due to access limitations.	
20	Reports of odour emission from plant are consistent with proximity of ventilation discharge into contained external area and with overseeing surrounding windows and doors and lack of maintenance to filters due to access problems.	

Current Planning Application

21 The current planning application changes the method for odour and smoke control currently installed.

22 The proposed system allows removal of all the plant and equipment supplied in November 2010 and to replace with a new, less powerful fan, two attenuators, two small Ozone generators and an extended ductwork shaft run externally to discharge the kitchen exhaust above the main roof level.

23 Following my review of this proposal, I list below briefly the problems that are apparent from the planning submission and information currently provided to me.

24 My observations are as follows, based upon planning application drawing 0879/P/1H by Archipek submitted:

- The discharge details on the drawing are inconsistent
- Method of grease and odour control inadequate
- Access to ductwork for maintenance difficult
- Duct sizes are inadequate for air flow volumes listed within acoustic report
- Duct sizes, for same air flow, range from 400 x 250mm to 550 x 250mm to 400 x 400mm giving duct velocities from 20m/s to 14.6m/s to 12.5m/s (DEFRA recommends 6-9m/s) based upon air flow figure quoted in acoustic report.
- Plant configuration shown is totally incorrect and unworkable
- Attenuators are incorrectly shown in series and separated from fan
- Fan and attenuators are without grease protection
- Air flow entry to fan poorly arranged
- Fan cannot be maintained as located on drawing
- Plasma ozone units are incorrectly shown in series and in line with air flow and should be used with ESP or activated carbon filtration
- As shown, the system is totally inappropriate and unworkable
- No fresh air makeup to kitchen shown to replace that extracted

25 The system offered will fail to meet odour and smoke control requirements and provides for an engineering system that is completely inoperable.

26 The design of the discharge stack is crucial for the correct operation of the system and to disperse the extracted air from the kitchen safely away from the window openings in walls and roofs and clear of other potential recipients. In this planned installation the discharge location is good, being well above the ridge of the main roof and a good distance from the windows mounted in the roof of the adjacent buildings. So with the correct discharge velocity from the stack, design of the terminal and regular maintenance of the filtration equipment no further odour problems should be received.

27 The size of the discharge stack shown of the drawings is inadequate to maintain adequate air flows, based upon the size of the canopy served and the cooking equipment currently in operation. A minimum extract air volume of 1.7m3/sec is required and maintaining a stack velocity of 6m/sec a duct of 0.28m2 csa is required. That equates to a duct size of 560mm x 500mm or 600mm diameter. The duct size shown on the planning drawing is 550mm x 250mm (0.137m2) for the main riser, with 400mm x 400mm (0.16m2) below and 450mm x 250mm (0.112m2) above. All about half the size they need to be.

Recommended Application

28 Due to the restricted nature of the site a solution for a satisfactory kitchen extract system will be a compromise. Access and maintenance are key factors in achieving a long term solution for such an installation. To develop this, a design solution will need to be carefully planned and detailed to achieve necessary access and the ability to install with minimum downtime for the kitchen operation with the limitations imposed by lack of space.

29 The concept of the current equipment installed is appropriate for the installation but has been configured without adequate consideration and planning. The method of low level discharge for the kitchen extract is totally inappropriate for this location.

30 Based upon the observations made during and following my survey and from the calculations carried out subsequently to confirm what should be installed to comply with the odour control from these premises, the following outline description is provided.

31 The installations, kitchen side, including the extract hood, baffles up to the internal ductwork are acceptable, accessible for cleaning and maintenance and no remedial work is necessary to these at this stage.

32 Provision for fresh air makeup into the kitchen to replace that air extracted and to maintain temperature and humidity within the kitchen area should be incorporated using a mixture of air drawn from the customer area and with the balance from a powered input from a fresh air inlet fan.

33 It is recommended therefore that:

- the existing fan is reused complete with Inverter but rearranged into a new design where better access is provided
- install fan with anti vibration mounts and flexible ductwork connections to prevent structural borne transmission
- check existing fan attenuators and replace if necessary

- the existing method of filtration is maintained to provide second and third stage removal of odours and grease and with sufficient dwell time for odours to be adequately absorbed prior to passing into the discharge system
- the filters are installed into a new cabinet designed for the limited space available and arranged for ease of filter renewal and checking
- the discharge ductwork is installed with constant area to maintain air velocities throughout its length with coned discharge 1000mm above the ridge tiles of the main roof level

34 Cooking produces smells which are welcomed in the kitchen and many encourage customers to purchase at the premises. However, as a waste product they are usually unwelcome to people living or working nearby.

35 The proposed works will set the ventilation system to work and effectively control the odour nuisance.

36 System should be checked for cleaning ductwork internally and access panels provided to allow such periodic work to be undertaken.

37 A maintenance and cleaning register and log book system should be set up with records, receipts and proof that work required has been carried out and filters replaced at appropriate recommended intervals.

38 The design of the discharge stack is crucial for the correct operation of the system and to disperse the extract air safely away from the window openings in walls and roofs and other potential recipients. In this planned installation the discharge location is good, being well above the ridge of the main roof and a good distance from the windows mounted in the roof of the adjacent buildings. So with the correct discharge velocity from the stack, design of the terminal and regular maintenance of the filtration equipment no further odour problems should be received.

39 The size of the discharge stack shown of the drawings is inadequate to maintain adequate air flows, based upon the size of the canopy served and the cooking equipment currently in operation. A minimum extract air volume of 1.7m3/sec is required and maintaining a stack velocity of 6m/sec a duct of 0.28m2 csa is required. That equates to a duct size of 560mm x 500mm or 600mm diameter. The duct size shown on the planning drawing is 550mm x 250mm (0.137m2) for the main riser, with 400mm x 400mm (0.16m2) below and 450mm x 250mm (0.112m2) above. All about half the size they need to be.

40 **Examples of best stack design considerations**

- Inadequate height of the discharge stack is one of the main reasons the emissions from a kitchen gives rise to odour nuisance. The stack design is paramount to achieving good dispersion.
- Good stack dispersion requires:
    - The effective stack height (discharge height plus plume rise) must be high enough to ensure that adequate dilution takes place before the plume interacts with a receptor.
    - Discharge velocity influences the plume rise and therefore the effective stack height. The effective stack height can be estimated from: ⊗H = 3W.d/U where,
        W (m/s) is the efflux speed at the chimney top
        U (m/s) is the wind speed at the height of the stack
        d (m) is the internal diameter of the stack
      Ideally W/U should be greater than 4.
      If W/V is less than 1.5, then down wash will occur resulting in a reduced effective stack height.
    - The discharge to be outside the wake of nearby buildings. Discharging ventilation air below a roof ridge may result in excessive entrainment within building down wash. In certain situations, the use of high velocity discharge systems can force the discharging plume out of the building wake.
    - The flow to be unimpeded. Cowls can increase the static pressure, noise, potential down draught and risk of re-entry of the exhaust back into the building.
      Alternative stack terminals are available and include:
      Terminals without integral drains e.g. reducing cone
      Solid top and
      Terminals with integral drains e.g. open top cone and drain, induction types and sleeve type.
    - Straight and vertical discharge.

Guidance on stack requirements for commercial kitchens varies between Local Authorities. The range of guidance issued by Local Authorities is summarised below:

- Guidance on the minimum stack height ranges from:
- 1 m above the eaves of the premises and/or above any dormer window;
- 1 m above ridge height of any building within 15 m; and
- Low level discharge should be avoided.

The height of external ground level should be taken into account when setting stack height. This is particularly important on rising ground where houses may be located above the discharge.

- A stack should be positioned to be as far as possible from the nearest residential accommodation.

A stack discharging into a semi-enclosed area such as a courtyard or the area between back additions should be avoided.

- Use of Chinaman's hats or other cowls is not recommended.
- The prevailing wind direction should also be considered in the ducting positioning.
- The ducting should be rigid in construction and resiliently mounted.
- Large section ducts may need bracing or stiffeners to prevent drumming.

In certain instances restriction on stack height might arise, for example:

- Where an A3 premises is a listed building and a visible stack is prohibited;
- Where an A3 premises is located within a conservation area and a visible stack is prohibited; and
- Operators of the A3 premises do not have legal right to attach a stack to upper floors of building.

Summary of grease and odour mitigation measures		
Grease filters	Filters are easy to clean and Maintain	Performance rapidly decline if not regularly maintained and cleaned
Carbon adsorption	High efficiency up to 95% under optimum conditions Moderate operating costs Relatively low capital cost Simple design	Filter blockage requires regular replacement Efficiency decreases with use Not effective against particulate components Temperature of input must be below 40$_{o}$C Sensitive to high moisture above 75%RH Constant and detailed maintenance required
In-line Ozone and UV systems	Minimal pressure drop Effective	Requires pre-filtration High capital cost Dilution and dispersion of residual necessary high energy usage Long residence time required
Odour counteraction and neutralisation	Minimal pressure drop Minimal maintenance	Requires pre-filtration High capital cost Dilution and dispersion of residual necessary Efficacy for aromatic cooking
Stack dispersion	Low capital and running costs Good dilution possible	May require tall structure to reach ridge or above

41 **COST ESTIMATE FOR WORK NECESSARY TO COMPLY**

Budget costs have been calculated and the following figures are provided to give an indication of likely costs involved in achieving the recommended works.

These prices to be tested against prices to be obtained from suppliers and contractors in due course once detailed working drawings are prepared to determine the works.

ACT Carbon Filters	£ 2,000
AB20 Bag Filters	£ 250
Reuse Existing Extract Fan	£ 200
Reuse Speed Controller	£ 100
New Filter Unit Casing	£ 2,500
Internal Ductwork/modifications	£ 600
Discharge ductwork to roof 17m(?)	£ 4,500
Scaffolding allowance	£ 2,500
Electrical wiring	£ 200
Removal of existing	£ 250
Installation of filter unit casing	£ 850
Fabrication Drawings	£ 650
Deliveries/Travelling/fuel allowance	£ 200
Commissioning	£ 150
Certificates	£ 200
	£ 15,150

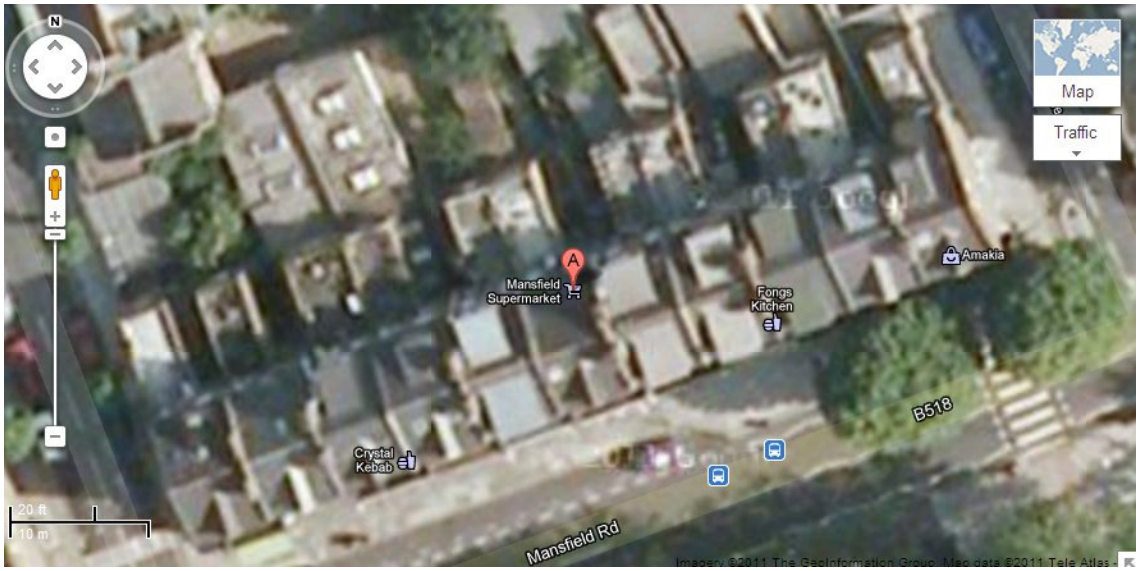
VAT: to be added as appropriate.

Total budget allowance of £15-£18,000 should be included for this work, plus associated VAT. Subject to provision of drawings and to be tested by contractors prices.

ADENDUM

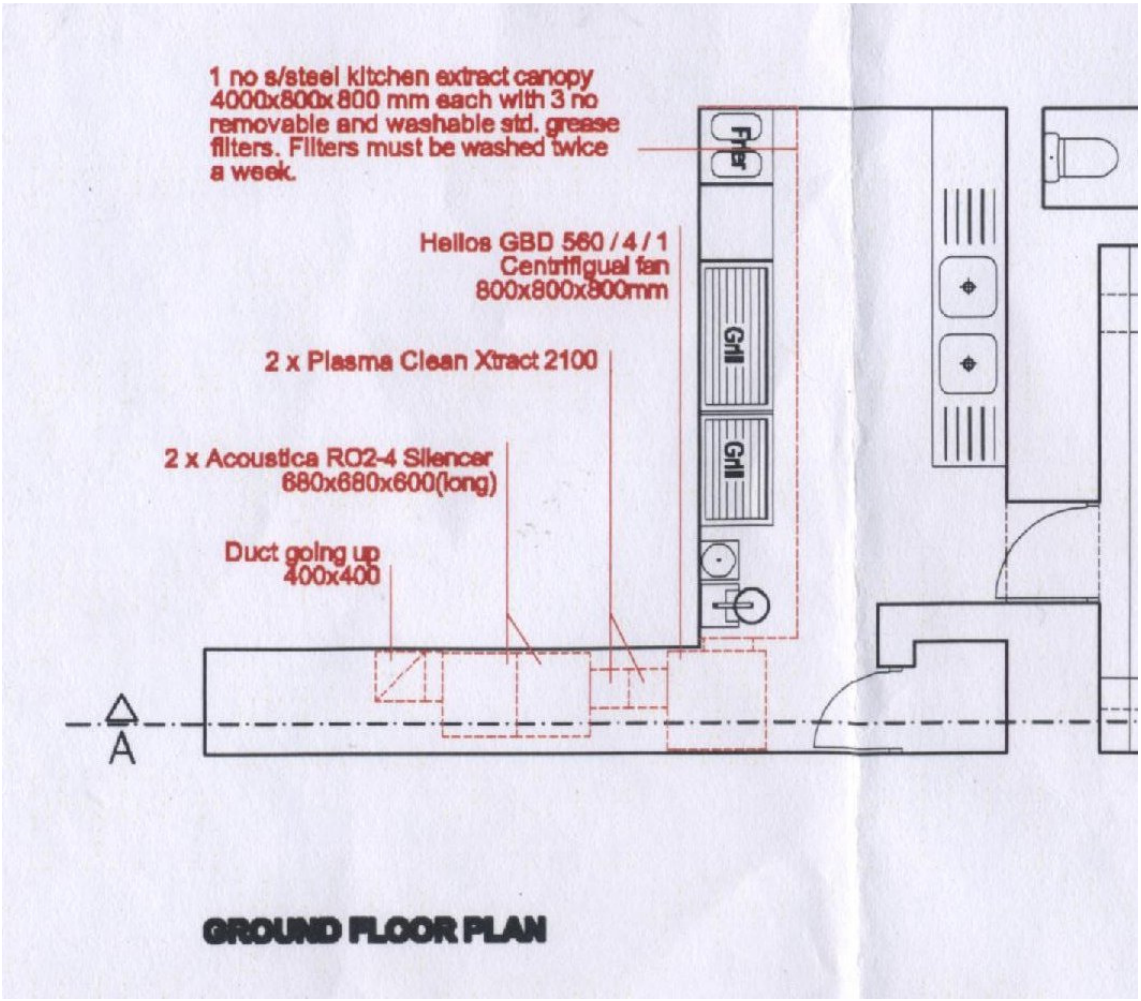
42 The following information is provided as an addendum and based upon planning application drawings received and survey notes obtained.

CRYSTAL CAFÉ - CAMDEN



Crystal café shop front elevations, street scene and Google site plans.

CRYSTAL CAFÉ – Designers Drawings 1

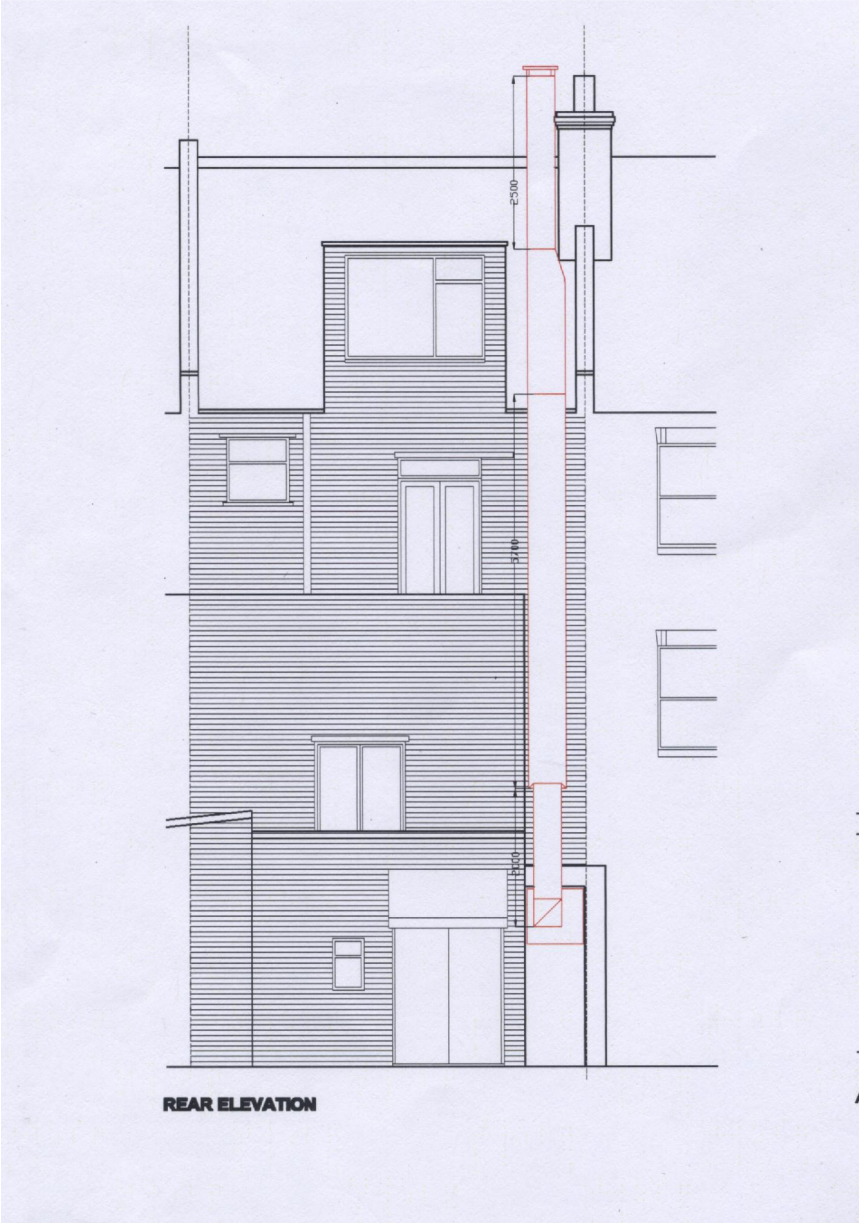


KITCHEN AREA – Showing proposed plant arrangement

NOTE: the plant configuration as shown is incorrect – fan and attenuators should be adjacent and protected from air borne grease and solids by filters. The proposed Plasma units are shown in series with all of the extract air going through these units. This is totally incorrect and will not work. These units are designed to attach to the wall adjacent to the kitchen canopy. The outlet is then connected into the kitchen canopy or ductwork and hardwired into mains electricity (230V / single phase / 50Hz) via the main fan control.

The Xtract 2100 normally injects ozone directly into the kitchen canopy, maximising the dwell time for the ozone to take effect. They should be used with UV, ESP units or activated carbon filters but space restrictions prohibit this.

CRYSTAL CAFÉ – Designers Drawings 2

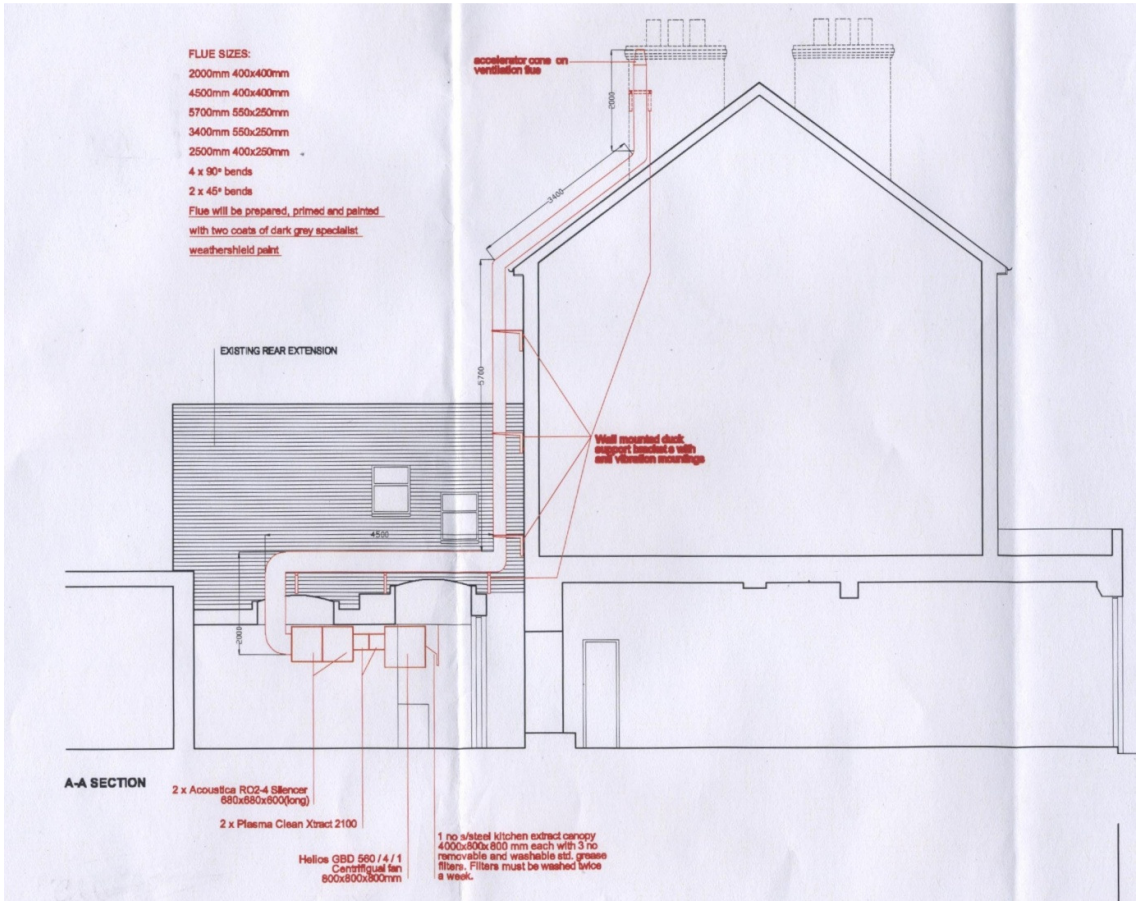


REAR ELEVATION – Showing proposed plant and discharge ductwork

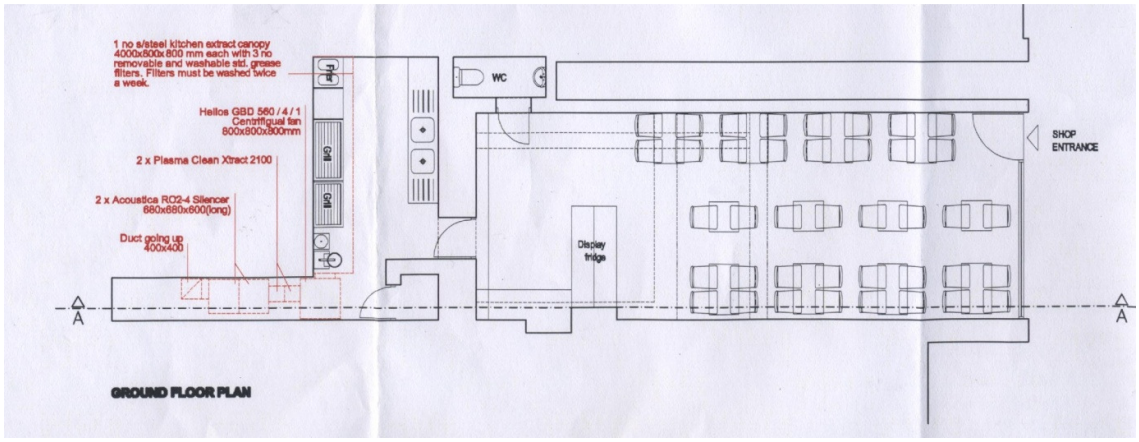
NOTE: The discharge shows a straight duct discharge with weather plate above. But the elevation on the Section drawing shows a tapered cone discharge with no weather protection.

Aesthetically the ductwork raises great concern and from a maintenance point of view, where all ductwork has to be cleaned on a regular basis, the installation is impossible to maintain.

CRYSTAL CAFÉ – Designers Drawings 3



SECTION - of proposed plant and exhaust duct riser



PLAN - of proposed ground floor works

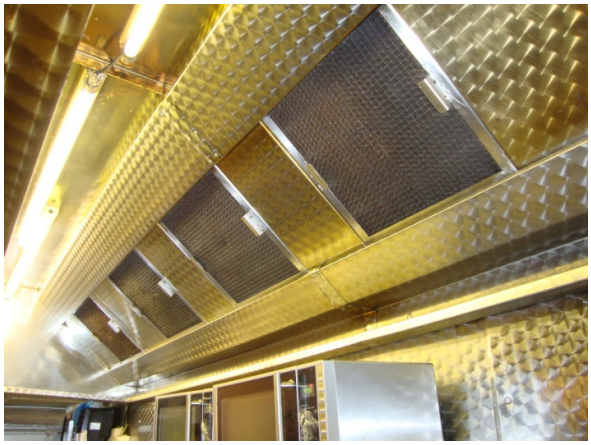
NOTE: the plant configuration as shown on both of these drawings is incorrect. The fan and attenuators should be adjacent to each other and protected from air borne grease and solids by filters. The proposed Plasma units are shown in series with all extract air going through these units. This is totally incorrect and will not work. These units are designed to attach to the wall adjacent to

the kitchen canopy. The outlet is then connected into the kitchen canopy or ductwork and hardwired into mains electricity (230V / single phase / 50Hz) via the main fan control.

The Plasma units induce oxidation using ozone and activated oxygen ions used to treat odour emissions from commercial and industrial kitchen processes (DEFRA, 2005: Guidance on the Control of Odour and Noise from Commercial Kitchen Exhaust Systems).

The Plasma Clean Xtract injects ozone into the kitchen extraction canopy where it reacts with odour, grease and smoke. These are oxidized in a chemical reaction which results in the production of carbon dioxide and water vapour. The ozone itself is consumed during the process and is converted back into oxygen. They should be used with ESP units or carbon filters.

Photographs showing present internal fit-out of kitchen and canopy.



Space is very tight and access to existing plant is so difficult, involving disconnection of ductwork to approach filter cabinet panels which need to be unbolted and filters removed to allow crawl space through the cabinet to reach extract fan. We could not access fan and filters during our non intrusive survey.