

# Acoustic Report

Environmental Noise Impact Assessment  
British Standard 4142:1997

Sheridan Court,  
47 - 49 Belsize Court,  
London,  
NW6 4RY.



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## **1. INTRODUCTION.**

### **1.1. Instruction.**

KR Associates (UK) Ltd have been instructed by Tesco Stores Ltd to undertake an assessment in line with the requirements of British Standard 4142:1997 [reference 1] on the likelihood of complaints from the development at Sheridan Court, 47 - 49 Belsize Court, London, NW6 4RY in terms of plant and delivery noise only.

### **1.2. Confidentiality.**

This report is strictly confidential and is written without prejudice. This report may only be disseminated by the relevant departments within Tesco Stores Ltd, the appointed and approved contractors of Tesco Stores, and the relevant departments of the Local Authority with jurisdiction over the site under investigation.

### **1.3. Competence.**

In line with the requirements of British Standard 4142:1997 [reference 1] the author of this report holds a Masters of Science Degree in Acoustics and Noise Control and has been practicing as a noise consultant for more than 5 years and holds full corporate membership of the Institute of Acoustics. It is considered by KR Associates (UK) Ltd that the internal procedures have been followed in the writing of this report and that the author has taken a reasonable duty of care. This report is submitted by KR Associates (UK) Ltd and therefore any comments or criticisms regarding the content of the report should be addressed to the company and not the individual author.

### **1.4. Scope of Report.**

This report details the impact on the local amenity in terms of noise with specific reference to the following elements of the proposed development:

Noise from the operation of the refrigeration and air conditioning noise.

Noise from the associated deliveries to the site.



## **2. SUMMARY**

### **2.1. Refrigeration and Air Conditioning Noise**

#### **2.1.1. Noise Impact**

The installation of refrigeration and air conditioning units will not have a detrimental effect on the local amenity in terms of noise if the equipment meets the specified noise criteria. It should be noted that the criteria have been calculated based on equipment that is likely to be installed and is commercially available and suitable for installation at this type of site.

#### **2.1.2. Noise Criteria**

Refrigeration Units: Sound Power Level -  $L_{eq,8 \text{ hour}}$  56 dB (ref.  $1 \times 10^{-12}$  watts)

Air Conditioning Units: Sound Power Level -  $L_{eq,8 \text{ hour}}$  62 dB (ref.  $1 \times 10^{-12}$  watts)

#### **2.1.3. Conditions**

It is the opinion of KR Associates that no planning conditions need to be considered with respect to the refrigeration units assuming the units meet the specified noise criteria. However, KR Associates would consider it appropriate to limit the operation of the air conditioning units so they only operate between 06:30 and 23:30 hours.

### **2.2. Delivery Noise**

#### **2.2.1. Noise Impact**

The delivery of goods to the site will not have a detrimental effect on the local amenity in terms of noise assuming the specific conditions are met.

#### **2.2.2. Conditions**

It is the opinion of KR Associates that deliveries should be undertaken between 06:00 and 23:00 hours Mondays to Fridays and between 07:00 and 22:00 hours Saturdays, Sundays and Bank Holidays. It would be recommended that as far as possible large refrigerated deliveries are undertaken within suitable periods of the day. Deliveries should not be undertaken at night.

### **2.3. Other Information**

#### **2.3.1. Layout of Site**

Clarification should be sort as to the distance between the refrigeration / air conditioning source and the nearest residential property. (Currently assumed to be 10m)



### **3. REFRIGERATION / AIR CONDITIONING**

The impact on the local amenity in terms of noise from the installation of the refrigeration and air conditioning units to support the operation of the proposed development are assessed strictly in accordance with British Standard 4142:1997 [reference 1].

#### **3.1. Scope.**

3.1.1. With reference to the guidance within section 10 of British Standard 4142 [reference 1]; the following information is reported to enable an assessment of the likelihood of complaints from the specific source under investigation. The external refrigeration and air conditioning condenser units are considered to be of an industrial nature and will be located within commercial premises and within the vicinity of residential properties.

#### **3.1.2. Background and Specific Noise Levels.**

Though in this case the background noise level and the specific noise level at the assessment position are unlikely to comply with the requirements of note 1 of section 1 in British Standard 4142 [reference 1] and are therefore considered 'very low' the assessment undertaken is considered to be appropriate in this case.

#### **3.1.3. Definitions and Symbols.**

To ensure clarity and understanding details of the quantities and symbols used within the assessment are included for reference in Appendix B. These definitions are inline with the descriptions contained within section 3 of British Standard 4142 [reference 1].

#### **3.1.4. Source.**

For clarity this British Standard 4142 [reference 1] assessment is undertaken on the likely installation of external refrigeration and air conditioning units as part of the development of the site at Swiss Cottage Exp and that meet the specified criteria.



### **3.2. Source Under Investigation.**

British Standard 4142 – Section 10.a.

#### **3.2.1. Description of Source.**

Refrigeration Units and Air Conditioning Units

It has not been decided yet what type of units are to be installed at this site. However, this assessment is based on the units meeting the requirements of the maximum levels detailed below and assuming the following operational requirements are required.

Refrigeration Units: Between 80 – 100 kW Total Heat Rejection

Air Conditioning Units: Cooling and heating to sales floor of around 2000 sq. ft.

#### **3.2.2. Proposed Hours of Operation.**

Refrigeration Units

Due to the duty requirements of the internal evaporators and the need to keep the stock at specific temperatures 24 hours a day the external refrigeration units will operate 24 hours a day 7 days a week. However, due to the underlying ambient temperature the units will only operate at maximum when the ambient temperature exceeds 32°C which is only likely to occur during a few mid day periods within the summer months. It should be noted that due to the lower ambient temperatures during the night time it is not possible for the units operate normally under full load.

Air Conditioning Units

The proposed unit will not be required to operate 24 hours per days and so for the purposes of this assessment it has been assumed they will operate between hours of 07:00 and 23:00 hours.



### 3.2.3. Proposed Mode of Operation.

#### Refrigeration Units

The units will operate on demand from the store evaporators within the fridges / freezers mounted on the sales floor. The multi compressors are designed to provide ever increasing duty by turning on in stages. The condenser fans are controlled simultaneously from a head pressure fan speed controller. The unit will only operate under full load conditions when the ambient temperature is above 30oC. Therefore at night the unit is unlikely under normal night time ambient temperatures to operate above 30£ capacity. The combined refrigeration units are likely to be of an enclosed nature within an appropriate acoustic housing or of a low noise type.

#### Air Conditioning Units

The air conditioning units only provide cooling / heating during the store opening hours and therefore the units are timed not to operate between the hours of 23:00 and 07:00 hours. During the day the units will cycle on and off when the internal AC cassette units demands an AC load and will only operate continuously in very high or very low ambient conditions.

### 3.2.4. Description of Premises.

#### Building

The store is located within a three storey detached building constructed with a pre cast concrete frame under a flat roof. The building is 'L' shaped and sits at the junction of Belsize Road and Hilgrove Road. The express will be located within the vacant ground floor area.

#### Local Area

The area is predominantly within a residential area 200m north of South Hampstead Station and railway line. There is a parade of shops and cafes to the north of the site on the opposite side of the roundabout.

#### Noise Sensitive Properties

The nearest residential properties to the proposed source position are located generally at the side of the store.

### **3.3. Subjective Impressions.**

British Standard 4142 – Section 10.b.

#### **2.3.1. Dominance or Audibility.**

From the experience of the installation of this type of refrigeration units and air conditioning units at similar sites and the observations made during the recent survey it is predicted that the units will be perceivable at the assessment position but not audible or distinct. Due to the operational nature of the proposed refrigeration and air conditioning units and the likelihood that full design ambient temperatures of 32°C will not be reached between 23:00 and 07:00 hours, it is unlikely that the units will ever be the dominant source at the assessment position.

#### **2.3.2. Main Sources of Residual Noise.**

The residual noise levels were influenced mainly by a combination of local traffic and pedestrian movement around the site. After approximately 01:30 the residual noise levels were effected by distant traffic noise.



### **3.4. Measurement Location.**

British Standard 4142 – Section 10.c.

#### **3.4.1. Location, Topography.**

Position 1.

Noise levels were recorded at the front of the store in order to ascertain the underlying background noise level at the assessment position.

Assessment Position.

The assessment position is located 1m from the residential property located generally at the side of the store on the opposite side of Loundon Road. The ground between the proposed source location and the assessment position is mainly concrete.. There is likely to be a direct line of site between the assessment position and the proposed specific source location.

#### **3.4.2. Measurements.**

Noise levels were recorded at position 1 using the equipment detailed in section 3.5. mounted on a standard tripod such that the microphone top was 1.35m above the average ground level complying with the requirements of Note 1 in section 5.3 of British Standard 4142 [reference 1].

### 3.4.3. Precautions Against Interference.

#### Wind over the Microphone.

The measurements described within section 2.7.1. indicated that there was unlikely to be interference from wind passing over the diaphragm of the instruments microphone.

#### Heavy Rain.

The measurements described within section 2.7.3. indicated that there was unlikely to be interference from heavy rain falling on the microphone windshield or surrounding surfaces.

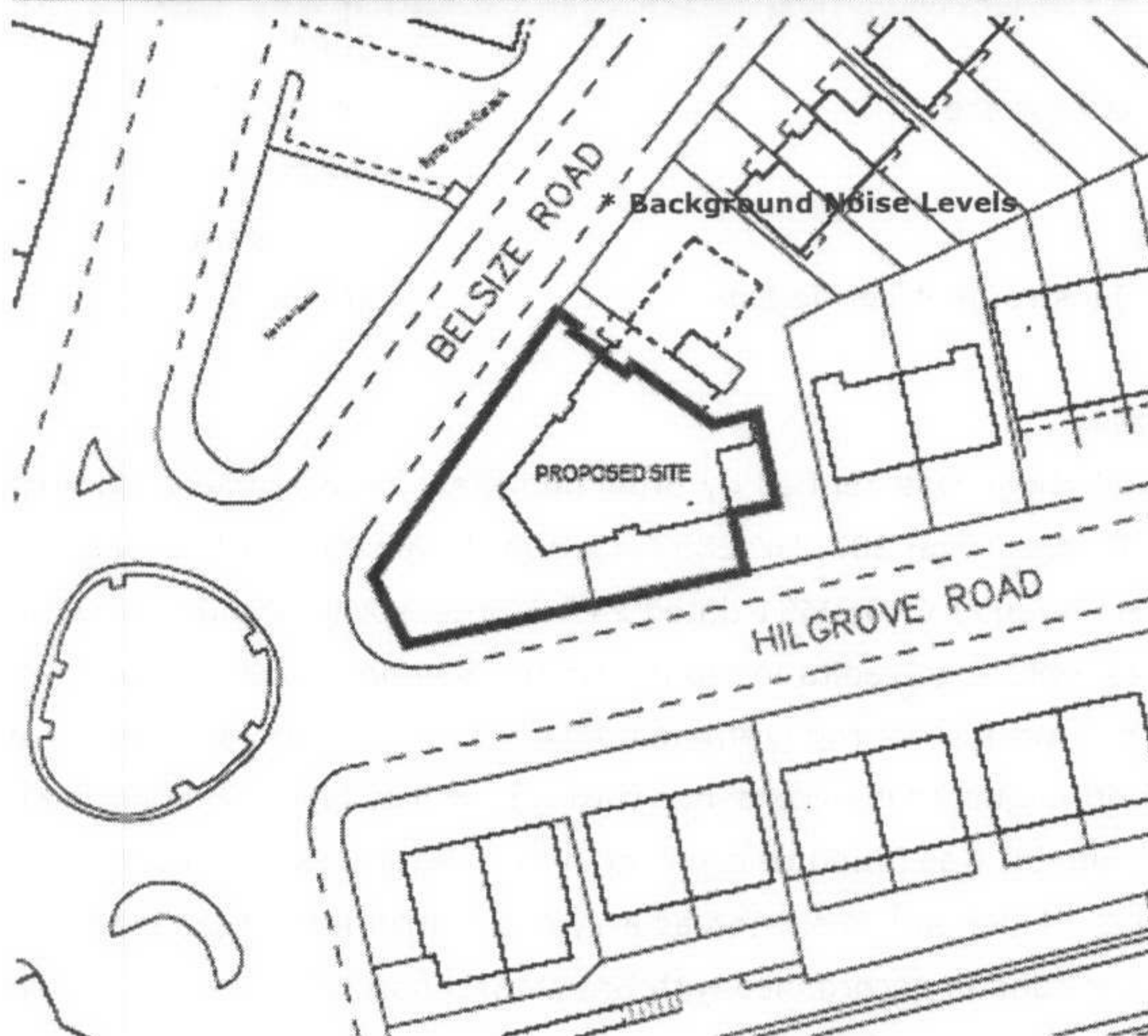
#### Electrical.

Observations and the operational tests detailed within section 2.6. indicated that there was unlikely to be any interference from the presence of electrical or electromagnetic sources.

The measurements undertaken were considered valid as the contribution from the above interferences and the weather conditions detailed in section 7. as they were at least 10 dB below the sound pressure levels being recorded and therefore complies with the requirements of section 5.4 of British Standard 4142 [reference 1].



3.4.4. Location Sketch.





### **3.5. Measurement Instrument.**

British Standard 4142 – Section 10.d.

#### **3.5.1. Type.**

Precision real time noise analyzer:	2250
Preamplifier:	ZC 0032
Half inch condenser microphone:	4189
Foam windshield:	UA 1650
10m Extension Cable:	AO 0442
Associated calibrator / instrument verification:	4231

#### **3.5.2. Manufacturer.**

All of the measurement equipment is manufactured by Bruel and Kjaer who are located in Naerum, Denmark.

#### **3.5.3. Serial Numbers.**

Precision real time noise analyzer:	2479672
Preamplifier:	3004
Half inch condenser microphone:	2470299
Foam windshield:	None Required
10m Extension Cable:	AO 0442 03/05
Associated calibrator / instrument verification:	2463714

#### **3.5.4. Verification Test Details.**

The equipment detailed above was verified by Bruel and Kjaer Laboratories (Laboratory Registration 307) of Skodsborgvej 307, DK 2850 Naerum, Denmark which issued a certificate of calibration number CA050491 dated 24<sup>th</sup> February 2005 complying with the requirements of the laboratory accreditation of the United Kingdom Accreditation Service (UKAS) and meeting the more strict requirements of Danak. The equipment was tested and its overall sensitivity adjusted in accordance with clause 5 of British Standard 7580 - Part 1:1987. The equipment was found to conform in full with the requirements of British Standard 7580 – Part 1 : 1997 and was rated as a Type 1 instrument. For reference the self generated noise recorded in accordance with British Standard 7580 – Part 1 : 1997, sub clause 5.5.2. was found to be 12dB(A).



### **3.6. Operational Test.**

British Standard 4142 – Section 10.e.

#### **2.6.1. Reference Level.**

Before and after the measurements were undertaken on 21st September 2006 the associated calibrator detailed in section 2.5. above was applied to the equipment and in line with the calibrators accreditation a level of 94.3 dB at 1000 Hz was applied to the measurement equipment.

#### **2.6.2. Meter Reading.**

The equipment detailed above was set to calibration mode and the corresponding readings at the 1000 Hz 1/3<sup>rd</sup> octave band centre frequency were noted before and after the measurements were undertaken on site.

Before measurements were undertaken: 94.3 dB.

After measurements were undertaken: 94.3 dB.

Therefore in accordance with British Standard 7580 Part 1 : 1997 the measurement equipment was considered to an appropriate level of confidence for Type 1 instrumentation. The associated calibrator conforms to the requirements of British Standard 7189 : 1989.

### **3.7. Weather Conditions.**

British Standard 4142 – Section 10.f.

#### **3.7.1. Wind Speed and Direction.**

The wind direction was mainly from the south. and  $0.6 \text{ ms}^{-1}$ . Measurements of the wind speed and direction using a Kestral 4000 Weather Tracker indicated that on average over the measurement periods. It should be noted that the weather equipment is not calibrated and so the confidence of the measurements is unknown. However, it should be noted that neither British Standard 4142 [reference 1] or British Standard 7445 require the weather conditions to be measured by a calibrated or traceable instrument.

#### **3.7.2. Temperature Inversion.**

Observations were made during the measurements to quantify the possibility of conditions that would likely lead to temperature inversion which could under certain conditions adversely affect the accuracy of the results. However, inline with the Concawe determination of Pasquill stability categories it is not possible to categorize the meteorological conditions when measurements are made under 100m from a source as the effects are minimal and well below the confidence limits of the measurement equipment. Though the measurements were taken on a fairly calm and still night temperature inversion was not considered to have effected the measurements taken. For reference the ambient temperature during the measurement periods was  $10^{\circ}\text{C}$ .

#### **3.7.3. Precipitation.**

The roads were generally dry. The skies were clear.

#### **3.7.4. Fog.**

During the measurement period there did not appear to be any cloud or fog with a relative humidity reading from the Kestral 4000 Weather Tracker of 48 % RH.



3.7.5. British Standard 7445.

Though not required by British Standard 4142 [reference 1] it was considered appropriate to measure the barometric pressure as required under section 6.2. sub section (a) of British Standard 7445 – Part 1 : 1991. The average barometric pressure during all the measurements was found to be using the Kestral 4000 Weather Tracker 1018 mBar.

3.7.6. Weather Conditions.

Observations on site indicate that the above weather conditions did not significantly alter during any of the measurements and therefore in line with section 5.5 of British Standard 4142 [reference 1] all weather conditions have been recorded during all noise measurements.

3.7.7. The measurements undertaken were considered valid as the contribution from the above weather conditions were at least 10 dB below the sound pressure levels being recorded and therefore complies with the requirements of section 5.4 of British Standard 4142 [reference 1].

**3.8. Date and Time of Measurements.**

British Standard 4142 – Section 10.g.

**3.8.1. Date and Time of Measurements.**

The measurements were undertaken 21st September 2006 on between 00:01 and 04:00 hours.



### 3.9. Specific Noise Levels.

British Standard 4142 – Section 10.h.

#### 3.8.1. Specific Noise Criteria

The following criteria will ensure a satisfactory assessment and is based on the expected noise emissions from the refrigeration and air conditioning equipment once they have been selected.

Table 1 –Criteria for refrigeration units

A-Weighted	Octave Band Center Frequency (Hz)						
	63	125	250	500	1000	2000	4000
56	57	61	60	53	47	46	42
Sound Power Level - $L_{eq,5 \text{ Min}}$ (dB) re $1 \times 10^{-12}$ watts							

Table 2 – Criteria for air conditioning units

A-Weighted	Octave Band Center Frequency (Hz)						
	63	125	250	500	1000	2000	4000
62	67	68	64	59	55	51	49
Sound Power Level - $L_{eq,5 \text{ Min}}$ (dB) re $1 \times 10^{-12}$ watts							

#### 3.8.2. Residual Noise Levels.

The residual noise levels were recorded at position 1 as detailed in section 2.4. and are summarized within the tables 3 and 4 below.

Table 3 – Residual Broad Band Levels.

Time Period	Environmental Levels						
	$L_{Aeq,5 \text{ Min}}$	$L_{eq,5 \text{ Min}}$	$L_{Amax,5 \text{ Min}}$	$L_{Amin,5 \text{ Min}}$	$L_{A90,5 \text{ Min}}$	$L_{A50,5 \text{ Min}}$	$L_{A10,5 \text{ Min}}$
00:00 – 01:00	55	76	78	53	48	58	66
01:00 – 02:00	52	66	76	49	44	52	65
02:00 – 03:00	51	67	70	45	41	51	59
03:00 – 04:00	50	64	74	43	41	48	55
Sound Pressure Level (dB) re $2 \times 10^{-5} \text{ Nm}^{-2}$							



Table 4 – Residual Frequency Levels.

Time Period	Octave Band Center Frequency (Hz)						
	63	125	250	500	1000	2000	4000
00:00 – 01:00	76	58	59	46	46	41	43
01:00 – 02:00	65	59	57	49	42	42	38
02:00 – 03:00	67	58	53	45	45	43	36
03:00 – 04:00	62	59	51	45	45	40	38
Sound Pressure Level - $L_{eq,5 Min}$ (dB) re $2 \times 10^{-5} \text{ Nm}^{-2}$							

### 3.9.1. Specific Noise Levels.

With consideration to the guidance within British Standard 4142 [reference 1] the specific noise level at the assessment position detailed in section 2.4 is calculated by applying appropriate corrections details of which are contained within section 3.9.5.

#### Night Time – 23:00 to 07:00

The specific noise level at the assessment position was calculated as found to be  $L_{Aeq,5min}$  22 dB with reference to an absolute level of  $2 \times 10^{-5} \text{ Nm}^{-2}$  as a result of the normal operation of the refrigeration units that are likely to be installed under normal ambient conditions.

#### Day Time – 07:00 to 23:00

The specific noise level at the assessment position was calculated as found to be  $L_{Aeq,1hour}$  32 dB with reference to an absolute level of  $2 \times 10^{-5} \text{ Nm}^{-2}$  as a result of the normal operation of the refrigeration and air conditioning units that are likely to be installed under normal ambient conditions.

### 3.9.2. Justifications of Methods.

#### Specific Noise Level.

The specific noise level is calculated from the manufacturers data supplied to KR Associates (UK) Ltd. The specific noise level at the assessment position was calculated in accordance with the guidance of section 6.3.5. of British Standard 4142 [reference 1]. Reference is also made to the scope of British Standard 4142 which allows assessments of calculated noise levels at the assessment position when specific sources have yet to be installed.



Residual Noise Level.

The residual noise level was recorded at position 1 and as the specific source has yet to be installed.

3.9.3. Details of Corrections.

Distance Correction.

The assessment position is located approximately 10m from the centre of the proposed position for the installation of the external refrigeration and air conditioning units.

Night Time Combined Sound Power Levels (Refrigeration equipment under normal load)	52 dB
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Day Time Combined Sound Power Levels (Refrigeration and air conditioning equipment Both under normal load)	62dB
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Correction for distance of 10 m (No barrier correction has been assumed)	20 dB
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Directivity of Source (The source is to be positioned against 1 reflective surfaces_	3 dB
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Correction for Sound Pressure Levels	-11 dB
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Barrier Correction.

At this time no barrier correction has been allowed for as it form part of the safety margin for the risk associated with noise on the operation of this site.

### **3.10. Measurement Time Intervals.**

British Standard 4142 – Section 10.i.

#### **3.10.1. Measurement Time Intervals.**

Measurements of the background noise levels were taken over a continuous 5 minute period and encompassed all other sources. No on-time correction is made as the units are designed to work under full load with an ambient temperature of 32 °C which is very likely to exist for any 5 minute period between the hours of 23:00 and 07:00. The manufacturer's data is considered to have included all temporal and level variations of the specific source.



**3.11. Reference Time Interval(s).**

British Standard 4142 – Section 10.j.

**3.11.1. Reference Time Interval(s).**

The reference time interval as described in section 6.2 of British Standard 4142:1997 was set at 5 minutes as the assessments are undertaken within the 'Night Time' period. 'Night Time' was considered between the hours of 23:00 and 07:00 in line with the guidance within note 1 of section 6.2 of British Standard 4142 [reference 1] and the current European Union guidelines on community noise.