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Project:	M&S - Buxton			
Client:	Simons Group Ltd			
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Contents

1.0 Introduction

Marks & Spencer propose to carry out a refurbishment of certain plant items associated with the existing Marks & Spencer retail premises situated within Buxton Town centre.

The works are to include the introduction of replacement ventilation and air-conditioning plant to be installed externally upon the roof and in view of this Paragon Acoustic Consultants Ltd has been appointed to undertake an environmental noise survey to obtain statistical noise data to characterise the existing local background and ambient noise climate at the site.

The data gained from the survey will be used to provide a specification of limiting noise levels to assist with the selection and procurement of suitable mechanical plant items to ensure that appropriate environmental noise levels are maintained.

The measurements and assessment of noise limits contained within this report will include the principles and recommendations contained within the following documents.

- BS 4142:1997 “Method for rating industrial noise affecting mixed industrial and residential areas”.
- BS 8233:1999 “Sound insulation and noise reduction for buildings”

For the purpose of assessment, the proposed new air-conditioning and ventilation plant shall be considered on the basis of operation during the stores opening hours only, i.e. operational period extending from 08:30 hours until 18:00 hours.

2.0 Site Description

The Marks & Spencer Store adjoins a shopping mall known as Spring Gardens Shopping Centre within Buxton town centre. The building boundaries of significance are described in further detail in the following section, and should be read in conjunction with the site layout details provided in Appendix A:

The front of the store looks out to the south towards “Spring Gardens” a pedestrianised shopping street, the view of which is completely interrupted due to the presence of the stores staff (domestic) block that rises some 3 metres above the main roof and other two and three storey adjacent premises.

Some distance to the west and north can be seen the continuation of the flat roofing to the Spring Gardens Shopping mall, the dominant element of which is associated with the Waitrose Supermarket. Numerous plant items including refrigeration and air-conditioning equipment were mounted upon the roof of this store. Furthermore, significant noise emissions from this plant and particularly from a large plantroom ventilation louvre situated at ground level within the east facing wall was also noted.

Extending some distance to the east of the store is situated a large public car park that provides some 450 spaces. The shopping centre and car-park is bounded to the north and east by Station Road which provides a major access through the town.

The noise sensitive premises of significance are identified as follows;

- 2nd Floor flat above Chippy'sPlaice.
- 3 storey residential accommodation to the rear of Miltons Head Inn PH.

The above premises are located some 12 metres to the south of the store's roof edge immediately to the south of Wye Street, and within direct line-of-sight from the position of the proposed new AHU exists, although this is not the case for the A/C units which occupy a sheltered position.

3.0 Existing Noise Climate

3.1 Road Traffic

The local noise climate heard at the primary noise monitoring position was largely influenced by contributions from vehicular movements along Station Road to the north and Terrace Road to the west.

3.2 Rail Traffic

Occasional noise emissions associated with rail movements along the nearby commuter railway line some 300 metres to the north were observed at the monitoring position identified in Section 4.1. The noise contribution upon the measurement results due to these events however were thought to be minimal.

3.3 Aircraft

Occasional high altitude aircraft overflights were observed during the monitoring period. Their contribution to the overall noise climate is included within the measurement results.

3.4 Mechanical Noise Sources

The noise monitoring position close to residential receptors identified to the south / east of the store was influenced by the emissions from existing 3rd party plant. In view of this it was decided to select an alternative position away from these emissions considered suitable for the purpose of obtaining representative noise data necessary for the assessment contained in this report.

4.0 Environmental Noise Survey

4.1 Measurements

The environmental noise survey was carried out generally in accordance with the principles and procedures set out within **BS 4142:1997** "Method for rating industrial noise affecting mixed industrial and residential areas".

The noise monitoring commenced on Tuesday 2nd August 2011 at approximately 14:00 hours and continued until approximately 18:00 hours, this being considered

likely to include the quietest environmental conditions during which the plant is proposed to operate. The measurements were made at the assessment locations described below.

- **MP1**: Within the car park off Wye Street.
- **MP2a**/**b**/**c**: Rooftop measurements made @ 1m/10m from the existing Refrigeration pack (obtained for record purposes only).
- **MP3**: Rooftop measurements made @ 1m from the existing Extract fan (obtained for record purposes only).

Representative measurements for the daytime period of plant operation were obtained using measurement time intervals T_m = 10 minutes for each reading, and which were considered sufficient to accurately represent the noise climate for each hour during which the readings were obtained during the day.

Various statistical broad-band and spectral sound pressure level measurements were obtained. The quantities recorded included:

- L_{Aeq}: the equivalent continuous noise level over the measurement period
- L_{Amax}: the maximum sound pressure level (Fast time-weighting)
- L_{A90}: the noise level exceeded for 90% of the measurement period

Measurements of the percentile level $L_{A90,T}$ were made using the sound level meter fast time constant (125ms), as per clause 3.10 of BS 4142:1997.

The weather conditions during the survey ranged from approximately 22-24 deg.C, overcast, dry, and generally still.

4.2 Instrumentation

Sound pressure level measurements were obtained using the following instrumentation complying with the Type 1 specification of IEC 60651, IEC 60804, IEC 61260 and IEC 61672:

- Norsonic Type 118 Sound level analyser, serial number 31322
- Norsonic Type 1225 ½" microphone

Calibration checks were made prior to and after completion of measurements using a Norsonic Type 1251 acoustical calibrator complying with Class 1 of IEC 942 (1988), calibration level 114.0 dB ± 0.3 dB, @ 1.0 kHz. All instrumentation carries current certification of conformance, copies of which can be provided upon request.

4.3 Results

The recorded statistical broad-band and spectral sound pressure levels were obtained at the positions indicated in 4.1 shown within Appendix A. The lowest representative day-time background noise level is summarised in Table 1.

Table 1: Lowest Background Sound Pressure Level Measurements

Measurement Position	Day time $L_{A90(08:30-18:00)}$
MP1	49 dB

5.0 Evaluation of External Noise Criteria

The local vicinity contains predominately commercial premises although residential dwellings are evident, both of which must be given due consideration in terms of acceptable levels of noise exposure from the new plant installation.

5.1 Residential Premises

The premises in proximity to the store include residential dwellings and these must be given particular consideration in terms of acceptable levels of noise exposure from the proposed fixed mechanical plant installation.

The method used to assess the effects of noise upon noise upon local residents is BS4142:1997 "Method for rating industrial noise affecting mixed residential and industrial areas", and which describes a method of rating the level of the noise of an industrial nature together with procedures for assessing whether the noise under investigation is likely to give rise to complaints from persons living in the vicinity. In general, the likelihood of complaint in response to a noise depends upon factors including the margin by which it exceeds the background noise datum level.

In general, a noise is likely to cause complaints when it exceeds the background by a certain margin. Thus;

- *a difference of around +10 dB or more indicates that complaints are likely*
- *a difference of around +5 dB is of marginal significance*
- if the rating level is more than 10 dB below the measured background noise level then this is a positive indication that complaints are unlikely

It has now become increasingly common for Local Authorities to adopt a strategy whereby future noise complaints from local residents are rendered of "marginal significance". In view of this a "Rating Level" shall be assigned to the project corresponding to 5dB below the lowest L_{A90} background noise level prevailing at the quietest time of the plant operational period and assessed at 1.0 metres perpendicular distance from the nearest exposed residential windows.

In acoustic terms, the implementation of the above would result in a theoretical 1 dB increase to the existing L_{A90} background noise level.

Rating level $L_{ArT} = L_{A90}$ - 5 dBA

5.2 Commercial Premises

It is also necessary to consider non-residential properties existing in the locality of the site. BS 8233:1999 "*Sound insulation and noise reduction for buildings*", recommends maxima for "Good" and "Reasonable" indoor ambient continuous noise levels, certain of which are reproduced as follows:

Area	Design range $L_{Aeq,T}$ dB	
	Good	Reasonable
Department Stores	50	55
Open Plan office	45	50
Restaurant	40-55	

In view of this it is reasonable to consider a noise criterion that is related immediately outside the windows of the affected premises and takes account of the internal design range. BS 8233:1999 indicates that any type of window in a façade when partially open will provide a weighted sound reduction index of 10-15 dB R_w. For the purposes of this assessment 10 dB is used as this is at the lower value of the range given in the Standard.

The following criteria are derived on the basis of maintaining "Good" / "Reasonable internal conditions":

Noise criteria external to **commercial office** premises = 55 dB $L_{Aeq,T}$
Noise criteria external to **retail** units = 60 dB $L_{Aeq,T}$
Noise criteria external to **restaurants** = 50 dB $L_{Aeq,T}$

6.0 Noise Limits

The derived external noise criteria to which the new building services plant shall be required to achieve are summarised in Table 2:

Table 2: Limiting Noise Criteria Applicable @ 1m From the Affected Premises

Plant location / noise source location	Direct line of sight between source & receiver	Minimum approximate receiver distance from plant	Nearest receptor	Daytime (08:30-18:00) L_{ArT}
New roof mounted AHU Unit (refer to Fig 1)	**Yes**	23m	South Milton Arms Inn (Residential area to rear of premises)	44dB
New roof mounted AC units installed upon lower roof level (refer to Fig 1)	**No**	32m	South/east Mr Chippy (Residential flat at rear of premises)	44dB

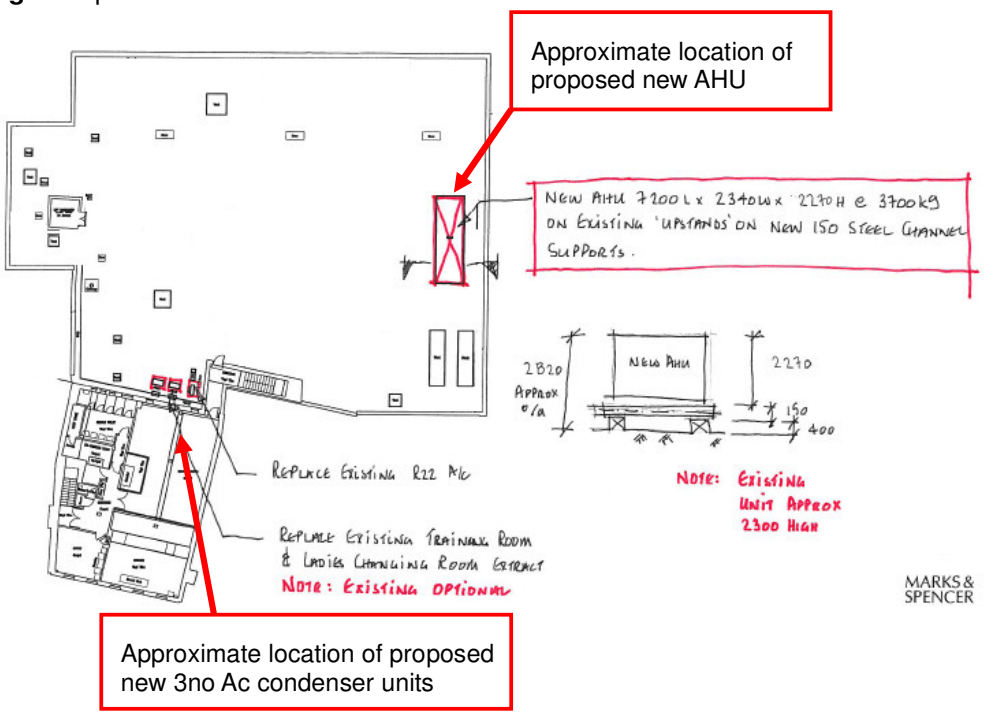
7.0 Plant Noise Specification

Calculations have been carried out to determine the limiting sound pressure levels required for each new plant item in order to achieve the design criteria stated in Table 2.

The limiting sound pressure levels given for the daytime period of operation are presented in the specification contained in Appendix C, and it is intended that this be used to encumber the manufacturers with the overall responsibility to provide plant that achieves the necessary acoustic requirements.

The precise location of new plant items has not yet been established, however, approximate positions are indicated in Fig 1 subject to final confirmation.

Fig 1 Proposed Roof Plant Location Plan



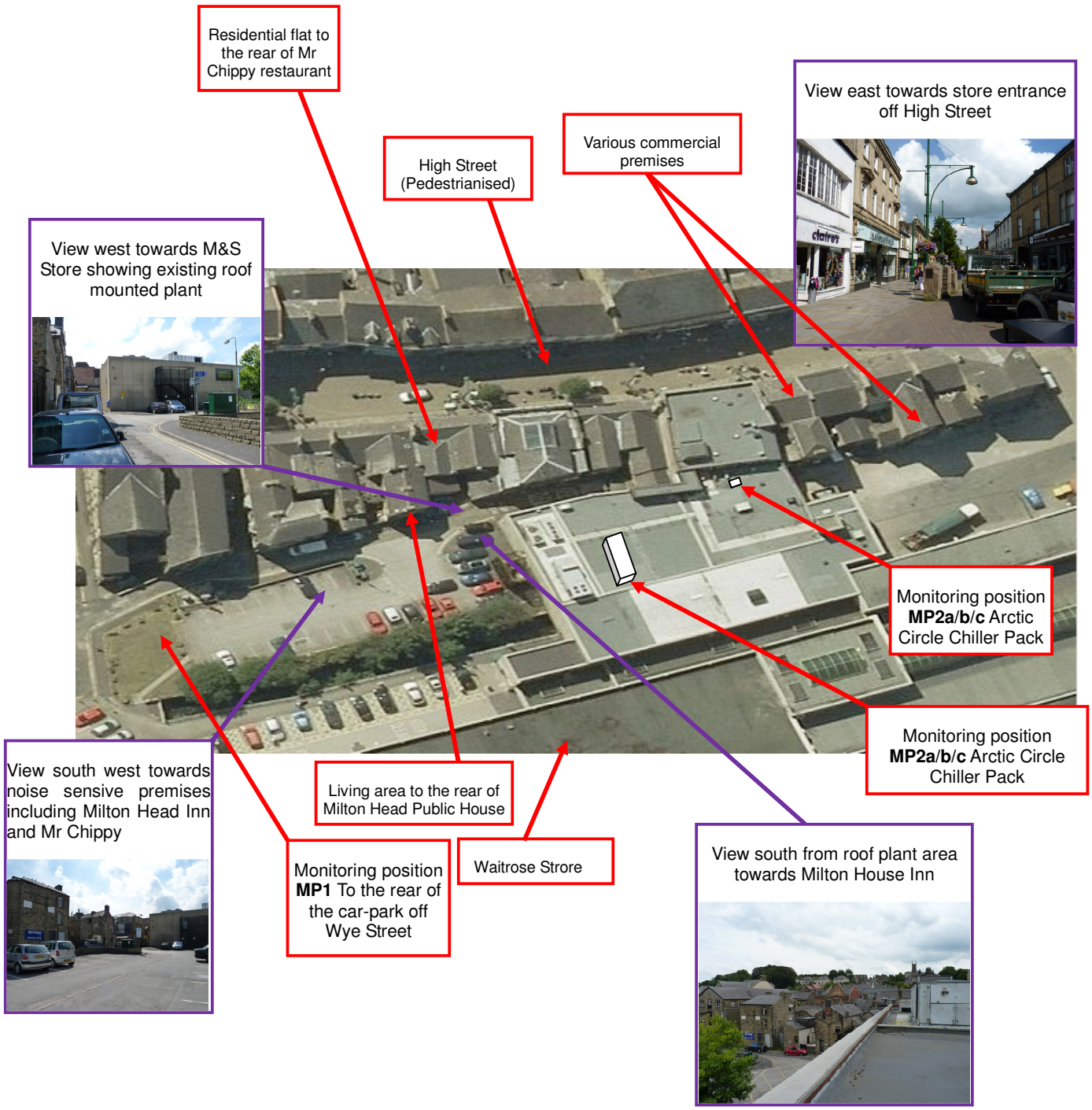
8.0 Conclusion

A background noise survey has been undertaken to determine the noise climate likely to exist proximal to noise sensitive premises in the vicinity of the Marks & Spencer store situated within Buxton Town centre where the installation of new ventilation and air-conditioning plant is proposed.

Appropriate external noise criteria have been identified following typical Local Authority environmental noise policy, and this is used to complete a detailed acoustical assessment. The results of the assessment are used to determine the necessary limiting noise levels to be applied to the new plant selections, the specification for which are contained within this report.

Adoption of the recommendations stipulated herein would bring about compliance with the noise targets identified within this report, and should provide a suitably robust basis for demonstrating that appropriate external noise levels would be maintained, and on that basis, future reservations from the Local Authority environmental and planning services relating to external plant noise emissions are not anticipated.

Appendix A: Site Layout



Appendix B: Measurement Data

Broad band Measurements – All

File	Date: 02/08/2011	Measurement	Global sound pressure level: dB			
	Period	Position	LAeq	LAF(max)	LAF,10	LAF,P90
NOR118_6212828_110802_0007	02/08/2011 14:49	MP1	52.7	70.0	52.9	49.6
NOR118_6212828_110802_0008	02/08/2011 15:05	MP1	53.3	59.1	55.1	50.2
NOR118_6212828_110802_0009	02/08/2011 15:46	MP2a- Lp@10m from Fridge pack	50.1	54.0	53.9	41.1
NOR118_6212828_110802_0010	02/08/2011 15:47	MP2b- Lp@1m from Fridge pack c/p end	56.1	57.1	56.8	55.5
NOR118_6212828_110802_0011	02/08/2011 15:48	MP2c- Lp@1m from Fridge pack side	57.3	57.7	57.8	56.8
NOR118_6212828_110802_0012	02/08/2011 15:51	MP3- Lp@1m from Ext Fan outlet	70.1	70.3	70.4	69.7
NOR118_6212828_110802_0013	02/08/2011 16:15	MP1	51.6	57.8	53.0	49.4
NOR118_6212828_110802_0014	02/08/2011 17:19	MP1	52.7	58.0	54.8	50.2

Spectral Measurements – L_{90}

Date: 02/08/2011	Measurement	LfF,90: Spectral sound pressure level: dB							
Period	Position	63Hz	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	8kHz
02/08/2011 14:49	MP1	61.3	56.4	50.2	44.6	43.4	40.4	34.4	25.8
02/08/2011 15:05	MP1	63.9	56.8	50.6	45.1	44.4	40.9	35.3	26.2
02/08/2011 15:46	MP2a- Lp@10m from Fridge pack	32.5	33.4	32.2	31.3	32.2	33.9	36.0	32.9
02/08/2011 15:47	MP2b- Lp@1m from Fridge pack c/p end	63.3	62.8	56.8	52.9	49.2	43.7	37.5	29.8
02/08/2011 15:48	MP2c- Lp@1m from Fridge pack side	64.9	63.5	60.0	52.5	50.4	46.0	38.6	32.9
02/08/2011 15:51	MP3- Lp@1m from Ext Fan outlet	66.6	66.3	60.0	66.7	64.7	63.6	56.4	49.7
02/08/2011 16:15	MP1	60.8	57.1	52.0	45.3	42.4	39.0	32.7	24.7
02/08/2011 17:19	MP1	62.2	58.1	52.8	45.5	42.9	39.7	33.3	25.1

Spectral Measurements – L_{eq}

Date: 02/08/2011	Measurement	Lfeq: Spectral sound pressure level: dB							
Period	Position	63Hz	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	8kHz
02/08/2011 14:49	MP1	66.9	58.9	52.1	47.0	45.3	43.7	45.7	39.7
02/08/2011 15:05	MP1	69.2	60.7	54.5	48.1	47.1	45.2	40.3	32.4
02/08/2011 15:46	MP2a- Lp@10m from Fridge pack	46.6	50.1	51.9	48.2	44.8	39.1	37.2	33.3
02/08/2011 15:47	MP2b- Lp@1m from Fridge pack c/p end	68.6	66.0	58.2	53.6	49.9	44.5	38.3	31.6
02/08/2011 15:48	MP2c- Lp@1m from Fridge pack side	67.6	66.5	61.0	53.4	50.8	46.5	39.0	34.2
02/08/2011 15:51	MP3- Lp@1m from Ext Fan outlet	68.2	67.5	60.9	67.5	65.2	64.0	56.7	50.0
02/08/2011 16:15	MP1	65.7	60.2	53.6	47.3	44.5	42.5	38.6	32.2
02/08/2011 17:19	MP1	67.0	61.4	55.3	47.1	45.0	43.5	41.2	36.0

Spectral Measurements – L_{max}

Date: 02/08/2011	Measurement	Lfmax: Spectral sound pressure level: dB							
Period	Position	63Hz	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	8kHz
02/08/2011 14:49	MP1	78.1	63.7	59.0	57.6	50.6	56.0	67.7	63.5
02/08/2011 15:05	MP1	80.5	65.2	62.1	52.5	52.8	54.2	52.3	47.2
02/08/2011 15:46	MP2a- Lp@10m from Fridge pack	50.8	54.4	56.4	52.6	49.0	42.3	38.2	33.5
02/08/2011 15:47	MP2b- Lp@1m from Fridge pack c/p end	74.5	68.0	59.7	54.2	50.7	45.2	39.1	33.0
02/08/2011 15:48	MP2c- Lp@1m from Fridge pack side	69.6	67.6	61.7	53.9	51.2	46.9	39.6	35.0
02/08/2011 15:51	MP3- Lp@1m from Ext Fan outlet	69.1	68.2	61.4	68.1	65.5	64.3	56.9	50.2
02/08/2011 16:15	MP1	72.5	67.4	59.3	55.0	51.5	51.4	52.9	43.5
02/08/2011 17:19	MP1	77.6	73.6	61.5	51.6	51.6	51.4	52.8	49.1

Appendix C: Plant Noise Specification

The new plant has yet to be selected and in view of this it is necessary to calculate the limiting sound pressure levels that are required to maintain the design noise criteria identified earlier in the report. The following noise levels determined on the basis of the plant quantities and positions stated shall form the basis of the specification accordingly:

The specialist plant supplier shall be required to provide all necessary inlet and discharge attenuation etc to maintain the limiting sound pressure levels stipulated in the following Table.

Limiting Sound Pressure Levels for New Roof Mounted Plant

Plant item	Number of Items	Plant Operation	Plant location (refer to Fig 1)	Reference Distance	Maximum sound pressure level @ stated distance (dB). Re: $2x10^{-5}$ pa Octave Band Centre Frequency							'Wtd' Sound pressure level @ stated distance
					63	125	250	500	1k	2k	4k	dBA
AHU	1	08:30 to 18:00hrs	Roof	10m	60	57	49	44	40	37	35	48
AC Units	3		Roof	1m	75	72	66	61	58	55	53	65

The stated free field sound pressure levels shall apply to each plant item, at the stated reference distance measured perpendicular to all sides over a flat reflective plane. Furthermore, the levels shall not be exceeded during any load / operating condition. The following list provides details of other requirements:

- AHU's: The limiting noise levels shall include:
    - Noise emissions from the inlet and discharge openings to atmosphere
    - Noise emissions from any gas fired burners
    - Noise emissions from any compressor sections and condenser fans
    - Noise breakout from the AHU casing and associated ductwork
- Noise emissions from the plant shall not contain any distinguishable, discrete or continuous tone, or display any distinct impulses irregular enough to attract attention. If the plant noise emissions contain any of these characteristics then the limiting noise levels for the item of plant shall be reduced by 5 dB. For the purpose of assessment by the equipment supplier, a tonal component is considered present if the sound pressure level in any one-third-octave band exceeds the sound pressure level in each of the two adjoining bands by 5 dB or more.
- The limiting noise levels have been assessed on the basis of external environmental noise requirements. Noise mitigation measures necessary to control noise emissions to internal areas shall be determined by others.
- The plant shall be fitted with high quality anti-vibration equipment including isolation mountings and flexible pipe connections. The equipment shall be designed to limit transmissibility to the building support structure to a maximum 5% applicable at all modes of operation. The equipment shall be corrosion treated, suitable for external application.