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20-21 KING'S MEWS, HOLBORN, LONDON

PLANNING COMPLIANCE REVIEW

Report 13378.PCR.01

For:

Marek Wojciechowski Architects

66-68 Margaret Street

London

W1W 8SR

Site Address	Report Date	Revision History
20-21 King's Mews, Holborn, London	16/02/2016	

CONTENTS

List of Attachments

1.0 INTRODUCTION

KP Acoustics Ltd, Britannia House, 11 Glenthorne Road, London, W6 0LH, has been commissioned by Marek Wojciechowski Architects, 66-68 Margaret Street, London, W1W 8SR, to undertake an environmental noise survey at 20-21 King's Mews, Holborn.

The background noise levels measured will be used to determine daytime and night-time noise emission criteria for a proposed installation of plant units, in agreement with the planning requirements of the London Borough of Camden.

This report presents the overall methodology and results from the environmental survey followed by calculations to demonstrate the feasibility of the plant installation to satisfy the emissions criterion at the closest noise-sensitive receivers and outline mitigation measures as appropriate.

2.0 ENVIRONMENTAL NOISE SURVEY AND EQUIPMENT

2.1 Procedure

Automated noise monitoring was undertaken on the proposed site as shown in Site Plan 13378.SP1. The choice of these positions was based both on accessibility and on collecting representative noise data in relation to the nearest noise sensitive receivers relative to the proposed plant installation. The duration of the survey was between 09:30 on 04/02/2016 and 11:00 on 05/02/2016.

Initial inspection of the site revealed that the background noise profile at the monitoring location was dominated by road traffic noise from the surrounding roads.

The weather during the course of the survey was generally dry with wind speeds within acceptable tolerances and therefore suitable for the measurement of environmental noise. The measurement procedure generally complied with ISO 1996-2:2007 Acoustics “Description, measurement and assessment of environmental noise - Part 2: Determination of environmental noise levels”.

2.2 Equipment

The equipment calibration was verified before and after use and no abnormalities were observed.

The equipment used was as follows.

- 1 No. Svantek 958 Class 1 Sound Level Meter
- B&K Type 4231 Class 1 Calibrator

3.0 RESULTS

The results from the continuous noise monitoring are shown as a time history of L_{Aeq}, L_{Amax}, L_{A10} and L_{A90} averaged over 5 minute sample periods in 13378.TH1.

Minimum background noise levels are shown in Table 3.1.

	Minimum background noise level $L_{A90:\,5min}$ dB(A).
Daytime (07:00-23:00)	45
Night-time (23:00-07:00)	40

Table 3.1: Minimum measured background noise levels

4.0 NOISE CRITERIA

The criterion of the London Borough of Camden for noise emissions of new plant in this instance is as follows:

"The proposed plant and machinery shall be operated so as to ensure that any noise generated is "not audible" outside the nearest residential premises. To demonstrate inaudibility, you will need to provide calculations that show that the plant noise level is 10dBA below the lowest background level (LA90 (15minutes)) 1m from the nearest residential window, over the proposed operating hours. Tonality must also be taken into consideration."

We therefore propose to set the noise criterion as shown in Table 4.1 in order to comply with the above requirement.

	Night-time (23:00 to 07:00)
Noise criterion at nearest receiver	30 dB(A)

Table 4.1: Proposed Noise Emissions Criterion

As the proposed A/C units will be used at any time, we would recommend the adoption of the night-time criterion to ensure the amenity of the closest receiver will be protected.

5.0 DISCUSSION

It is understood that the plant installation is comprised of the following units:

- 7 No. Mitsubishi- Model MXZ-4D72VA

7 No. units are proposed to be installed in the main roof of property as shown in Site Plan 13378.SP1. The closest noise sensitive receiver to this location will be a window located approximately 6 metres from the proposed plant units location.

The sound pressure levels at 1m as provided by the manufacturer for the unit is shown in Table 5.1.

	Sound Pressure Level (dB) in each Frequency Band							
Unit	**63Hz**	**125Hz**	**250Hz**	**500Hz**	**1kHz**	**2kHz**	**4kHz**	**8kHz**
Mitsubishi- Model MXZ-4D72VA in heating mode	59	57	55	51	48	43	36	30

Table 5.1 Manufacturer's Sound Pressure Levels at 1m

5.1 Objective overview

Taking all acoustic corrections into consideration, including distance corrections, the noise level expected at the closest residential window would be as shown in Table 5.2. Detailed calculations are shown in Appendix B.

Receiver - Nearest Noise Sensitive Window	**Criterion**	**Noise Level at closest Receiver**
7 No. Units	30 dB(A)	29 dB(A)

Table 5.2 Predicted noise level and criterion at nearest noise sensitive receivers

As shown in Appendix B and Table 5.2, transmission of noise to the nearest sensitive windows due to the effects of the plant installation fully satisfies the emissions criteria set based on the requirements of the London Borough of Camden. However, this is providing that the mitigation measures indicated in Section 5.2 are implemented.

5.2 Proposed Mitigation Measures for Plant Unit Installation

In order to reduce noise emissions from the proposed plant units to within the criteria specified in Section 4.0, a set of acoustic enclosure with louvres should be installed. The acoustic louvres should provide the minimum attenuation characteristics shown in Table 5.3.

	Attenuation Levels (dB) in each Frequency Band (at 1m)							
Unit	63Hz	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	8kHz
Acoustic Louvres (300 mm)	-5	-7	-10	-12	-14	-16	-13	-12

Table 5.3: Required attenuation levels of proposed louvres

Acoustic louvres as outlined above can be provided from Noico, EEC, or any similar provider of noise control products.

5.3 BS8233 Assessment

Furthermore, the value of 29 dB(A) is to be considered outside of the nearest residential window. Windows may be closed or partially closed leading to further attenuation, as follows. Further calculations have been undertaken to assess whether the noise emissions from the plant units installation would be expected to meet the recognised British Standard recommendations, in order to further ensure the amenity of nearby noise sensitive receivers.

British Standard 8233:2014 '*Sound insulation and noise reduction for buildings – Code of Practice*' gives recommendations for acceptable internal noise levels in residential properties. Assuming worst case conditions, of the closest window being for a bedroom, BS8233:2014 recommends 30 dB(A) as being the value for internal resting/sleeping conditions in night - time.

With a calculated external level of 29 dB(A), the residential windows itself would need to provide minimal attenuation in order for the conditions to be achieved. According to BS8233:2014, even a partially open window offers 10-15dB attenuation, thus leading to a further reduced interior noise level.

Receiver	'Good' Condition Design Range – *For resting/sleeping conditions in a bedroom, in BS8233:2014*	Noise Level at Receiver
Closest to Installation location	30 dB(A)	19 dB(A)

Table 5.4 Noise levels and criteria inside nearest residential space

Predicted levels are shown in Table 5.4, with detailed calculations shown in Appendix B. It can therefore be stated that, as well as complying with the requirements of the London Borough of Camden, the noise emissions from the plant unit installation would be expected to comfortably meet the most stringent recommendations of the relevant British Standard.

6.0 CONCLUSION

An environmental noise survey has been undertaken at 20-21 King's Mews, Holborn, London by KP Acoustics Ltd between 09:30 on 04/02/2016 and 11:00 on 05/02/2016. The results of the survey have enabled criteria to be set for noise emissions from proposed plant units.

Using manufacturer noise data, noise levels are predicted at the nearby noise sensitive receiver for compliance with current requirements.

Calculations show that noise emissions from the proposed air conditioning units installation would meet the requirements of the London Borough of Camden providing that the mitigation measures stipulated in Section 5.2 are implemented.

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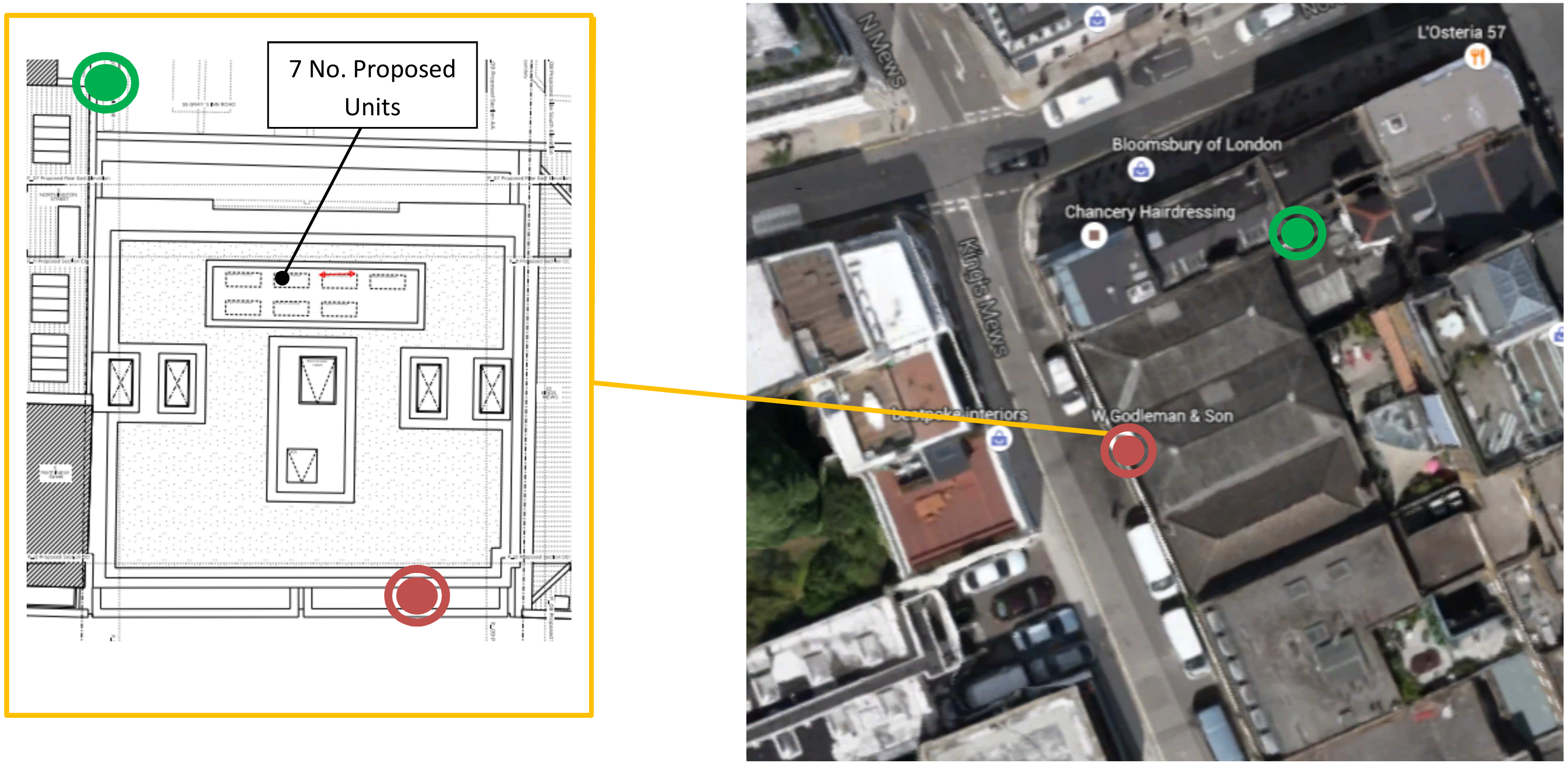

Noise Measurement Position

Closest Noise Sensitive Receiver

Title:

Indicative site plan showing noise measurement position

(*Ref: Google Earth*)

Date: 16 February 2016

FIGURE 13378.SP1

KP acoustics

20-21 King's Mews, Holborn, London
Environmental Noise Time History
4th February to 5th February 2016

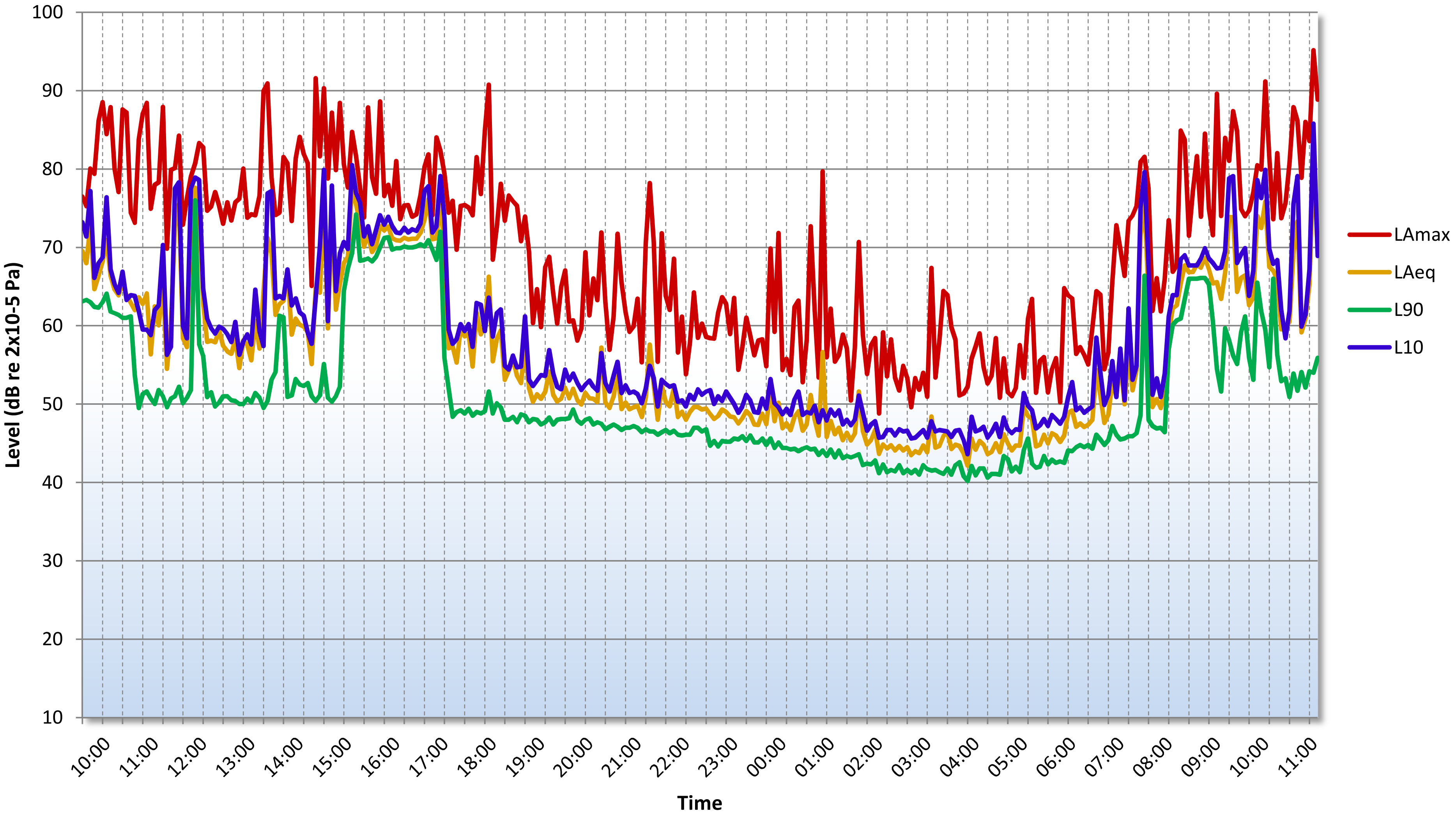

Figure 13378.TH1

APPENDIX A

GENERAL ACOUSTIC TERMINOLOGY

Decibel scale - dB

In practice, when sound intensity or sound pressure is measured, a logarithmic scale is used in which the unit is the 'decibel', dB. This is derived from the human auditory system, where the dynamic range of human hearing is so large, in the order of 10^{13} units, that only a logarithmic scale is the sensible solution for displaying such a range.

Decibel scale, 'A' weighted - dB(A)

The human ear is less sensitive at frequency extremes, below 125Hz and above 16Khz. A sound level meter models the ears variable sensitivity to sound at different frequencies. This is achieved by building a filter into the Sound Level Meter with a similar frequency response to that of the ear, an A-weighted filter where the unit is dB(A).

L_{eq}

The sound from noise sources often fluctuates widely during a given period of time. An average value can be measured, the equivalent sound pressure level L_{eq}. The L_{eq} is the equivalent sound level which would deliver the same sound energy as the actual fluctuating sound measured in the same time period.

L_{10}

This is the level exceeded for no more than 10% of the time. This parameter is often used as a "not to exceed" criterion for noise.

L_{90}

This is the level exceeded for no more than 90% of the time. This parameter is often used as a descriptor of "background noise" for environmental impact studies.

L_{max}

This is the maximum sound pressure level that has been measured over a period.

Octave Bands

In order to completely determine the composition of a sound it is necessary to determine the sound level at each frequency individually. Usually, values are stated in octave bands. The audible frequency region is divided into 11 such octave bands whose centre frequencies are defined in accordance with international standards. These centre frequencies are: 16, 31.5, 63, 125, 250, 500, 1000, 2000, 4000, 8000 and 16000 Hertz.

Environmental noise terms are defined in BS7445, *Description and Measurement of Environmental Noise*.

Appendix A

Applied Acoustic Terminology

Addition of noise from several sources

Noise from different sound sources combines to produce a sound level higher than that from any individual source. Two equally intense sound sources operating together produce a sound level which is 3dB higher than a single source and 4 sources produce a 6dB higher sound level.

Attenuation by distance

Sound which propagates from a point source in free air attenuates by 6dB for each doubling of distance from the noise source. Sound energy from line sources (e.g. stream of cars) drops off by 3dB for each doubling of distance.

Subjective impression of noise

Hearing perception is highly individualised. Sensitivity to noise also depends on frequency content, time of occurrence, duration of sound and psychological factors such as emotion and expectations. The following table is a guide to explain increases or decreases in sound levels for many scenarios.

Change in sound level (dB)	Change in perceived loudness
1	Imperceptible
3	Just barely perceptible
6	Clearly noticeable
10	About twice as loud

Transmission path(s)

The transmission path is the path the sound takes from the source to the receiver. Where multiple paths exist in parallel, the reduction in each path should be calculated and summed at the receiving point. Outdoor barriers can block transmission paths, for example traffic noise. The effectiveness of barriers is dependent on factors such as its distance from the noise source and the receiver, its height and construction.

Ground-borne vibration

In addition to airborne noise levels caused by transportation, construction, and industrial sources there is also the generation of ground-borne vibration to consider. This can lead to structure-borne noise, perceptible vibration, or in rare cases, building damage.

Sound insulation - Absorption within porous materials

Upon encountering a porous material, sound energy is absorbed. Porous materials which are intended to absorb sound are known as absorbents, and usually absorb 50 to 90% of the energy and are frequency dependent. Some are designed to absorb low frequencies, some for high frequencies and more exotic designs being able to absorb very wide ranges of frequencies. The energy is converted into both mechanical movement and heat within the material; both the stiffness and mass of panels affect the sound insulation performance.

APPENDIX B

20-21 King's Mews, Holborn

PROPOSED PLANT UNIT EMISSIONS CALCULATIONS

Source: Proposed Internal Plant Unit Installation **Receiver: Nearest Noise Sensitive Window**	*Frequency, Hz*								
	63	***125***	***250***	***500***	***1k***	***2k***	***4k***	***8k***	***dB(A)***
Manufacturers Sound Pressure Levels at 1m									
1 No. Mitsubishi - MXZ-4D72VA (Sound Pressure Level in heating mode), dB	59	57	55	51	48	43	36	30	
Correction for number of units (7), dB	9	9	9	9	9	9	9	9	
Attenuation provided by distance (min. 6m)	-16	-16	-16	-16	-16	-16	-16	-16	
Attenuation Provided by building's envelope	-3	-4	-6	-7	-10	-13	-13	-13	
Attenuation provided by the proposed louvres (300 mm)	-5	-7	-10	-12	-14	-16	-13	-12	
Sound pressure level 1m from closest noise sensitive receiver	**44**	**39**	**32**	**25**	**17**	**7**	**3**	**0**	**29**

Design Criterion	**30**

Receiver: Inside Nearest Residential Window **Source: Proposed plant installation**	*Frequency, Hz*								
	63	***125***	***250***	***500***	***1k***	***2k***	***4k***	***8k***	***dB(A)***
Sound pressure level outside window	44	39	32	25	17	7	3	0	29
Minimum attenuation from partially open window, dB	-10	-10	-10	-10	-10	-10	-10	-10	-10
Sound pressure level inside nearest residential window	**34**	**29**	**22**	**15**	**7**	**0**	**0**	**0**	**19**

Design Criterion	**30**

ANTI-VIBRATION MOUNTING SPECIFICATION REFERENCE DOCUMENT

1.0 General

1.1 All mountings shall provide the static deflection, under the equipment weight, shown in the schedules. Mounting selection should allow for any eccentric load distribution or torque reaction, so that the design deflection is achieved on all mountings under the equipment, under operating conditions.

1.2 It is the supplier's responsibility to ensure that all mountings offered are suitable for the loads, operating and environmental conditions which will prevail. Particular attention should be paid to mountings which will be exposed to atmospheric conditions to prevent corrosion.

1.3 All mountings shall be colour coded, or otherwise marked, to indicate their load capacity, to facilitate identification during installation.

Where use of resilient supports allows omission of pipe flexible connections for vibration/noise isolation, it shall be the Mechanical Service Consultant's or Contractor's responsibility to decide whether such devices are required to compensate for misalignment or thermal strain.

2.1 Type A Mounting (Caged Spring Type)

2.1.1 Each mounting shall consist of cast or fabricated telescopic top and bottom housings enclosing one or more helical steel springs as the principle isolation elements, and shall incorporate a built-in levelling device. The housing should be designed to permit visual inspection of the springs after installation, i.e. the spring must not be totally enclosed.

2.1.2 The springs shall have an outside diameter of not less than 75% of the operating height, and be selected to have at least 50% overload capacity before becoming coil-bound.

2.1.3 The bottom plate of each mounting shall have bonded to it a rubber/neoprene pad designed to attenuate any high frequency energy transmitted by the springs.

2.1.4 Mountings incorporating snubbers or restraining devices shall be designed so that the snubbing, damping or restraining mechanism is capable of being adjusted to have no significant effect during the normal running of the isolated machine.

2.1.5 All nuts, bolts or other elements used for adjustment of a mounting shall incorporate locking mechanisms to prevent the isolator going out of adjustment as a result of vibration or accidental or unauthorised tampering.

2.2 Type B Mounting (Open Spring Type)

2.2.1 Each mounting shall consist of one or more helical steel springs as the principal isolation elements, and shall incorporate a built-in levelling device.

2.2.2 The springs shall be fixed or otherwise securely located to cast or fabricated top and bottom plates, shall have an outside diameter of not less than 75% of the operating height, and shall be selected to have at least 50% overload capacity before becoming coil-bound.

2.2.3 The bottom plate shall have bonded to it a rubber/ neoprene pad designed to attenuate any high frequency energy transmitted by the springs.

2.3 Type C Mounting (Rubber/Neoprene Type)

Each mounting shall consist of a steel top plate and base plate completely embedded in oil resistant rubber/neoprene. Each mounting shall be capable of being fitted with a levelling device, and should have bolt holes in the base plate and a threaded metal insert in the top plate so that they can be bolted to the floor and equipment where required.

3.0 Plant Bases

3.1 **Type A Bases (A.V. Rails)**

An A.V. Rail shall comprise a steel beam with two or more height-saving brackets. The steel sections must be sufficiently rigid to prevent undue strain in the equipment and if necessary should be checked by the Structural Engineer.

3.2 **Type B Bases (Steel Plant Bases)**

Steel plant bases shall comprise an all-welded steel framework of sufficient rigidity to provide adequate support for the equipment, and fitted with isolator height saving brackets. The frame depth shall be approximately 1/10 of the longest dimension of the equipment with a minimum of 150 mm. This form of base may be used as a composite A.V. rail system.

3.3 **Type C Bases (Concrete Inertia Base: for use with steel springs)**

These shall consist of an all-welded steel pouring frame-work with height saving brackets, and a frame depth of approximately 1/12 of the longest dimension of the equipment, with a minimum of 100 mm. The bottom of the pouring frame should be blanked off, and concrete (2300 kg/m^3) poured in over steel reinforcing rods positioned 35 mm above the bottom. The inertia base should be sufficiently large to provide support for all parts of the equipment, including any components which over-hang the equipment base, such as suction and discharge elbows on centrifugal pumps.