



**THE BRITISH MUSEUM
THE SOUTH STAIR, CENTRAL
SALOON AND GALLERIES 38 TO 40
BUILDING SERVICES CONSULTING ENGINEER'S ACOUSTIC STAGE 1 DESIGN REPORT**

(TGA REF: 6228AC-STAGE D-TGA002)

29 September 2006

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INTRODUCTION

TGA Consulting Engineers were commissioned to contribute to an option study for Rooms 36..40 in January 2006 which was completed in March 2006.

Subsequently, the British Museum have appointed a design team to implement the refurbishment of the South Stair, the Central Saloon and Galleries 38 to 40 largely in line with the recommendations of identified in the feasibility study report.

In the period which has followed, the feasibility study proposals have been developed into a scheme design. During this period TGA Consulting Engineers have carried out further modelling of a number of different scenarios / options in respect of the ventilation and heating / cooling of the spaces which make up the project scope.

This document considers the acoustic performance of the plant that it is proposed to site externally on the roof of Gallery 40 and it's potential impact on surrounding properties. Supporting calculations are included in Appendix B.

It is intended that this report be read in conjunction with the Building Services Engineer's Stage 1 Design Report as well as that prepared by the Architect.

ACOUSTIC REPORT

Boundary Requirements

The requirements at the site boundary, as set out in the British Museum Harmonisation document are as follows:

Day-time background noise levels at site boundary

North Boundary:	46dB(A)
South Boundary:	55dB(A)
East Boundary:	47dB(A)
West Boundary:	47dB(A)

Night-time background noise levels at site boundary

North Boundary:	37dB(A)
South Boundary:	39dB(A)
East Boundary:	33dB(A)
West Boundary:	40dB(A)

These background noise levels take into account that the existing ambient noise levels at the site boundary must not be increased by more than 5 dB(A).

We have only considered night-time as this is the more stringent requirement with regard to noise levels and the plant will operate on a 24-hour basis.

Plant Proposals

The proposed works include the provision of a new, internally located air handling unit, which will comprise attenuators in both the room side ductwork and the atmospheric side ductwork.

Two externally mounted condensing units will provide the heat rejection for the air handling unit cooling coil. As can be seen in the cross-section included in Appendix A, these condensing units will be located in a plant well, with the sides of the well enclosure projecting above the top of the condensing unit.

Exclusions

Also to be installed as part of this project is a smoke extract system. The noise levels from the smoke extract fans have not been considered in the calculations as these will only operate in the event of a fire, and their operation is deemed unlikely. Also, as can be seen from the calculations, the effect of the condensing units and fresh air intake has an insignificant

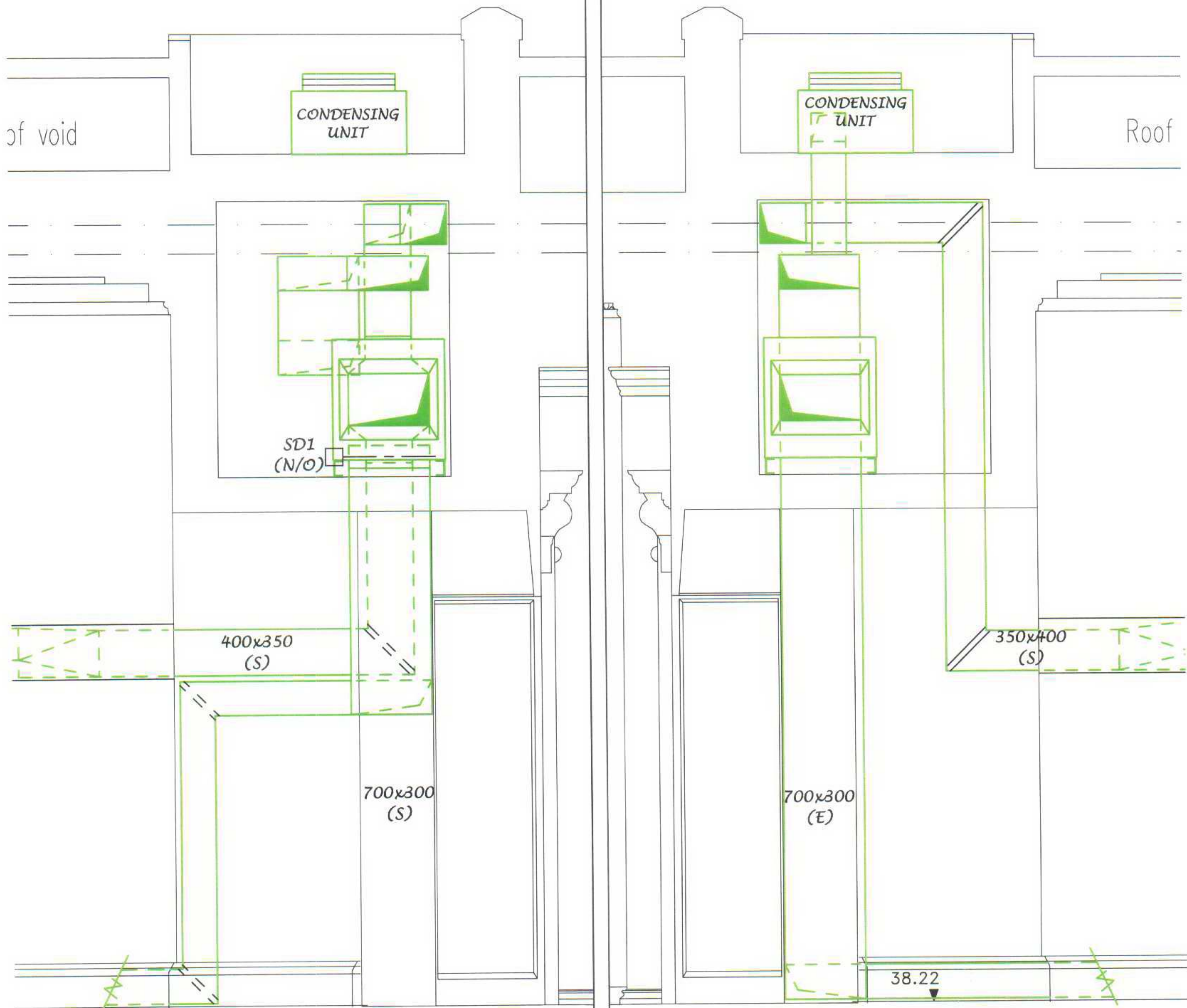
impact on ambient noise levels at the site boundary and even if the smoke extract fans were to operate, they would not cause the existing ambient noise levels at the nearest property to exceed by more than 5 dB(A).

Conclusion

Only the East Boundary has been considered for the acoustic calculations as this has the more stringent criteria and, in addition, as can be seen in the drawings in Appendix A, it is the boundary closest to the plant location. As can be seen in the calculations enclosed in the appendices, the sound pressure level of the proposed new plant at the boundary has been calculated at 17dB(A), which is well below the requirements set above.

APPENDIX A: DRAWINGS

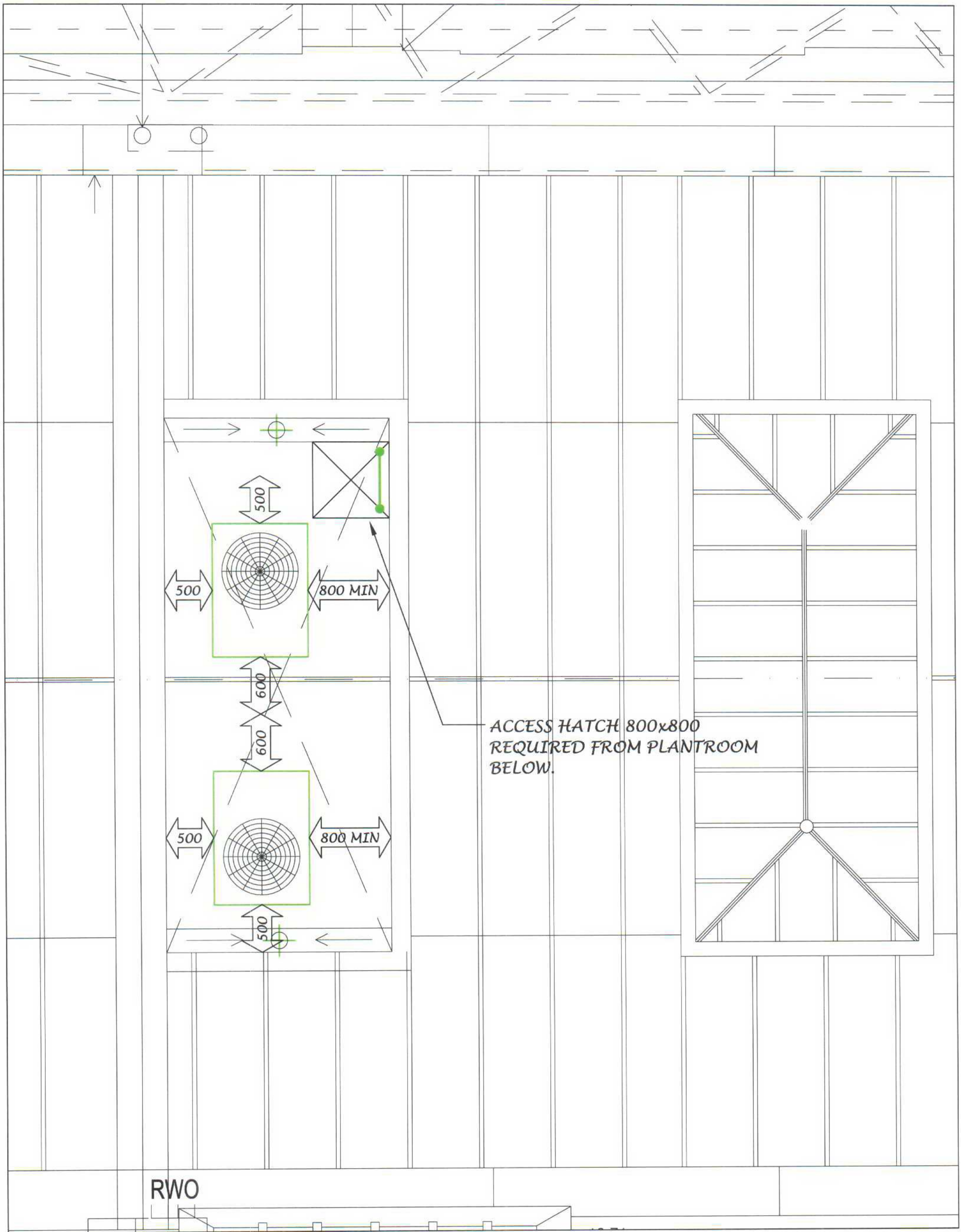




SECTION A-A
(SEE DRG 6228-TGA-M-SK-2005
FOR LOCATION)

SECTION B-B
(SEE DRG 6228-TGA-M-SK-2005
FOR LOCATION)

6228-TGA-M-SK-2006, REV P2
SECTIONS A-A & B-B THRU'
PLANTROOM



6228-TGA-M-SK-2011,
REV P0
PLAN OF CONDENSING
UNITS AT ROOF LEVEL

APPENDIX B: ACOUSTIC CALCULATIONS

Noise Calculations - Atmospheric Side Ductwork

ACOUSTIC CALCULATION - SOUND PRESSURE LEVEL AT FRESH AIR INLET

Job No: 6228

Distance of noise source from destination [r]: 7 m
Fan dB input - SPL or Lw Sound Power Level (Lw)

Design NR: 50 Design dBA: 58

Inlet or Outlet Area: 0.075 m²

Angle Between Source and Recipient: 0 °

Frequency (Hz)		63	125	250	500	1k	2k	4k	8k	Total	
Fan Sound Power Level (dB) [User input]:	a	80	85	84	77	78	73	72	68	90	83 dBA
Design (dB) [From tables]:	l	74.9	65.5	58.5	53.3	50	47.5	45.4	43		
Deduction for Distance (dB): [-10Log(10)4*Pi*r^2]	g	-28	-28	-28	-28	-28	-28	-28	-28		
Correction for Direction (dB) [From Tables]:	f	4	5	6	7	8	8.5	8.5	9		
Adjacent building construction	h	N/A	0	0	0	0	0	0	0		
Any barriers (-):	i	Walls, etc	0	0	0	0	0	0	0		
Distance A (m)		0									
Distance B (m)		0									
Distance C (m)		0									
Outlet Reflection in cm ² (-):	c	0.075	-20	-16	-11	-7	-3	0	0		
Any other corrections (dB):	b1	Bends, etc	-1.5	-1.5	-1.12	-12.75	-16.5	-8.5	-6.5		
		Noico Model									
Any other corrections (dB):	b2	40 (1200 Long)	-7	-10	-17	-32	-40	-32	-30	-16	
Total duct attenuation (dB): [b1+b2+c]	d		-28.5	-27.5	-29.12	-51.75	-59.5	-40.5	-36.5	-22.5	
SWL leaving system (dB): [a+d]	e		51.5	57.5	54.88	25.25	18.5	32.5	35.5	45.5	
Total Additional Attenuation (dB): [f+g+h+i]	j		-24	-23	-22	-21	-20	-19.5	-19.5	-19	
SPL at specified location (dB): [e+j]	k		27.5	34.5	32.88	4.25	-1.5	13	16	26.5	
Required insertion loss (dB) [k-l]:	m		-47.4	-31	-25.62	-49.05	-51.5	-34.5	-29.4	-16.5	
Selection attenuation (dB) [User input]:	n		8	12	22	39	50	40	28	23	
Type [User input]:											
Excess Attenuation (dB) - negative denotes shortfall [n-m]:	o		55.4	43	47.62	88.05	101.5	74.5	57.4	39.5	
Result (dB) [k-n]:	p		19.5	22.5	10.88	0	0	0	0	3.5	25 SPL at Specified Location (dB)
Correction (to obtain dBA) [From tables]:	q		-26	-16	-9	-3	0	1	1	-1	
Result (dBA) [p+q]:	r		0	6.5	1.88	0	0	1	1	2.5	12 dBA at Specified Location
Noise excess or noise within requirement (dB) - 0 denotes within requirement [p-l]	s		0	0	0	0	0	0	0	0	0 dBA at Specified Location

These cell values for C3 can be obtained from the Trox design guide

Shaded cells above indicate noise excess at the stated frequency

Noise Calculations - Breakout East

ACOUSTIC CALCULATION - SOUND PRESSURE LEVEL AT EAST BOUNDARY

Job No: 6228

Distance of noise source from destination [r]: 55 m
 Fan dB input - SPL or Lw Sound Pressure Level (SPL)
 Enter distance of of test point from unit: 1 m
 Design NR: 30 Design dBA: 40
 Inlet or Outlet Area: 0.5 m²
 Angle Between Source and Recipient: 90 °

Frequency (Hz)		63	125	250	500	1k	2k	4k	8k	Total	
Condensing Unit (dB) [User input]:		73	71	74	71	69	64	57	50	80	74 dBA
No. of Condensing Units of equal sound pressure level:		2									
Any other sound source:		0	6.5	1.88	0	0	1	1	2.5		
Total Condensing Unit sound pressure level (dB):	a	76	74	77	74	72	67	60	53	83	77 dBA
Design (dB) [From tables]:	l	59.1	48.1	39.9	33.9	30	27.1	24.8	23		
Deduction for Distance (dB): [-20Log10r]	g	-35	-35	-35	-35	-35	-35	-35	-35		
Correction for Direction (dB) [From Tables]:	f	0	0	0	0	0	0	0	0		
Adjacent building construction	h	0	0	0	0	0	0	0	0		
Any barriers (-):	i	-16	-18	-21	-25	-27	-30	-32	-34		
Distance A (m)		38.8									
Distance B (m)		30.4									
Distance C (m)		58.6									
Any other corrections (dB):	b	0	0	0	0	0	0	0	0		
Total Additional Attenuation (dB): [b+f+g+h+i]	j	-51	-53	-56	-60	-62	-65	-67	-69		
SPL at specified location (dB): [e+j]	k	25	21	21	14	10	2	-7	-16		
Required insertion loss (dB) [k-l]:	m	-34.1	-27.1	-18.9	-19.9	-20	-25.1	-31.8	-39		
Selection attenuation (dB) [User input]:	n	0	0	0	0	0	0	0	0		
Type [User input]:											
Excess Attenuation (dB) - negative denotes shortfall	o	34.1	27.1	18.9	19.9	20	25.1	31.8	39		
[n-m]:											
Result (dB) [k-n]:	p	25	21	21	14	10	2	-7	-16	29	SPL at Specified Location (dB)
Correction (to obtain dBA) [From tables]:	q	-26	-16	-9	-3	0	1	1	-1		
Result (dBA) [p+q]:	r	0	5	12	11	10	3	0	0	17	dBA at Specified Location
Noise excess or noise within requirement (dB) - negative denotes within requirement [p-l]	s	-34.1	-27.1	-18.9	-19.9	-20	-25.1	-31.8	-39	-23	dBA at Specified Location

Shaded cells above indicate noise excess at the stated frequency

These cell values for C3 can be obtained from the Trox design guide