NMAP

Ocean Park Corporation, Hong Kong

Repositioning and Long Term Operation Plan of Ocean Park: *Noise Mitigation and Audit Plan for Phase 3*

August 2014

Environmental Resources Management
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NMAP

Ocean Park Corporation, Hong Kong

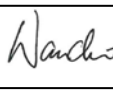
Repositioning and Long Term Operation Plan of Ocean Park: *Noise Mitigation and Audit Plan for Phase 3*

August 2014

Reference 0238176

For and on behalf of
ERM-Hong Kong, Limited

Approved by: Frank Wan

Signed: 

Position: Partner

Date: 18 August 2014

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Ocean Park Master Redevelopment Project

Environmental Permit No. EP-249/2006/D - Condition 2.25

Noise Mitigation and Audit Plan for the Operation of the Facilities and Venues for Special Events

Submitted by ERM-Hong Kong, Limited dated 18-08-2014

This is to verify that

Noise Mitigation and Audit Plan for the Operation of the Facilities and Venues for Special Events

Submitted by ERM-Hong Kong, Limited

dated 18-08-2014

Has been verified by the undersigned.

Signed _____

Ir Eric Ching
Independent Environmental Checker (IEC)
Retained by Ocean Park Corporation
pursuant to Environmental Permit No. EP-249/2006/D

Date 19 August 2014

Ocean Park Master Redevelopment Project

EP-249/2006/D – Condition 2.25

Noise Mitigation and Audit Plan for the Operation of the Facilities and Venues for Special Events

August 2014

Certified by _____ on 19-August-2014
Winnie Ko (ETL)

Verified by Independent Environmental Checker on 19 August 2014
IEC Certificate attached in the submission? Yes

1 INTRODUCTION

1.1 BACKGROUND

Following the approval of the Repositioning and Long Term Operation Plan of Ocean Park (the Project) Environmental Impact Assessment (EIA) report (Register No.: AEIAR-101/2006) (hereafter referred to as the approved EIA Report), an Environmental Permit (EP) (EP-249/2006) was granted for the Project in July 2006 and amendments to the EP were approved in October 2006, November 2010 and December 2013. To update the opening hours of the Ocean Park (the Park) and the layout plans for the Waterfront and Summit, an application for Variation of EP (VEP) was submitted to the EPD and new EP (EP-249/2006/D) was issued on 2 July 2014.

In accordance with Condition 2.25 of the EP-249/2006/D, the Permit Holder shall deposit with the Director four hard copies and one electric copy of Noise Mitigation and Audit Plan(s) (NMAP), no later than two weeks before the noise measurement and audit works are carried out. The Permit Holder shall carry out noise measurement and audit works according to the Noise Mitigation and Audit Plan(s) (NMAP) and submit a *Report on Commissioning Test Results* to the Director for approval, prior to the implementation of the specified periods of the proposed extension of opening hours.

1.2 PURPOSES OF THIS PLAN

If the results of the commissioning test demonstrate that the mitigation measures have achieved the required Sound Power Levels, the extension of the opening hours will be implemented in three phases, as follows:

- Phase 1 – extension of the opening hours of the Park from 10:00 to 09:00 hours and from 22:00 to 23:00 hours (excluding the Sky Fair Plaza Performance Venue and attractions for special events);

- Phase 2 - extension of the opening hours of the Park during Special Events to 01:00 hours and extension of opening hours of Restaurants and Retail Shops from 09:00 to 08:00 hours and from 23:00 to 02:00 hours of the next day (excluding the Sky Fair Plaza Performance Venue); and

- Phase 3 – operation of the Sky Fair Plaza Performance Venue (See *Figure 1.1*).

This *Plan* presents the proposed noise measurement methodology for the commissioning test for Phase 3 in accordance with Condition 2.31 of the EP-249/2006/D.

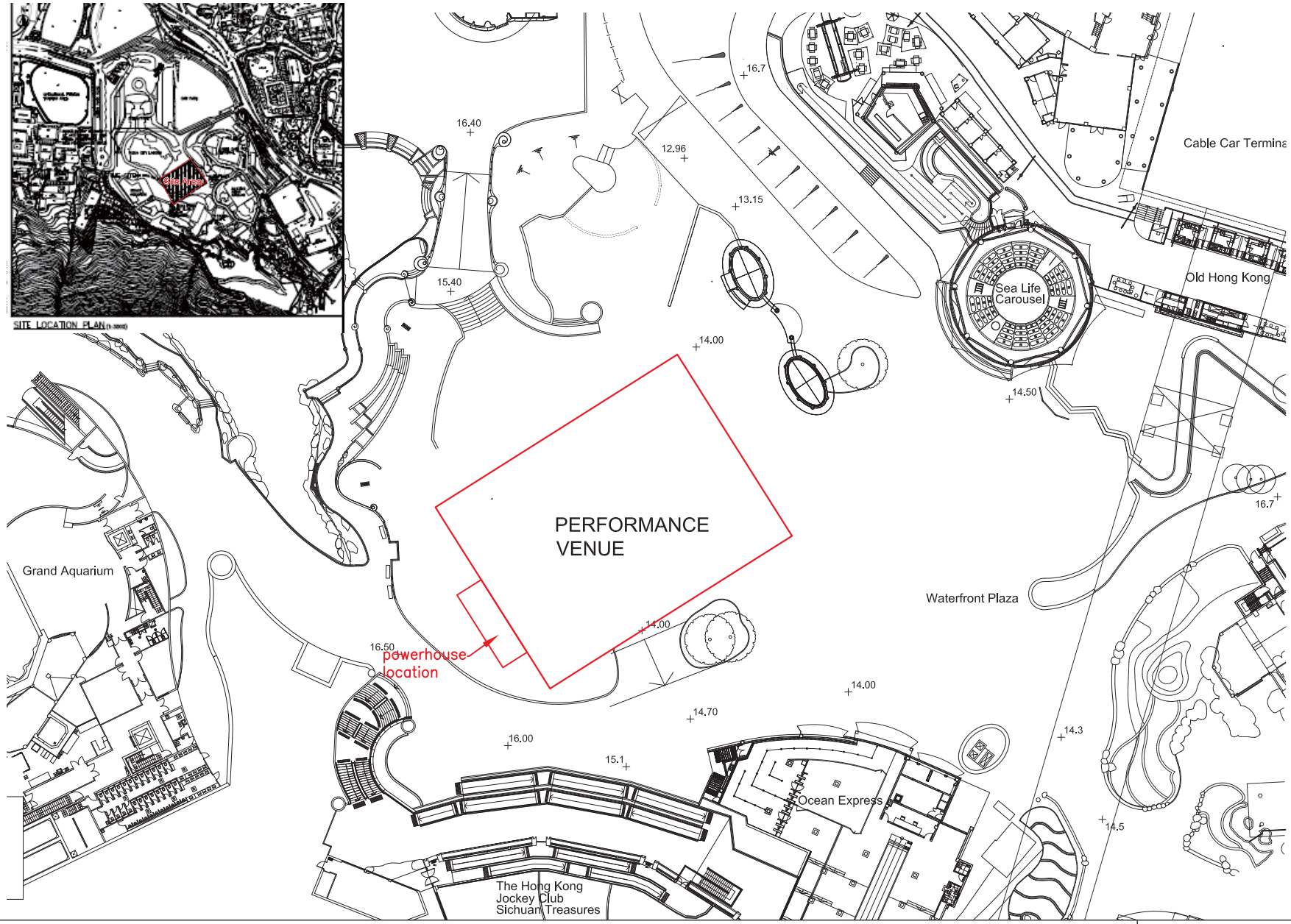

Figure 1.1

Location of Sky Fair Plaza Performance Venue

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2 COMMISSIONING REQUIREMENTS AND PROPOSED MEASUREMENT METHODOLOGY

2.1 COMMISSIONING REQUIREMENTS

The Commissioning Requirements and the operational control for the Sky Fair Plaza Performance Venue during different time periods are given in *Table 2.1*.

Table 2.1 Commissioning Requirements and Operational Control

Item	Commissioning Requirements	Operational Control
Sky Fair Plaza Performance Venue	**09:00 – 23:00 hrs - Not During Lagoon show:** Total SWL of the venue will not exceed 95dB(A).	Total SWL of the venue will not exceed 95dB(A).
	09:00 – 23:00 hrs - During Lagoon Show: Total SWL of the venue will not exceed 90dB(A).	No Show, ie closed[a]
	During 23:00 – 01:00 hrs: Total SWL of the venue will not exceed 85dB(A).	No Show, ie closed[a]
	During 01:00 – 02:00 hrs: Closed	No Show, ie closed[a]

Note:
[a] As confirmed by OPC, there will be no show at the Sky Fair Plaza Performance Venue during lagoon show and after 23:00 hrs.

2.2 NOISE SOURCES OF THE VENUE AND MEASUREMENT LOCATIONS

Shows and performance activities will be held inside the Sky Fair Plaza Performance Venue (the venue). The potential noise sources include the loudspeaker system inside the venue, two sets of chillers with three sets of associated water pumps, two sets of Air Handling Units (AHUs) and 2 split-type AC units.

The venue is fully enclosed by fixed wall, operable walls and roof constructed with acoustic panel, acoustic doors for side doors, sealed windows, and main entrance with double doors.

Operable walls and sealed windows are installed at various locations at the sides of the venue that will not be opened during the show. There is no opening on the roof. The acoustic doors and operable walls are installed with double retractable bottom seal to avoid noise leakage (*Annex G*). During the show, only the main entrance will be used for visitors and/or crews for getting in/out the venue. All other exits will be closed and in/out will not be allowed during the show, except for emergency. OPC confirmed that well-trained staff will be designated to control the in/out of people during the show to make sure at most one of the main entrance door is open during stage shows.

Elevations showing the locations of the main entrance, side doors, operable walls and windows on different sides of the venue are shown in *Annex A*. The locations of the chillers and associated water pumps are shown in *Annex B*. The location of the AHUs and the associated fresh air intakes are shown in *Annex C*, and the locations of the two split-type AC units are shown in *Annex D*.

Details of noise source identified, mitigation measure implemented, noise insulation performances of the mitigation measures, dimensions of noise sources and proposed measurement locations are summarized in *Table 2.2*.

Table 2.2 Details of Noise Source Identified, Mitigation Measure Implemented, Noise Insulation Performances of the Mitigation Measures, Dimensions of Noise Sources and Proposed Measurement Locations of the Mitigation Measures

Noise Source	Mitigation Measures	Noise insulation component	Surface Density/ Noise insulation rating	Details of Mitigation Measures	Potential Noise Leakage Location and dimensions	Measurement Location
Venue Music	Enclosed by the venue structure	Wall Panel (acoustic panel made of 1.5mm thick galvanised mild steel (GMS) plate internally lined with 100mm thick fiberglass (80kg/m^3). The acoustic panel is then sandwiched by two layers of 0.6mm thick steel plate (Lysaght Prestige Panel))	Approx. 30kg/m^2 (a)	Annex E	Main Entrance, 1.5m x 2.1m (H) each outer door (2 outer doors, total 4 door leaves)	5m from and perpendicular to centre of main door (*Figure 2.1*)
		Roof Panel (constructed by corrugated panel (steel sheet thickness of 0.48mm), 100mm thick insulation wool (48kg/m^2) and 24mm (two layers of 12mm) thick cement board)	Approx. 38kg/m^2 (b)	Annex F		
		Operable Wall (metal sliding doors)	STC49	Annex G		
		Acoustic door (side doors)	STC44	Annex H		
		Double Door for Main Entrance (inner doors are made of acoustic curtain and outer doors (total of two doors) are made of operable wall, internal sides of the double door box are covered by additional 0.4mm thick sound proof sheet (0.5kg/m^2)	Inner Curtain Door: STC 26 Outer Doors (operable wall) STC 49 Additional Sound Proof Sheet with 0.5kg/m^2: Rw 12dB	Annex I		
		Window (6mm glass + 50mm air + 8mm glass)	40kg/m^2 (c)	Annex J		
2 Chillers and 3 associated water pumps	Enclosed by the chiller enclosure with provision of acoustic louvre and silencer	Acoustic panel (1.5mm thick GMS)	12 kg/m^2 (d)	Annex K	Acoustic louvre for 2 air inlets, Louvre: 16.6m x 2m (overall) Chiller: 4m x 3m x 2.4m (H) each Water pump: 0.2m x 0.2m x 0.8m (H), each	6m (based on >L/π) from the louvre and perpendicular to centre of each chiller. (*Figure 2.2*) 1m from the louvre and perpendicular to centre the water pumps (*Figures 2.2* and *2.4*)
		Acoustic Louvre (model ALC-B2)	TL : 24dB at 500Hz and 28dB at 1000Hz	Annex K		

Noise Source	Mitigation Measures	Noise insulation component	Surface Density/ Noise insulation rating	Details of Mitigation Measures	Potential Noise Leakage Location and dimensions	Measurement Location
		Silencer (Model CSR-12 -4D)	TL : 26dB at 500Hz and 37dB at 1000Hz	Annex L	2 Exhaust air outlets, 3.5m x 2.2m each	2m (based on >L/π) from and perpendicular to centre of each exhaust (*Figure 2.2*)
2 AHU	Enclosed by acoustic panel with provision of silencer at the fresh air intake	Casing, acoustic plenum (double skinned construction from polyurethane foam (88mm thick with density of 40kg/m^3) sandwiched between two layers of 1mm pre-painted galvanized steel sheet)	19kg/m^2 (e)	Annex M	2 Fresh air intakes via silencers, 0.875m x 0.875m each	2m from and perpendicular to centre of the fresh air intake of the AHU (with silencer) (*Figure 2.3*)
		Silencer (Model 18RDS)	-	Annex N		
2 split-type AC units	-	-	-	-	0.85m x 0.30m x 1.1m(H) each	2.5m from each AC unit (*Figure 2.4*)

Notes:

(a) The surface density of steel plate is calculated based on the volume density of 7,800kg/m^3.
The surface density of 0.6mm thick steel plate = 7,800 x 0.6/1,000 = 5 kg/m^2 (x 2 for 2 outer layers)
The surface density of 1.5mm thick GMS plate = 7,800 x 1.5/1,000 = 12 kg/m^2
The surface density of 100mm thick fiberglass = 80kg/m^3 x 100/1000 = 8 kg/m^2
Therefore, the total surface density of the wall panel is approximately 30 kg/m^2.

(b) The density of the cement board is 1.2g/cm^3, ie 1,200 kg/m^3 (See *Annex F*).
The surface density of 0.48mm thick metal plate = 7,800 x 0.48/1,000 = 4 kg/m^2
The surface density of 100mm thick wool = 48kg/m^3 x 100/1000 = 5 kg/m^2
The surface density of 24mm thick cement board = 1,200 kg/m^3 x 24/1000 = 29 kg/m^2
Therefore, the total surface density of the wall panel is approximately 38 kg/m^2.

(c) Reference is made from *Engineering Noise Control* by David A Bies and Colin H Hansen, 4th ed Pages 409-414.

(d) The surface density of 1.5mm thick GMS plate = 7,800 x 1.5/1,000 = 12 kg/m^2

(e) The surface density of 1mm thick pre-painted galvanized steel sheet = 7,800 x 1/1,000 = 8 kg/m^2 (x2 for 2 outer layers) = 16kg/m^2
The surface density of 88mm thick polyurethane foam = 40kg/m^3 x 88/1000 = 3.5 kg/m^2
Therefore, the total surface density of the acoustic panel is approximately 19 kg/m^2.

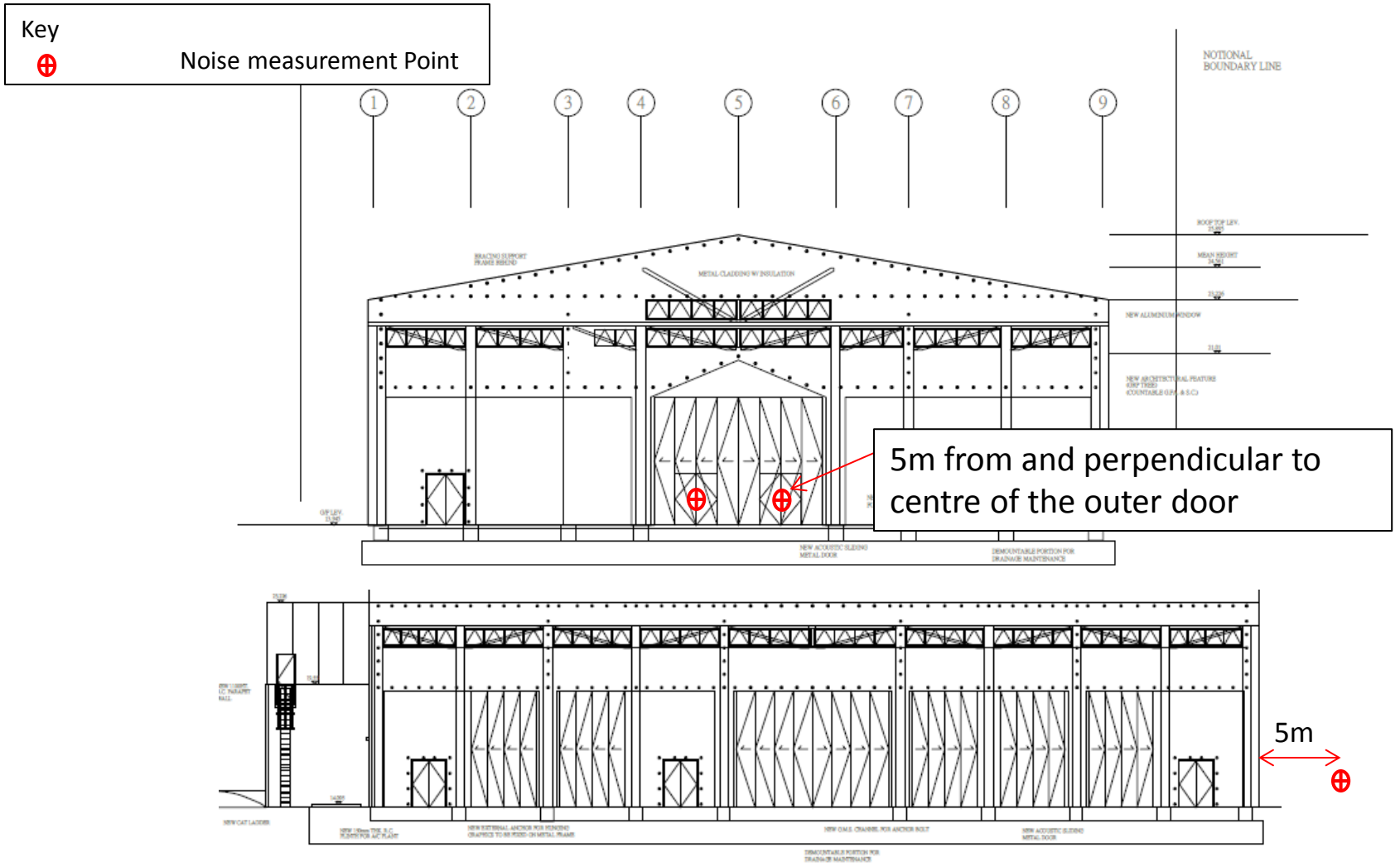

Figure 2.1

Measurement location at the main entrance

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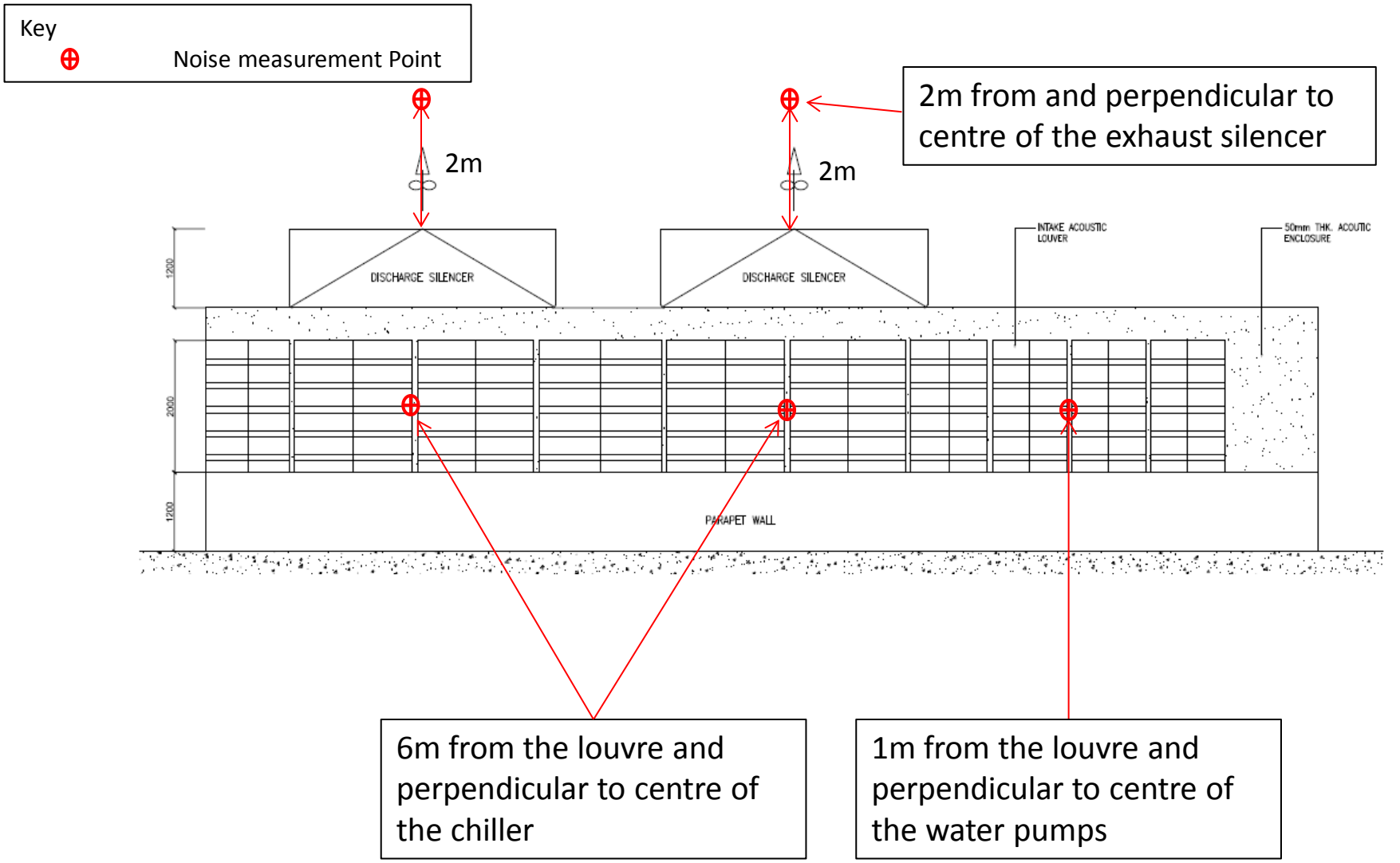

Figure 2.2 Measurement location at the Chiller Air intake louvre and Exhaust Silencer

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Key

Noise measurement Point

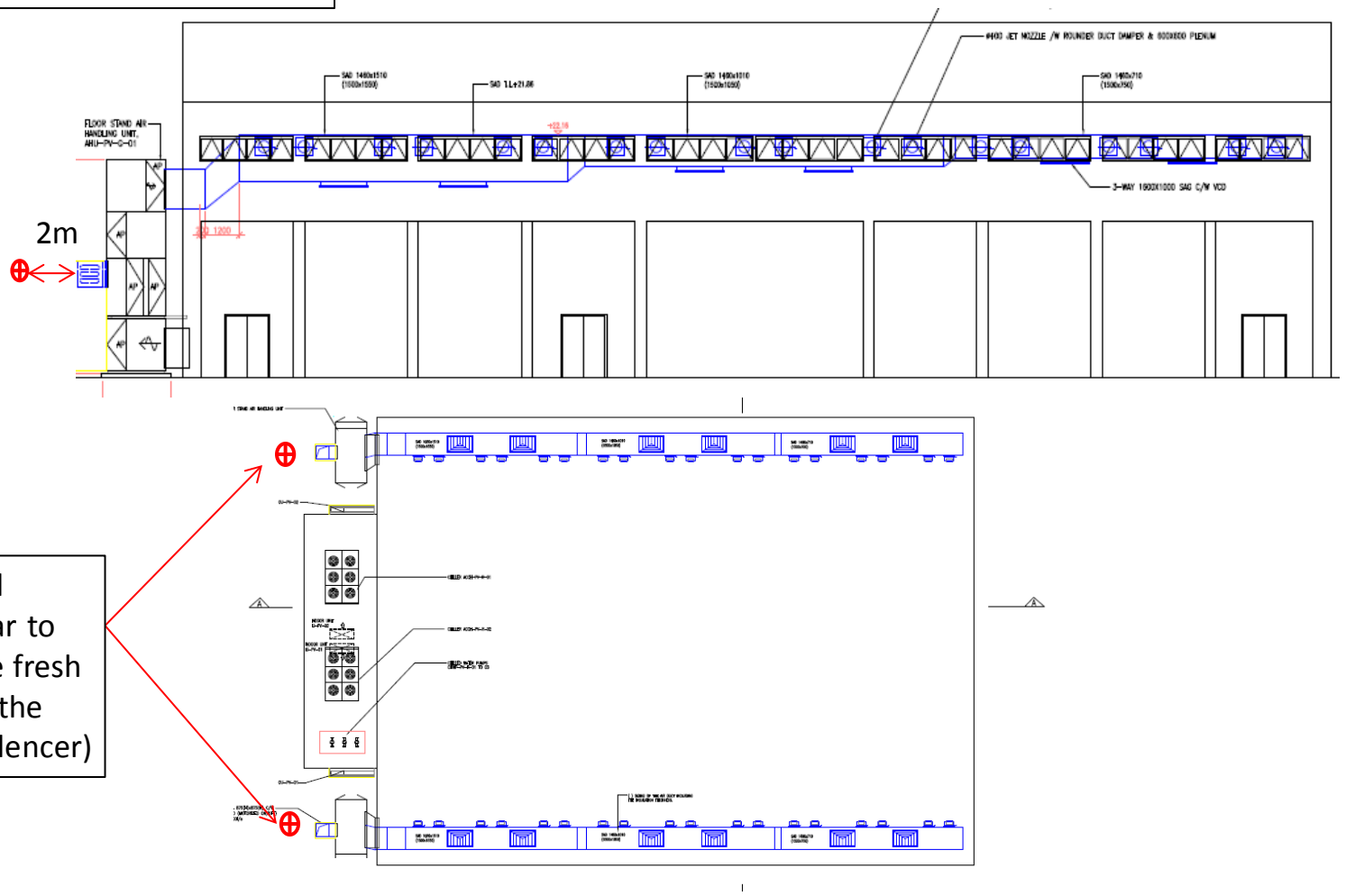

Figure 2.3

Measurement location at the fresh air intake of the AHUs

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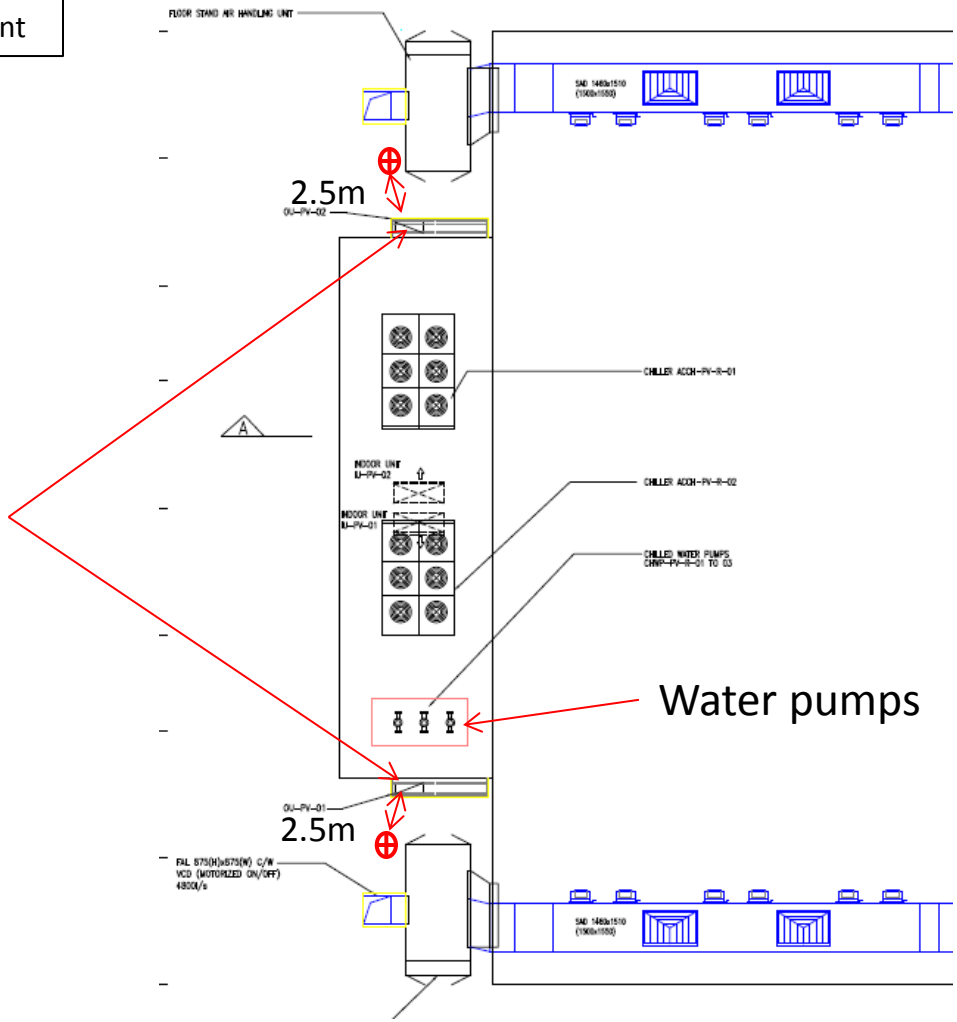
Key

⊕ Noise measurement Point



Split-type AC units

Figure 2.4 Measurement location for the Split -type AC units

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With consideration of the venue is constructed by propriety high noise insulation materials with gap sealing technique, the potential noise leakage locations are identified at the main entrance, two fresh air intakes from the AHU's silencers, air intake of the chillers through the acoustic louver and exhaust of the chillers through the silencers. The sound power level of the venue is calculated by summation of the all sound power levels (SWL) of the noise leakage locations.

2.3 COMMISSIONING NOISE MEASUREMENT METHODOLOGY

2.3.1 Determination of the SWL of the Venue

During noise measurement, sound tracks of show music and visitor noise will be played by the loudspeaker system with the volume settings equivalent to the future operation. Volume of the loudspeaker will be controlled by a signal processor named "The Soundweb London BLU-160" which is scalable audio "Processing Objects" that can offer real-time control of parameters (see *Annex O*).

5-minutes A-weighted equivalent continuous noise level ($L_{Aeq, 5min}$) will be measured at the main entrance. The measurement distance from the main entrance is determined based on standard acoustical principles. For each measurement location, three set of measurement data will be taken.

In consideration that the main entrance will be used for visitors and/or crews for getting in/out the venue during the show, five scenarios of noise measurements will be conducted at this location:

- With both doors closed;
- With 4 outer acoustic door leaves closed and two inner curtain doors opened
- With 2 outer acoustic door leaves (the left door when viewing from outside) opened and two inner curtain doors closed.
- With 2 outer acoustic door leaves (right door when viewing from outside) opened and two inner curtain doors closed ; and
- With both doors (inner and outer doors) open with low volume setting of the background music (for a scenario loading in and out the guests before and after the stage show).

All side doors, other than the main entrance doors, will be closed during the stage shows, and before and after the show when people are entering and leaving the venue. Windows are all double-glazed and well-sealed, ie will not be opened at all time.

2.3.2 Determination of the SWL of the Chillers and Water Pumps

Two chillers and three associated water pumps are located inside the noise enclosure with provision of the acoustic louvre for air intake and two silencers for exhaust. Only one water pump is required to support the operation of a

chiller. At most 2 water pumps will be operated simultaneously while the other one is a standby unit and water pumps are always operating with chillers. For each measurement location, three sets of measurement data will be taken. Noise level will be measured for each chiller and SWL of each chiller will be determined individually.

2.3.3 Determination of the SWL of the AHUs

Noise measurement for AHUs will be measured for each fresh air intake which has been installed with silencers. For each measurement location, three set of measurement data will be taken. SWL of each AHU will be determined individually.

2.3.4 Determination of the SWL of the Split-type AC unit

Noise measurement for split-type AC units will be measured for each unit. For each measurement location, three set of measurement data will be taken. SWL of each split-type AC unit will be determined individually.

2.3.5 Measurement of Background Noise

The background noise will be measured in terms of $L_{Aeq,\ (1\ min)}$ at the each measurement point with loudspeaker system, chillers and its associated water pumps, AHUs and the split-type AC units switching off. At each location, one set of background noise data will be taken. If any abnormal intrusive noise exists during background noise measurement, the measurement data will be discarded. The measured noise levels will be subject to background noise correction in accordance with standard acoustical principles.

2.3.6 Comparison against Commissioning Requirement

The SWL of the venue is calculated by summation of the all SWL of the noise leakage area. The total SWL should not exceed the commissioning requirement as given in *Table 2.1*. All noise measurement will be supervised and endorsed by a qualified person possessing at least seven years of noise control experience and a corporate membership of Hong Kong Institute of Acoustics or equivalent.

The instruments that will be used for the noise measurements shall comply with International Electrotechnical Commission Publications 651:1979 (Type 1) and 804:1985 (Type 1).

Before and after each series of measurements, a sound calibrator will be applied to each microphone to verify the calibration of the measuring system. The difference between the readings made before and after each series of measurements shall be less than or equal to 0.5 dB. If this value is exceeded, the results of this series of measurements shall be discarded.

The sound calibrator will be calibrated at intervals not exceeding 1 year and the compliance of the sound level meters with the requirements of IEC 61672-1 verified at intervals not exceeding 2 years. Sound level meters and calibrator to be used are listed in the *Table 3.1*. The equipment calibration certificates are shown in *Annex P*. For the above-mentioned requirement, reference was made to the approved EM&A plan for other theme park (ie Section 5.3 of EM&A Plan (Revision H) prepared under EP-01/059/2000/C[1]) and relevant ISO standard (ie ISO 3746-2010, Section 5.2, 3rd paragraph).

Table 3.1 Noise Measurement Equipment

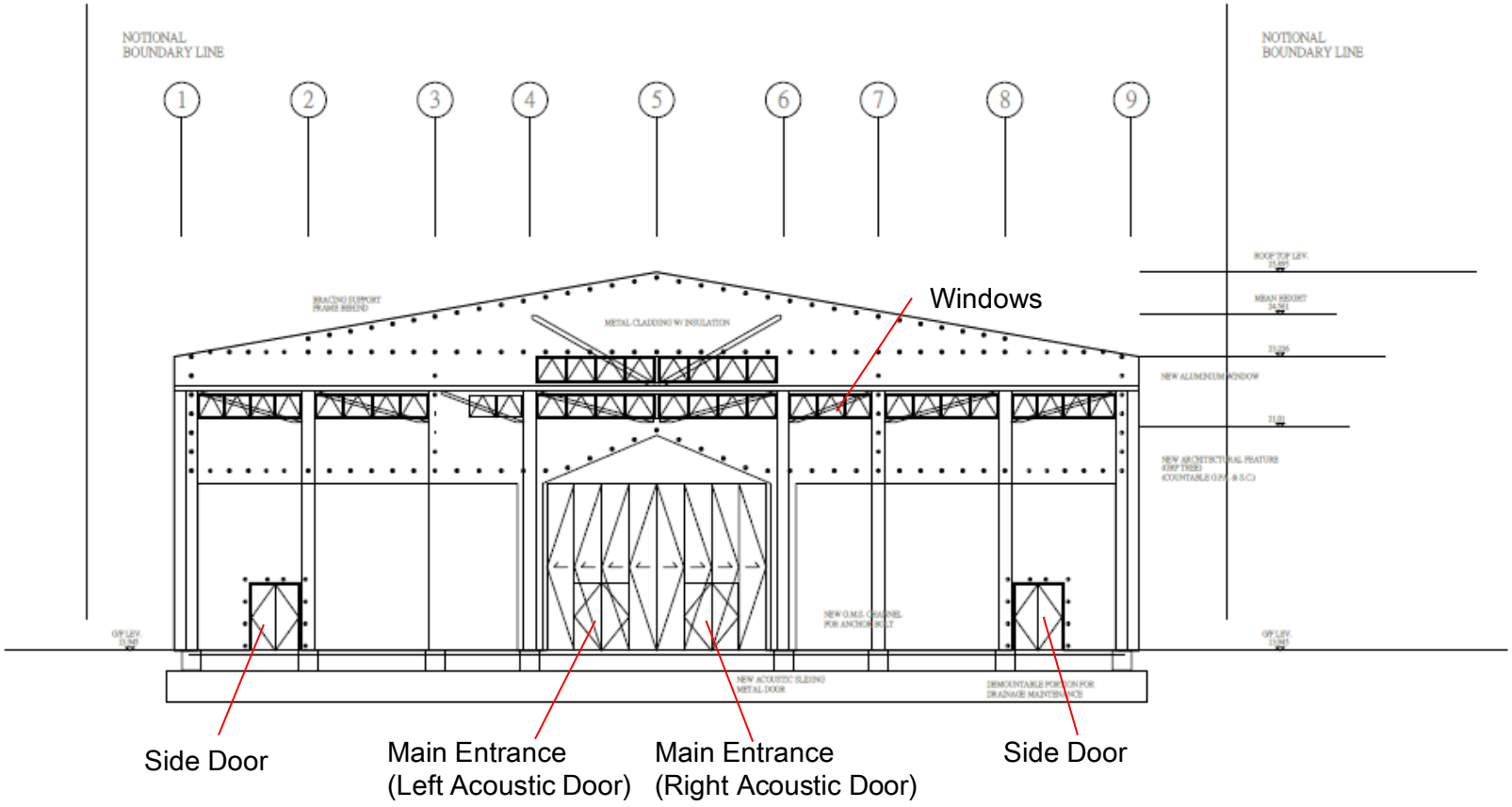
Equipment	Model	Serial Number
Sound Level Meter	01dB – Solo	65225
	01dB – Solo	65226
Calibrator	Svantek SV30A	No.7971
	01dB – CAL 21	No.34113609(2011)

The measurement parameter will be set to A-weighted sound pressure level and the time weighting will be set in fast response.

[1] http://www.epd.gov.hk/eia/register/english/permit/vep3782012/documents/emarp/pdf/emarp.pdf

Annex A

Locations of Main Entrance, Side Doors, Operable Walls and Windows



Annex A1

LOCATIONS OF MAIN ENTRANCE, SIDE DOORS, OPERABLE WALLS AND WINDOWS (NORTH-EAST ELEVATION)

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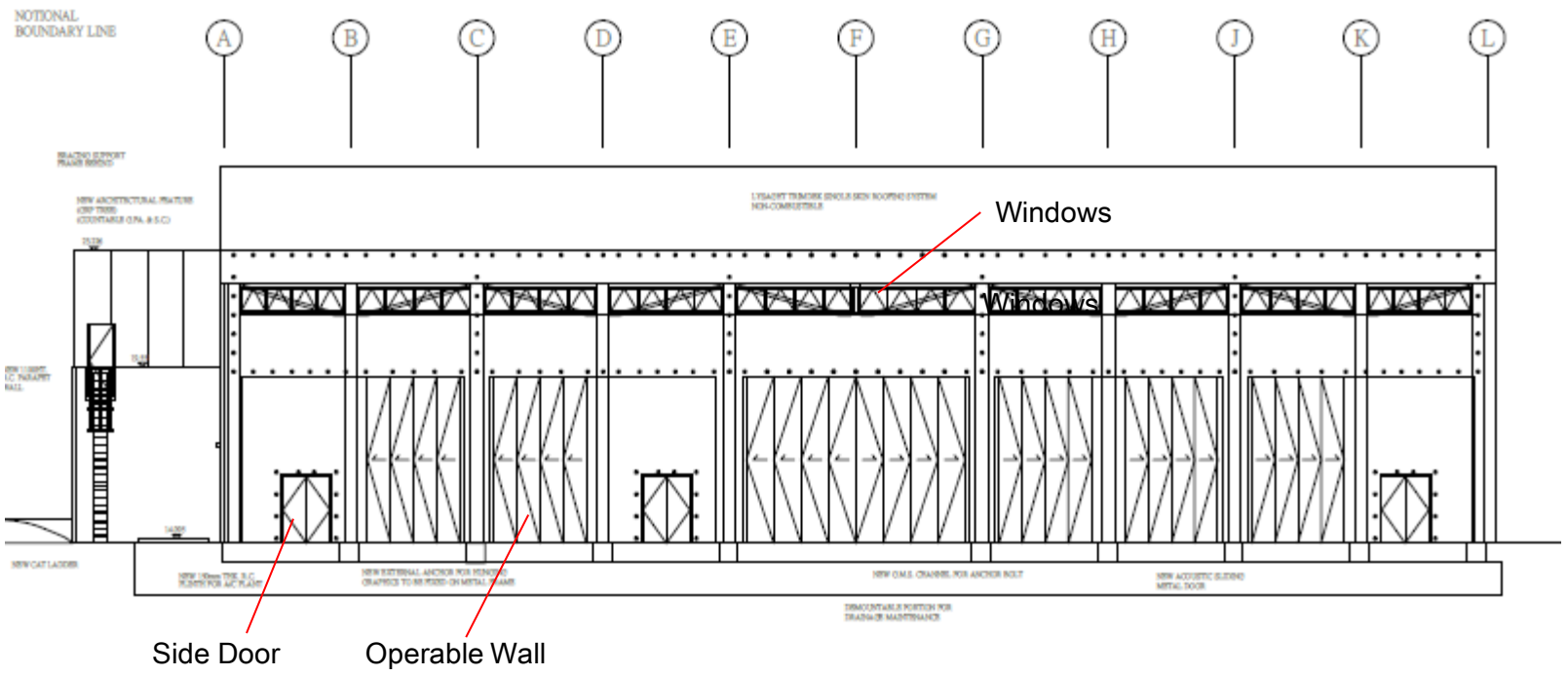

Annex A2

LOCATIONS OF MAIN ENTRANCE, SIDE DOORS, OPERABLE WALLS AND WINDOWS (SOUTH-EAST ELEVATION)

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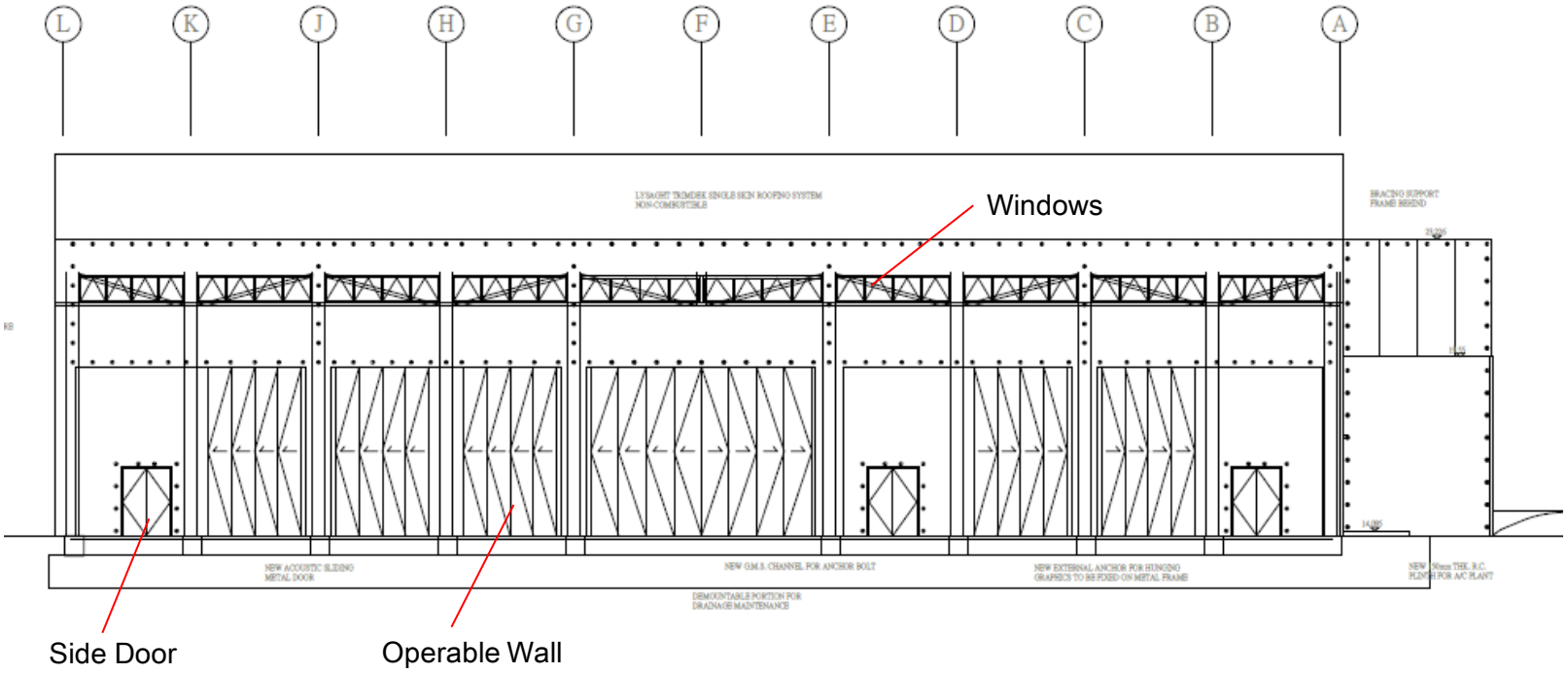

Annex A3

LOCATIONS OF MAIN ENTRANCE, SIDE DOORS, OPERABLE WALLS AND WINDOWS (NORTH-WEST ELEVATION)

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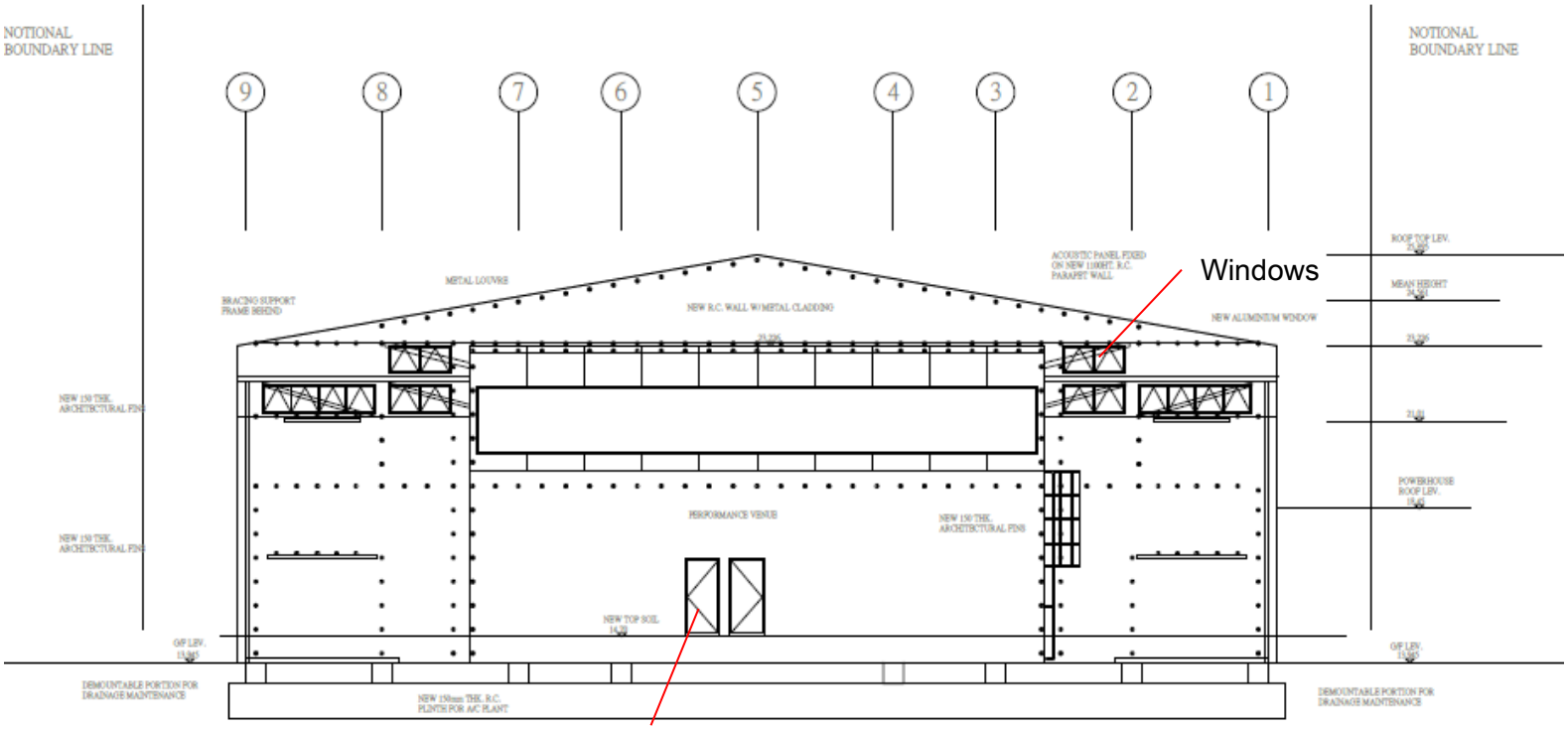

Annex A4

LOCATIONS OF MAIN ENTRANCE, SIDE DOORS, OPERABLE WALLS AND WINDOWS (SOUTH-WEST ELEVATION)

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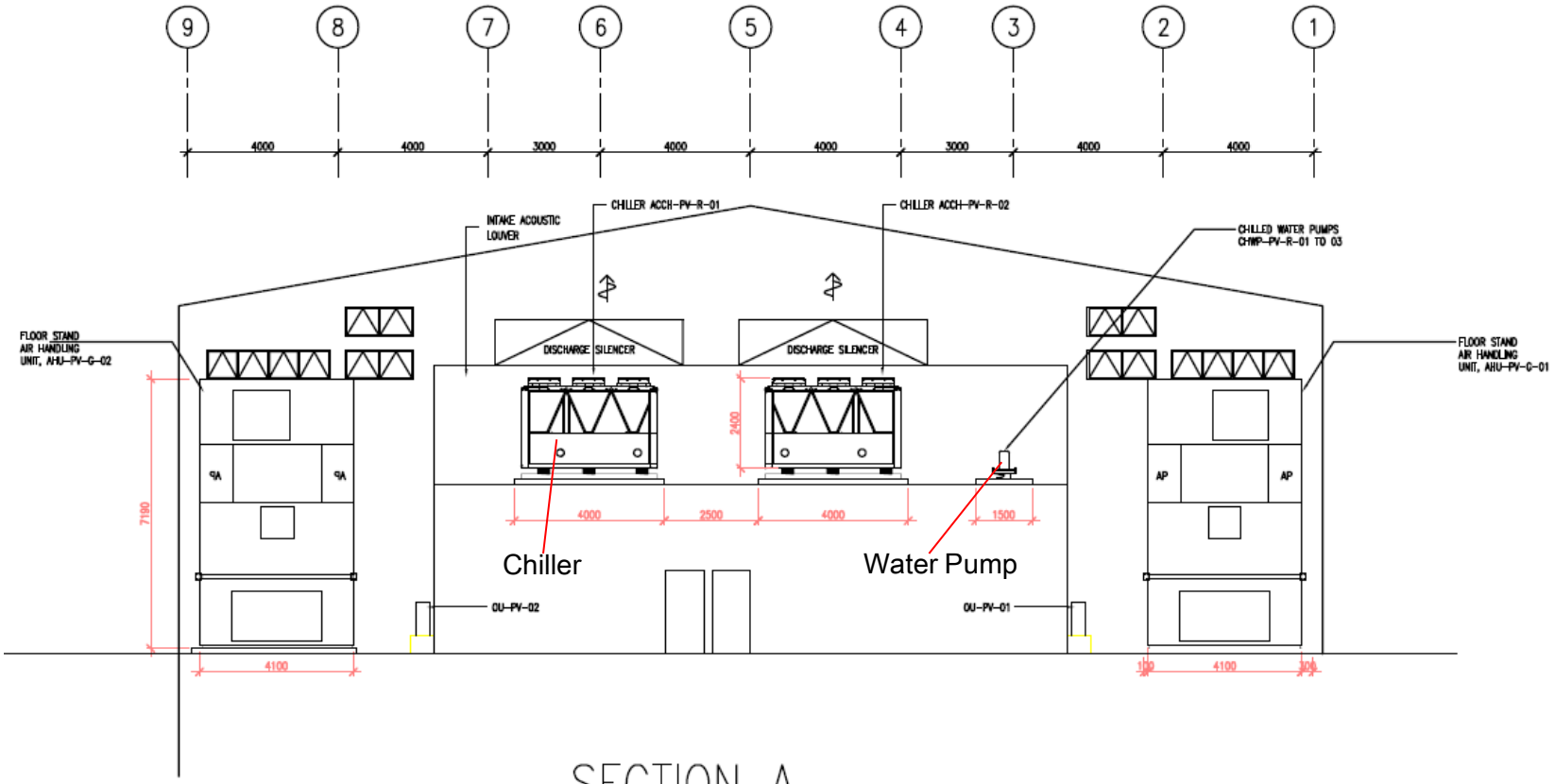
Annex B

Location of Chillers and Water Pumps



Annex B1

LOCATION OF CHILLERS AND WATER PUMPS

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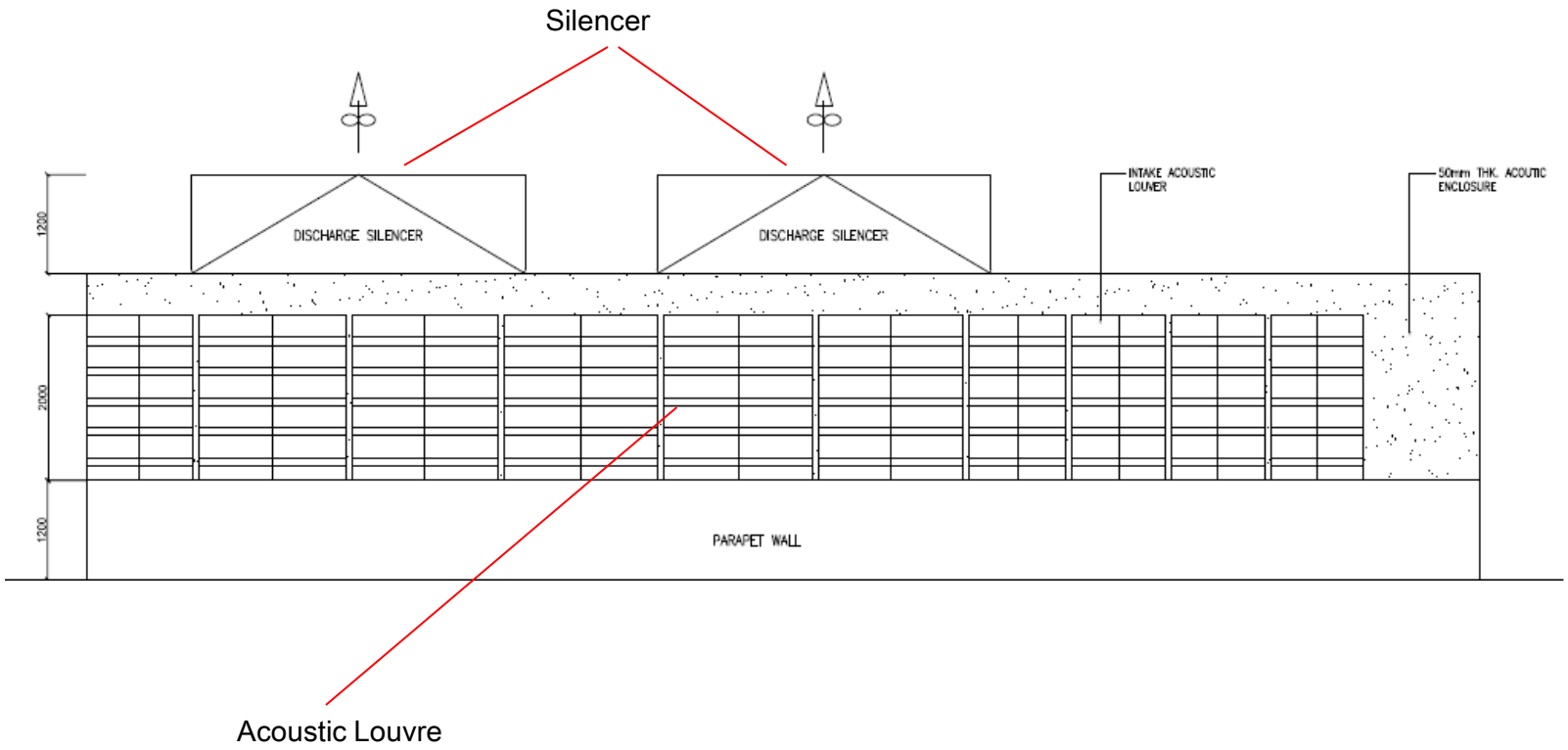

Annex B2

LOCATION OF ACOUSTIC LOUVRE AND SILENCER

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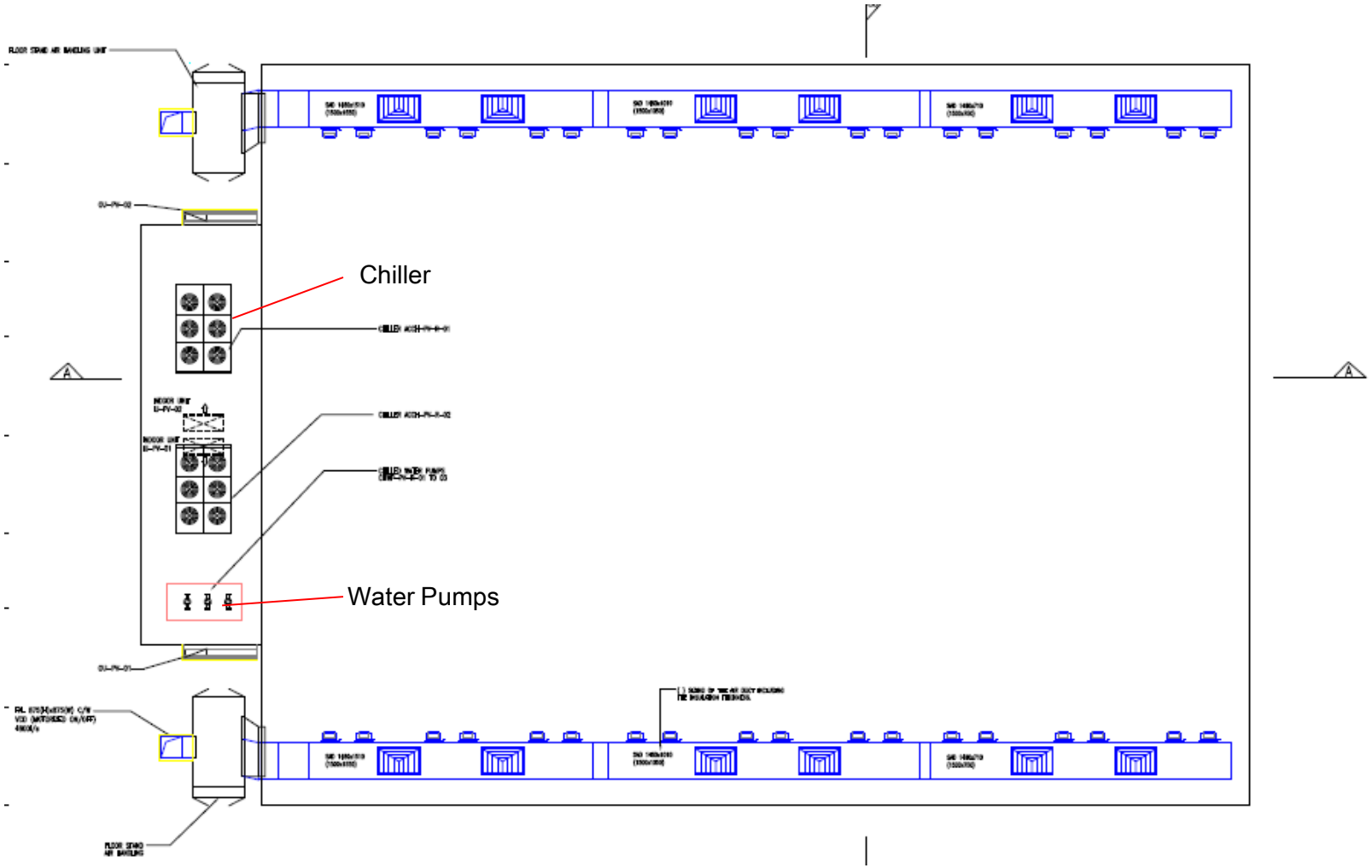

Annex B3

LOCATION OF CHILLERS AND WATER PUMPS

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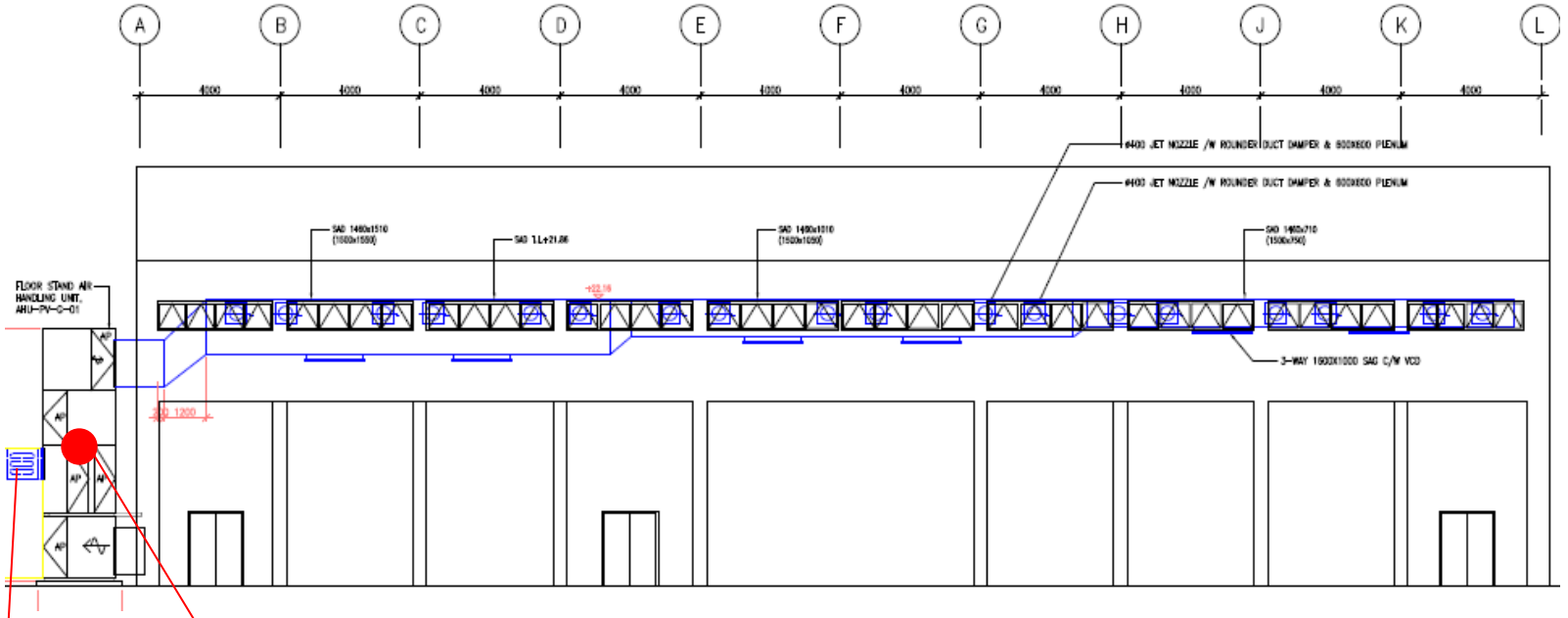
Annex C

Location of AHUs and fresh air intakes



Annex C1

Location of AHUs and its fresh air intakes

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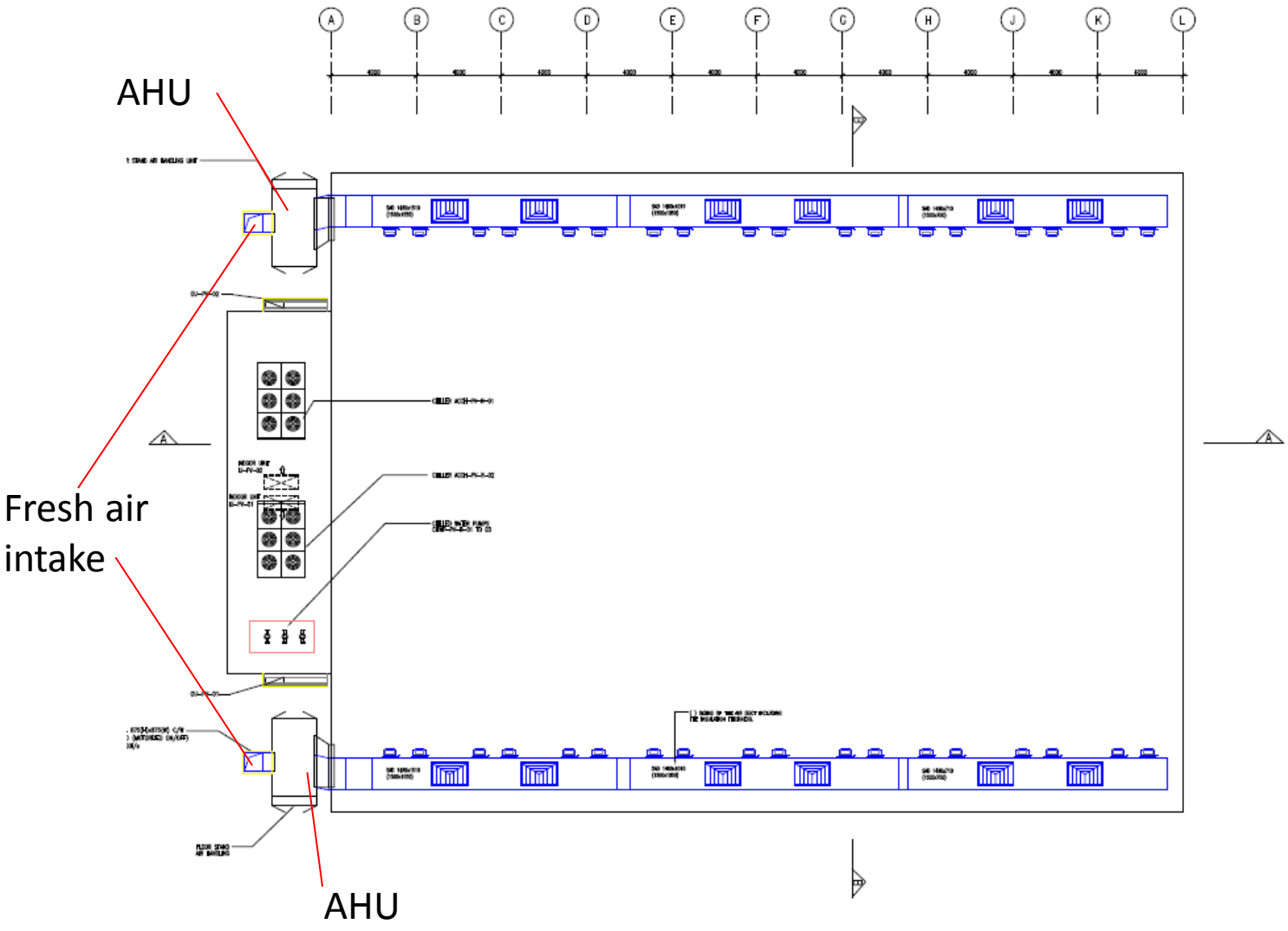

Annex C2

Location of AHUs and its fresh air intakes

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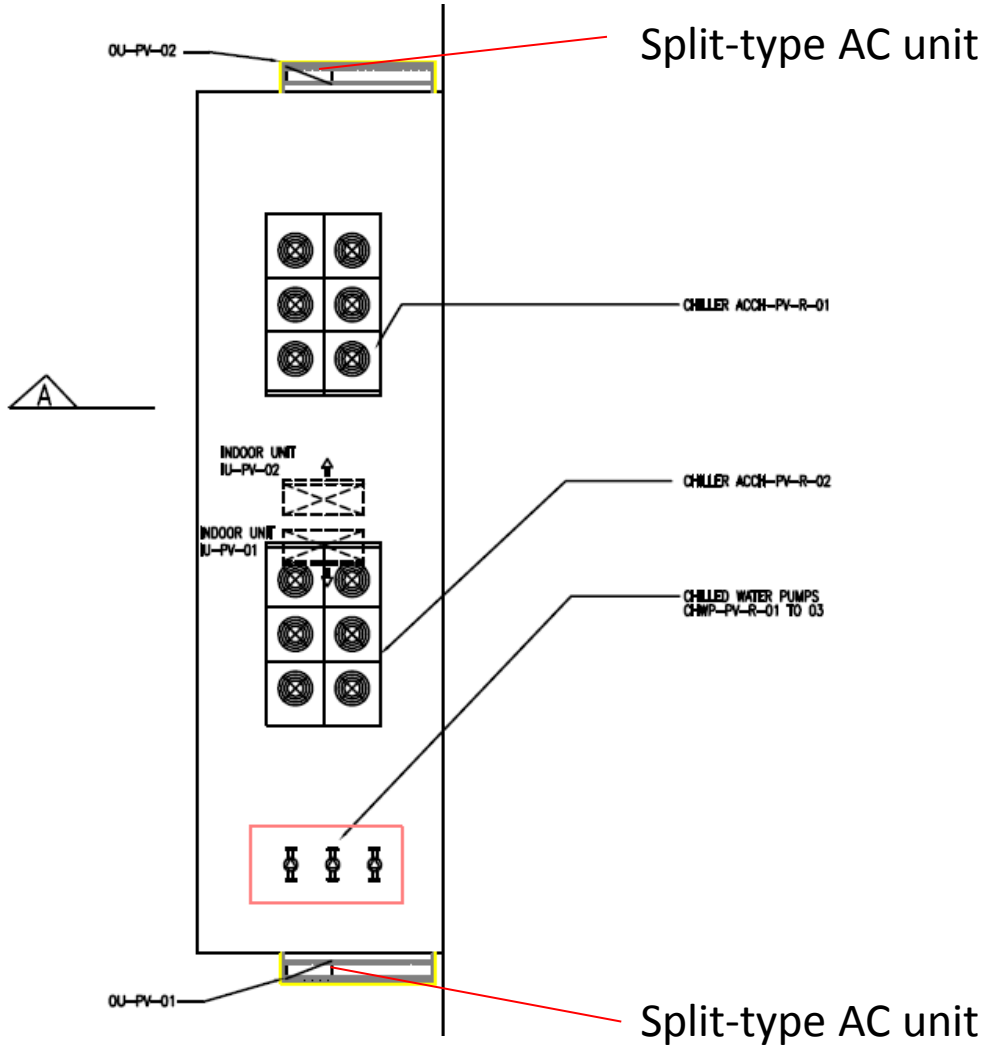
Annex D

Location of the Split type AC unit



Annex D

LOCATION OF THE SPLIT TYPE AC UNIT

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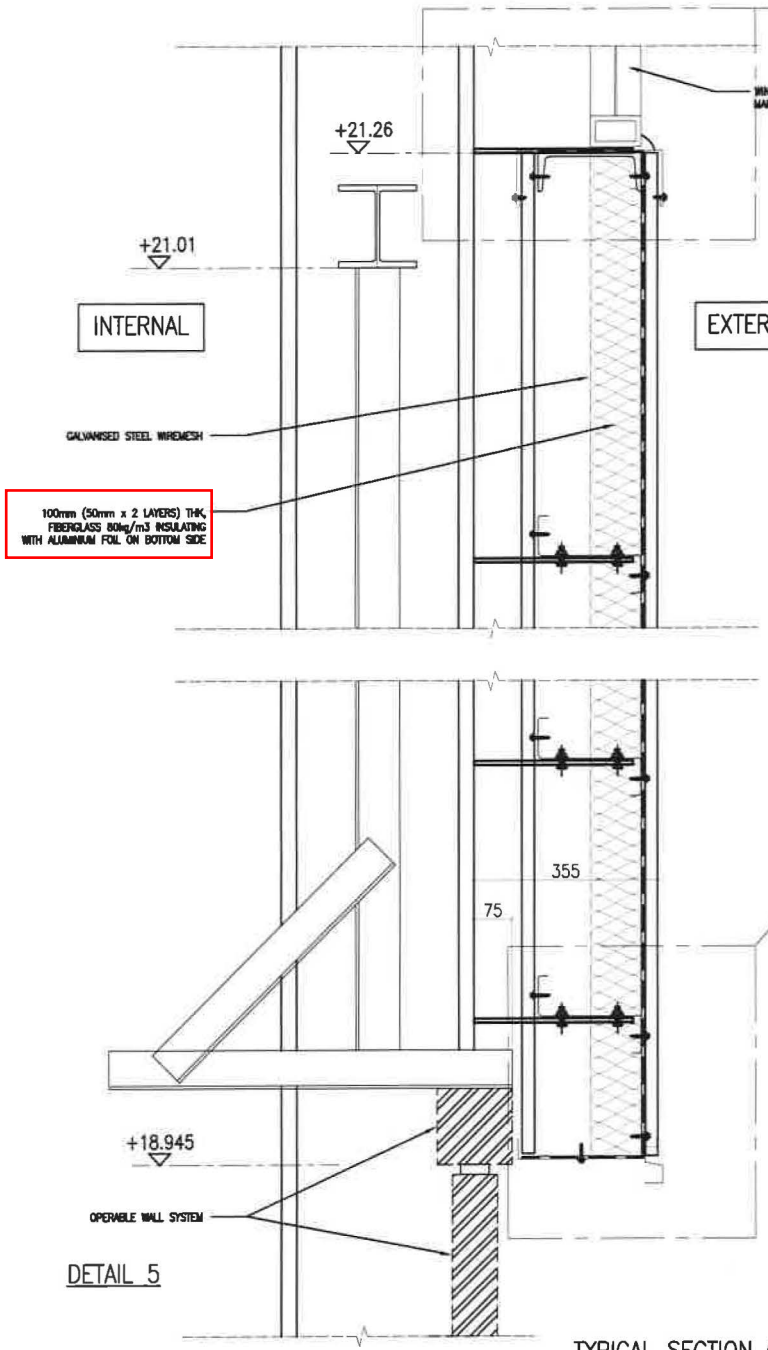
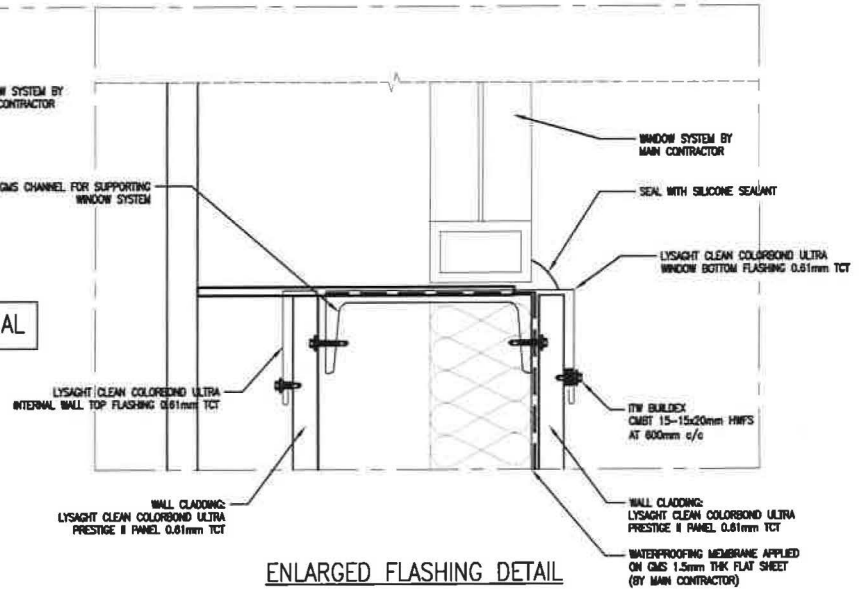
Annex E

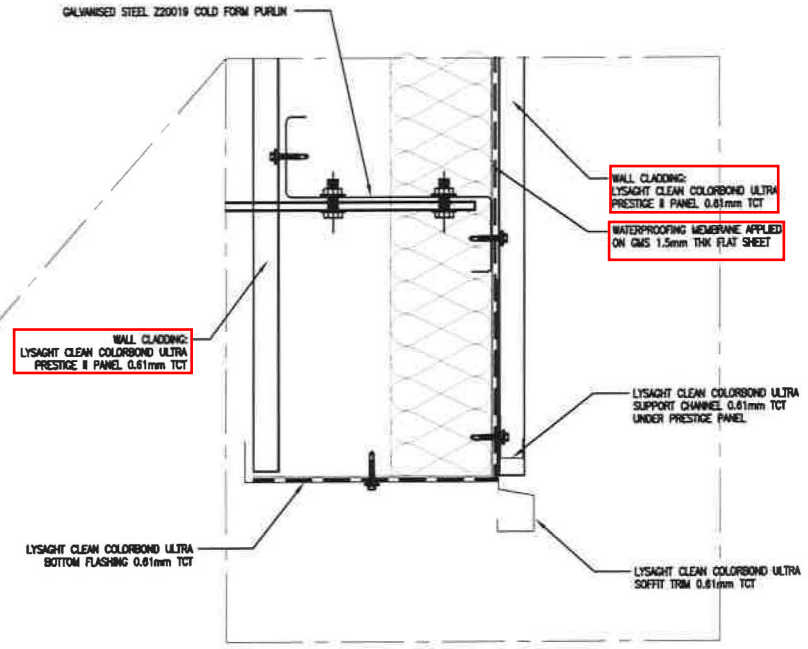
Wall Panel Drawing



DETAIL 5



ENLARGED FLASHING DETAIL



ENLARGED FLASHING DETAIL

TYPICAL SECTION OF PRESTIGE INSULATED WALL CLADDING SYSTEM 1

GENERAL NOTES:

1. ALL DIMENSIONS ARE SHOWN IN MILLIMETERS UNLESS OTHERWISE STATED.
2. DO NOT SCALE DRAWING.

REV.	DESCRIPTION	BY	DATE
0	ISSUE FOR COMMENT	BL	13-8-14

ARCHITECT :

DAVID S K AU & ASSOCIATES LTD.

MAIN CONTRACTOR :

NEW PROGRESS CONSTRUCTION CO. LTD.

PROPRIETARY ROOFING SYSTEM MANUFACTURER :

AUTHORIZED AGENT:

PROJECT:

OCEAN PARK HONG KONG
WATERFRONT PLAZA PERFORMANCE VENUE FORMATION, WATERFRONT

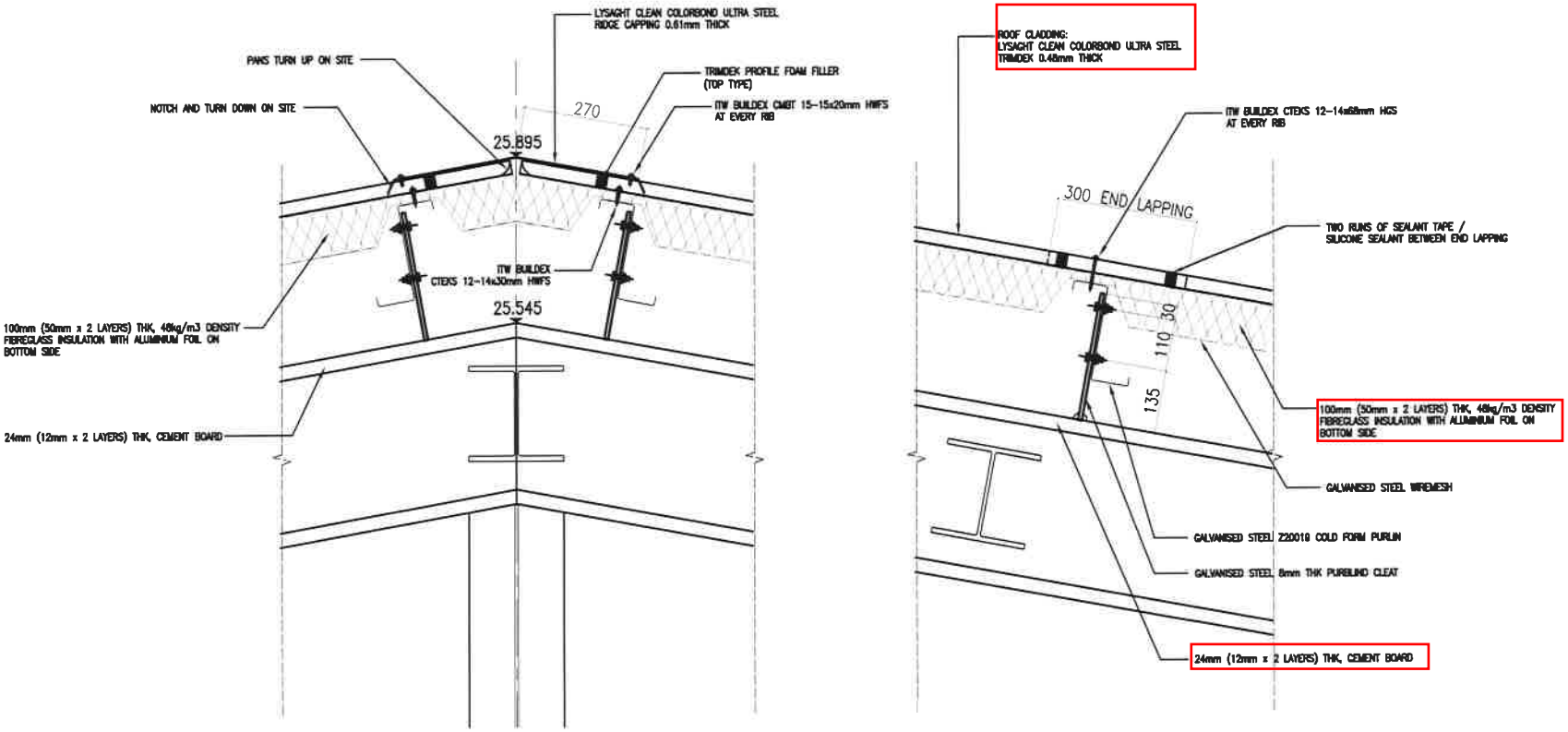
DRAWING TITLE:

TYPICAL DETAIL 3

DRAWN	MI	A/C APPR.	A/C
CHKD		PROJECT MANAGER	
SCALE	1:5	DATE	15-08-14
CAD REF.			
DWG NO.	DE/03	REV.	0

Annex F

Roof Panel Drawing and Cement Board Specifcation



TYPICAL SECTION OF TRIMDEK INSULATED ROOF CLADDING SYSTEM

GENERAL NOTES:

1. ALL DIMENSIONS ARE SHOWN IN MILLIMETERS UNLESS OTHERWISE STATED.
2. DO NOT SCALE DRAWING.

REV.	DESCRIPTION	BY	DATE
0	ISSUE FOR COMMENT	BL	13-3-14

ARCHITECT :

DAVID S K AU & ASSOCIATES LTD.

MAIN CONTRACTOR :

NEW PROGRESS CONSTRUCTION CO. LTD.

PROPRIETARY ROOFING SYSTEM MANUFACTURER :

AUTHORISED AGENT:

PROJECT:

OCEAN PARK HONG KONG
WATERFRONT PLAZA PERFORMANCE VENUE FORMATION, WATERFRONT

DRAWING TITLE:

TYPICAL DETAIL 1

DRAWN	MI	A/C APPR.	A/C
CHKD		PROJECT NUMBER	
SCALE	1:5	DATE	15-08-14
CAD REF.			
DWG NO.	DE/01	REV.	0

德译认证
DE CERTIFICATION APPROVE

TEST REPORT

Report No.: ECO(13)-151-CPR

Type of Equipment:	**FIBER CEMENT BOARD**
Model No.:	**3mm, 4mm, 5mm, 6mm, 8mm, 9mm, 10mm, 12mm, 15mm,18mm, 20mm, 22mm,24mm**
Issued Date:	**2013-04-26**
Brand Name/Trade mark:	NOYA M & T
Test standard(s):	**EN 12467:2012**

Prepared for:

Xiamen Noya Manufacturing & Trading Co.,Ltd

2L,Xinghu Building,No.46,Huli Road Xiamen

Fujian,P.R.China

Prepared by

Shanghai DEYI Investment Co., Ltd
Room 2005, Building A, Global World Building, No.168 Yuyuan Road,
Jing'an District, Shanghai, P.R.C
Website: www.deyi-cert.com

TEST REPORT

EN 12467:2012

Fibre-cement flat sheets — Product specification and test methods

Report
Report reference No. ..... : No: ECO(13)-151-CPR
Tested by(+ signature)..... : Downey Xue
Reviewed by(+ signature)..... : Gao Yiming
Date of issue ..... : 2013-04-26
Number of pages (Report) ..... : 8

Testing laboratory
Name. ..... :Shanghai Deyi Investment Co., Ltd.
Address .....:Room 2005, Building A, Global World Building, No.168 Yuyuan Road, Jing'an District, Shanghai, P.R.C.
Testing location .....:Room 2005, Building A, Global World Building, No.168 Yuyuan Road, Jing'an District, Shanghai, P.R.C.

Client
Name .....: Xiamen Noya Manufacturing & Trading Co.,Ltd
Address ..... : 2L,Xinghu Building,No.46,Huli Road,Xiamen Fujian,P.R.China

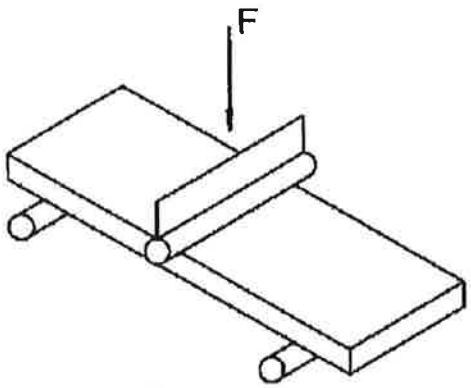
Test specification
Standard ..... : EN 12467:2012
Test procedure ..... : CE-CPR
Procedure deviation ..... : N.A.
Non-standard test method ..... : N.A.

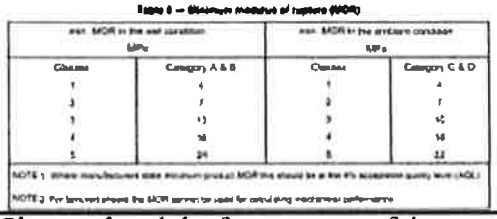
General description

Xiamen Noya Cement Board is made of using the revolutionary HPSC technology. This unique technology makes these boards' totally moisture resistant, termite and fire resistant. These boards are ideal for residential, commercial and industrial use. The board, in combination with different substrate framework like timber, steel and aluminum, offers unique advanced dry wall constructions, which leverage space utilization to the maximum along with substantial savings on time. It gives the architects major flexibility of changing designs with thermal & acoustic insulation besides being maintenance free and highly durable.

Test Property	Test Method	Test Principle / Requirements	Test Result
Composition	EN 12467:2012 Clause 5.1.1	Sheets shall consist essentially of cement or a calcium silicate formed by a chemical reaction of a siliceous and a calcareous material, reinforced by fibres. The cement shall comply with EN 197-1 or with technical specifications relevant in the country of use.	Pass. Cement,Quartz Sand,Fiber
Appearance and finish	EN 12467:2012 Clause 5.1.2	The exposed face of the sheets can be with or without texture. The sheets can be coloured or left in their natural colour. The sheets can also receive adherent coloured or uncoloured coatings on their surface. Variations of the surface appearance which do not impair the fitness for purpose of the sheets are permitted.	Pass. gray.
Classification	EN 12467:2012 Clause 5.2	Category A Sheets which are intended for applications where they may be subjected to heat, high moisture and severe frost. Category B Sheets which are intended for applications where they may be subjected to heat, moisture and occasional frost, e.g. where they are either protected from or not subjected to severe weathering conditions. Category C Sheets which are intended for internal applications, where they may be subjected to heat and moisture, but not to frost. Category D Sheets for rigid underlayer applications.	Pass. Category A
Groups of sizes	EN 12467:2012 Clause 5.2.6	Small size sheets Sheets for which the method of installation includes horizontal overlap. Their dimensions are generally such that their area is < 0,4 m^2 and have a length/width relation = 3. Large size sheets Sheets which do not correspond to indicators for small size sheets. Large sheets may be declared as "small size sheets" provided tolerances for small size	Pass. Large size sheets

Test Property	Test Method	Test Principle / Requirements	Test Result
		sheets apply and are specified in the manufacturer's literature.	
Nominal length and width	EN 12467:2012 Clause 5.3.2	The manufacturer shall specify the nominal length and width of the sheets.	Pass. 900mm*1800mm 915mm*1815mm 1200mm*2400mm 1220mm*2440mm
Thickness	EN 12467:2012 Clause 5.3.3	The manufacturer shall specify the nominal thickness of the sheets.	Pass. 3mm, 4mm, 5mm, 6mm, 8mm, 9mm, 10mm, 12mm, 15mm, 18mm, 20mm, 22mm, 24mm
Tolerances on length and width	EN 12467:2012 Clause 5.3.4.1	Tolerances on length and width shall be in accordance with Table 1, for the appropriate level. **Table 1 — Tolerances on nominal dimensions in accordance with value and level** Nominal dimension a* / Level I / Level II a ≤ 600 mm / ± 3 mm / ± 4 mm 600 mm < a ≤ 1 000 mm / ± 3 mm / ± 5 mm 1 000 mm < a ≤ 1 600 mm / ± 0,3% a / ± 0,5% a 1 600 mm < a / ± 5 mm / ± 8 mm * a is the nominal width or length	Pass. Level II. ± 5 mm
Tolerances on thickness	EN 12467:2012 Clause 5.3.4.2	For non-textured sheets, tolerances shall be in accordance with Table 2. **Table 2 — Tolerances on thickness for non-textured sheets** e ≤ 6 mm / ± 0,6 mm 6 mm < e ≤ 20 mm / ± 10 % e e > 20 mm / ± 2 mm	Pass. The tolerance on thickness is ± 0.3mm.
Straightness of edges	EN 12467:2012 Clause 5.3.5.1	The tolerances on the straightness of edges are defined as a percentage of the length of the edge of the relevant dimensions (length or width), and shall be in accordance with Table 4 for the appropriate level. **Table 4 — Tolerances on straightness of edges** Level I / Level II 0,1% / 0,3%	Pass. Level I The tolerances on the straightness of edges is 0.1%.
Squareness of edges	EN 12467:2012 Clause 5.3.5.2	The tolerances on squareness of sheets shall be in accordance with Table 5, for the appropriate level. **Table 5 — Tolerances on squareness of edges** Level I / Level II 2 mm/m / 4 mm/m	Pass. Level I The tolerances on squareness of sheets is 2mm/m.
Apparent density	EN 12467:2012 Clause 5.4.2&	The manufacturer shall specify in his literature the minimum apparent density	Pass. The density is at

Test Property	Test Method	Test Principle / Requirements	Test Result
	Clause 7.3.1	for each category of sheet. Determine the volume V of the specimen by immersion in water or another method having an equivalent accuracy. In the case of immersion in water, the specimen shall be saturated in water beforehand. Determine the mass m of the specimen after drying it in a ventilated oven maintained at 100 °C to 105 °C for 24 h. The apparent density is given by the formula: $d = \frac{m}{V}$ When tested in accordance with the method specified in 7.3.1 the density shall be not less than this value.	least 1.20g/cm³.
Mechanical characteristics – Bending strength	EN 12467:2012 Clause 5.4.3 & Clause 7.3.2	Arrange the test piece with the underside against the supports and load the test piece by means of the central loading bar. Load the specimen such that breakage occurs within 10 s and 30 s. A constant rate of deflection is preferred.  Where this facility is not available a constant rate of loading is acceptable. For non-textured specimens measure the thickness at two points, either before breaking along the loading line or after breaking along the broken edge as shown in Figure 4. The modulus of rupture MOR, in megapascals, for each breaking load direction is given by the formula:	Pass. Bending Strength: Transverse= 11.0N/mm² Vertical= 8.5N/mm² Class 2.

Test Property	Test Method	Test Principle / Requirements	Test Result
		$$MOR = \frac{3Fl_s}{2be^2}$$ The minimum modulus of rupture of the sheets in the weaker direction shall be not less than 70 % of the specified value in Table 6 for the average of the two directions. 	
Water impermeability	EN 12467:2012 Clause 5.4.4 & Clause 7.3.3	Place and seal the frame on top of the face of the specimen and fill with water to a height of 20 mm above the face of the sheet. Place the specimens in a controlled environment at (23 ± 5) °C and (50 ± 10) % relative humidity so that the underside can be viewed without moving the specimen during the test. The duration of the test shall be 24 h. Examine the under face after 24 h , traces of moisture may appear on the under surface of the sheet, but in no instance shall there be any formation of drops of water.	Pass. There is no instance any formation of drops of water.
Freeze-thaw	EN 12467:2012 Clause 5.5.2 & Clause 7.4.1	specimens to the relevant number of freeze-thaw cycles as specified in Table 7: -cool (freeze) in the freezer which shall reach a temperature of (-20 ± 4) °C within 1 h to 2 h and hold at this temperature for a further 1 h, -heat (thaw) in the water bath which shall reach a temperature of (20 ± 4) °C within 1 h to 2 h and hold at this temperature for a further 1 h. During both the cooling and heating (freezing and thawing) cycles position the specimens to enable free circulation of the conducting medium (air in the freezer or water in the bath) around them.	Pass. No distortion after 100 repeated cycles of freezing and thawing. The ratio R_L is 0.87.

<table>
<tr><th>Test Property</th><th>Test Method</th><th>Test Principle / Requirements</th><th>Test Result</th></tr>
<tr><td></td><td></td><td>The temperature indicated refers to the temperature of the media, i.e. air or water.
Each freeze/thaw cycle shall take between 4 h and 6 h but an interval of 72 h maximum may be taken between cycles during which the specimens shall be stored in water at 20 °C.
When tested in accordance with 7.4.1, after 100 freeze-thaw cycles for Category A and 25 cycles for Category B and D, the ratio RL as defined in 7.4.1.4 shall be not less than 0,75.</td><td></td></tr>
<tr><td>Heat-rain</td><td>EN 12467:2012 Clause 5.5.3 & Clause 7.4.2</td><td>Fix the specimens to the test frame in accordance with the manufacturer's recommendations and the following:
-edge fixing distance-minimum specified;
-spacing between fixings-maximum specified;
-include all waterproofing and other attachments normally specified;
-include joints in both directions.
Subject the assembled frame to the test cycle in accordance with Table 11:
Table 11 — Heat-rain cycle<table><tr><th>Cycles</th><th>Duration</th></tr><tr><td>Water spray</td><td>2 h 50 min ± 5 min</td></tr><tr><td>Pause</td><td>10 min ± 1 min</td></tr><tr><td>Radiant heat</td><td>2 h 50 min ± 5 min</td></tr><tr><td>Pause</td><td>10 min ± 1 min</td></tr><tr><td>Total cycle
Repeat all steps</td><td>6 h ± 12 min</td></tr></table>When tested in accordance with 7.4.2, after 50 heat-rain cycles for Category A and 25 cycles for Category B, any visible cracks, delamination, warping and bowing or other defects in the sheets shall not be of such a degree as to affect their performance in use.
(a) Water tightness is tested according to 5.4.4.
(b) Warping and bowing are visually assessed.</td><td>Pass.
After 50 heat-rain cycles,any visible cracks, delamination, warping and bowing and other defects in the sheets are not to affect their performance in use.</td></tr>
<tr><td>Warm water</td><td>EN 12467:2012 Clause 5.5.4 & Clause 7.3.5</td><td>Immerse the 10 specimens of the second lot in water at (60 ± 2) °C saturated with product of the same composition, for (56</td><td>Pass. The ratio R_L is not less than 0.75.</td></tr>
</table>

Test Property	Test Method	Test Principle / Requirements	Test Result
		± 2) days. At the end of this period, condition the specimen in accordance with Table 10, then carry out the bending strength test in accordance with 7.3.2. After 56 days at 60 °C, the ratio R_L as defined in 7.3.5.4 shall be not less than 0.75.	
Soak-dry	EN 12467:2012 Clause 5.5.5& Clause 7.3.6	the relevant number of soak-dry cycles as specified in Table 7 consisting of: -immersion in water at ambient temperature (more than 5 °C) for 18 h; -drying in a ventilated oven of (60 ± 5) °C and relative humidity of less than 20% for 6 h. The 20% humidity shall be achieved for at least 3 h prior to the conclusion of the 6 hours drying. If necessary, an interval up to 72 h between cycles is allowed. During this interval, specimens shall be stored in immersed conditions. After the required number of cycles, place the specimens in a laboratory atmosphere for 7 days. When tested in accordance with 7.3.6, after 50 soak-dry cycles for Category A and 25 cycles for Categories B, C and D the ratio RL as defined in 7.3.6.4 shall be not less than 0,75.	Pass. After 50 cycles,t the ratio R_L is not less than 0.75.
Reaction to fire	EN 12467:2012 Clause 5.6.1& Clause 7.5	Sheets shall be tested and classified in accordance with EN 13501-1. The sheets to be tested shall, where the test method requires, be installed, in addition to the general provisions given in the test method, in a manner representative of their intended use in accordance with the manufacturer's specifications.	Pass. It is Flame Resistant to Combustion at 800 and Remains Flameless at 1200 . Class A
Release of dangerous substances	EN 12467:2012 Clause 5.6.2	For products containing substance(s) defined in Council Directive 76/769/EEC, the content shall be declared by the manufacturer. This applies to substances contained in the original formulation or created during the manufacturing process. In addition see Annex ZA.	Pass. It is manufactured from a unique blend of Mineral Components, and does NOT contain any Toxic ingredients ,Asbestoes,

Test Property	Test Method	Test Principle / Requirements	Test Result
			Formaldehyde or Ammonia

A.1 Photos

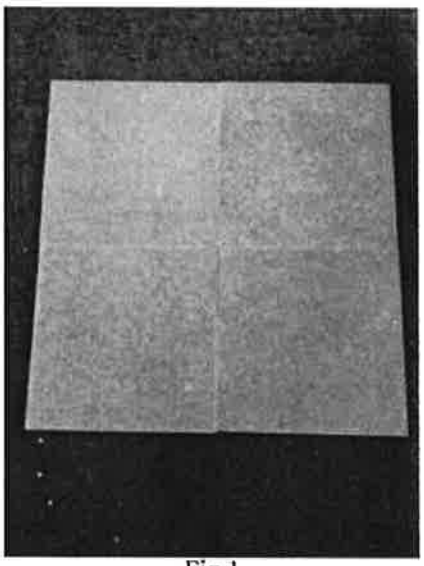


Fig.1

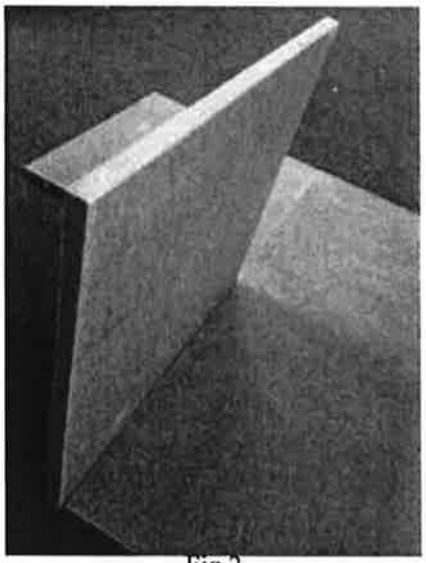


Fig.2

A.2 Differences

Instructions between he same series but different model:

The same material but different size and thickness ,such as :
3mm*1220mm*2440mm3mm*1220mm*2440mm;
3mm*900mm*1800mm, 3mm*915mm*1815mm;

4mm*1220mm*2440mm,4mm*1220mm*2440mm;
4mm*900mm*1800mm, 4mm*915mm*1815mm;

5mm*1220mm*2440mm,5mm*1220mm*2440mm;
5mm*900mm*1800mm,5mm*915mm*1815mm;

6mm*1220mm*2440mm,6mm*1220mm*2440mm;
6mm*900mm*1800mm, 6mm*915mm*1815mm;

8mm*1220mm*2440mm,8mm*1220mm*2440mm;
8mm*900mm*1800mm, 8mm*915mm*1815mm;

9mm*1220mm*2440mm,9mm*1220mm*2440mm;
9mm*900mm*1800mm, 9mm*915mm*1815mm;

10mm*1220mm*2440mm,10mm*1220mm*2440mm;
10mm*900mm*1800mm, 10mm*915mm*1815mm;

12mm*1220mm*2440mm,12mm*1220mm*2440mm;
12mm*900mm*1800mm, 12mm*915mm*1815mm;

15mm*1220mm*2440mm,15mm*1220mm*2440mm;
15mm*900mm*1800mm, 15mm*915mm*1815mm;

18mm*1220mm*2440mm,18mm*1220mm*2440mm;
18mm*900mm*1800mm, 18mm*915mm*1815mm;

19mm*1220mm*2440mm,19mm*1220mm*2440mm;
19mm*900mm*1800mm, 19mm*915mm*1815mm;

20mm*1220mm*2440mm,20mm*1220mm*2440mm;
20mm*900mm*1800mm, 20mm*915mm*1815mm;

22mm*1220mm*2440mm,22mm*1220mm*2440mm;
22mm*900mm*1800mm, 22mm*915mm*1815mm;

24mm*1220mm*2440mm,24mm*1220mm*2440mm;
24mm*900mm*1800mm, 24mm*915mm*1815mm;

A.3 Technology Data

Raw Materials: Cement,Quartz Sand,Fiber
Basic Color:Gray
Density:=1.20g/cm3
Moisture Content: =10%
Water Absorbing Capacity: =55%
Thermal Conductivity: Average=0.20W/MK
Bending Strength: Transverse=11.0N/mm3 Vertical=8.5N/mm3
Radioactivity: Conforming to GB6566-2001 A Class
Fire Resistance: Incombustibility A Class(GB8624-A)
Packing: Wooden Pallet

Main characteristics
Fire resistant:
It is Flame Resistant to Combustion at 800 and Remains Flameless at 1200 .
Non-Flammability: Grade A

Weather resistant:
Resistant to Deformation in Wet, Hot and Dry Conditions.
Can be used at -40 degree.Out of Shape Rate in the Condition of Wet or Dry is 0.26%.

Water and Damp Proof:
The board still keeps Intact after being Soaked in Water for One Month ,the Phenomenon of Swelling and Out of Shape will Not Happen.
It will NOT Disintegrate when Immersed in Water Or Exposed to Freeze/Thaw Cycles for Prolonged Periods of Time.

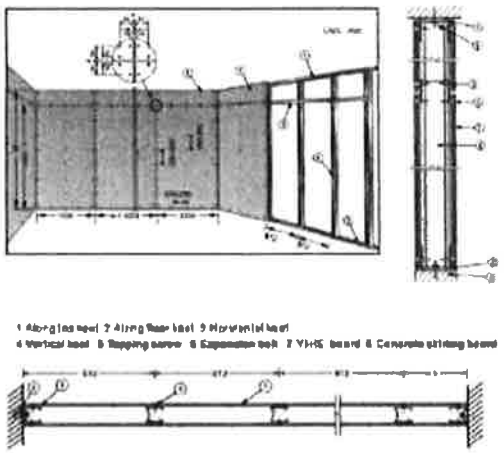
Bug & Mildew free:
After tests under ASTM G-21, this board has been found to be Non-Nutrient to Mold ,Fungus Growth or Insect Life.

Insulation:
After Inspection by the National Center for Quality Supervision and Testing of Fire Building Materials (NFTC) it has been found that the Superior Sound Insulation Factor of a Wall built from the board ranges between 44dB and 47 Db.
In addition to being a great Sound insulator ,This board benefits from having a Low Thermal Conductivity of 0.216 W/Mk which makes it a superior Heat Insulator.

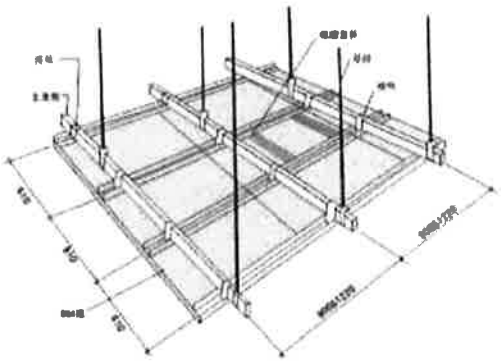
Environmentally Friendly:
This Environmentally Friendly board is manufactured from a unique blend of Mineral Components, and does NOT contain any Toxic ingredients ,Asbestoes, Formaldehyde or Ammonia

A.4 Installation Instruction

Interior wall installation



Suspension ceiling system



Annex G

Specification of the Operable Wall

Operable Walls

Section 10650

General Notes:

Panel..... Sigma Series - "A" Panel Construction - 49 S.T.C.- Incombustible.
Construction and Sound Rating
20 gauge sheet steel panel faces fusion welded to 16 gauge steel channel frame with 14 gauge top channel. Inner core of panel to be filled with fiberglass insulation.

Aluminum..... Aluminum to be 6063-T5 and 6063-T6 alloy
Track Finish..... CLEAR SATIN ANODIZED ALUMINUM FINISH
Panel Trim Finish..... CLEAR SATIN ANODIZED ALUMINUM FINISH
Hardware..... Exposed hardware: Powder coated to match aluminum extrusions
Concealed hardware: One coat shop prime
Flush pulls: Powder coated to match aluminum extrusions

Wall Covering Information:

**** Prime Painted Panel Faces.**
(Grey metalized primer with rust inhibitors.)
NOTE: If final finish is to be Paint, use only Satin or Flat finish paint.
Do not use "Gloss" or "Semi-gloss" paints.

Operable Wall Information:

Architect: If the partition presented in the following sheets is supported by an overhead structure, please indicate the live load deflection anticipated at mid-span of beam due to partition weight.

Approximate weight of panels is 28.9 kg/m2 per square meter.

Approximate weight of track is 15.0 Kg. per lineal meter.

Anticipated deflection: Indicate:

Contractor: Floor under partition in extended or stacked position to be level ±1/8". The "Hanger rod spacing templates" indicate location of track support required for operable wall. Beam drilling (by others) should conform to the templates and to related sections.

Project Information:

Job Name: Ocean Park - Water Front Plaza Location: Hong Kong

Architect: David S K AU & Associates LTD Contractor: Indicate

Distributor: Kinetics Noise Control Manufacturer: Advanced Equipment Corporation

Operable wall type: 5 M R 3 2 A 1 9** P.O.#/Contract#: #KNC-A911-14

Special Notes:

EXCLUSION:
1. Structural support & drilling or punching of same.
2. Sound Barrier above ceiling or soffit.
3. Lateral bracing
4. Installation
5. Any inport duties, taxes or permits that may be required.
6. Cost of Letter of Credit or any bank charges.
7. Freight from Fullerton, CA U.S.A. to Hong Kong

TERMS:
Pre-Payment by Wire Transfer
10% with Order
40% before TRACK shipment
50% before PANEL shipment

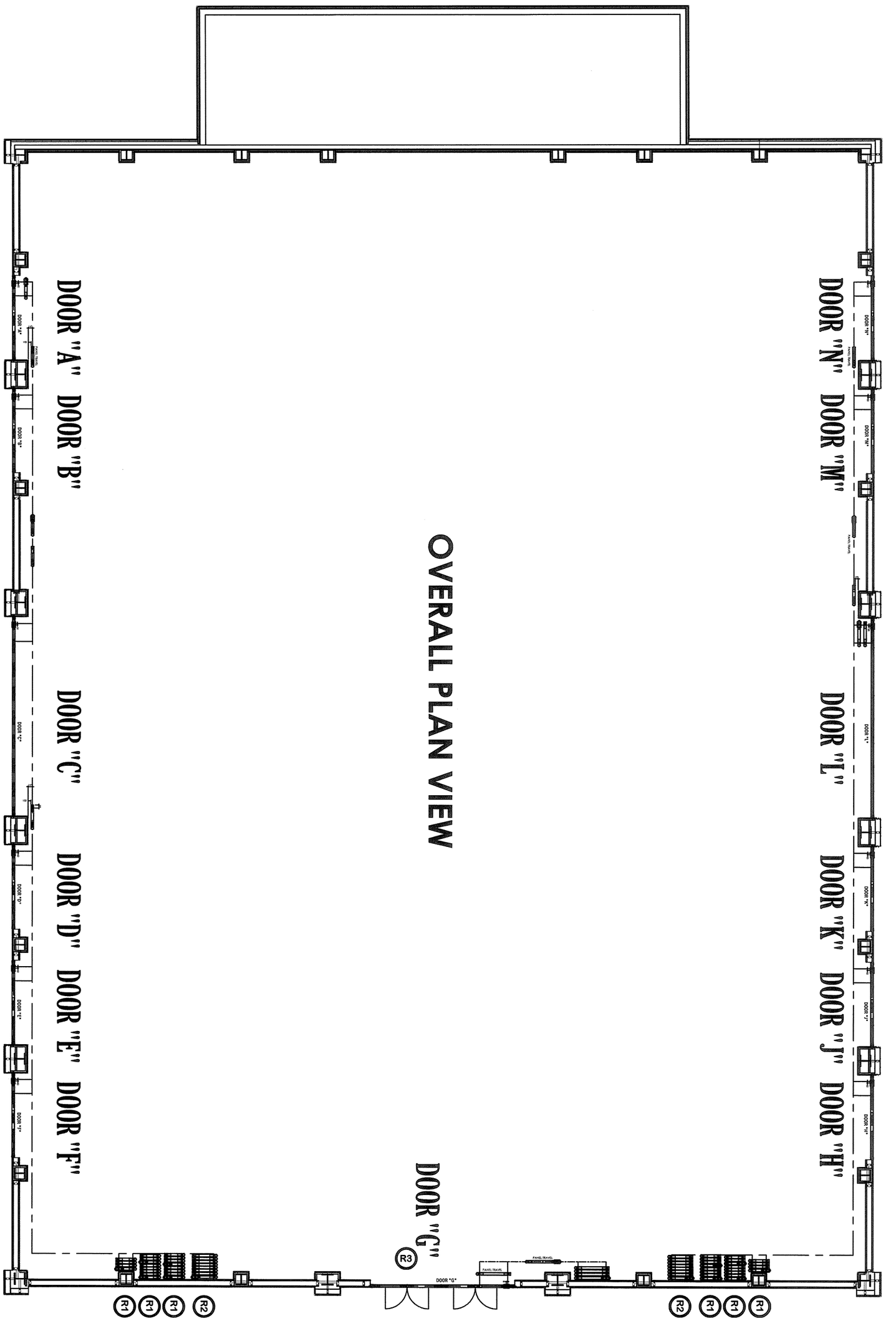
SHEET 1 OF 23

12444 JOB NUMBER

ENGINEERING BY: BOB DATE: 5/08/14
REV: DATE:
REV: DATE:

2401 West Commonwealth Ave
Fullerton, CA 92833
Tel: (714) 635-5350 Fax: (714) 525-6083

advanced equipment® CORPORATION



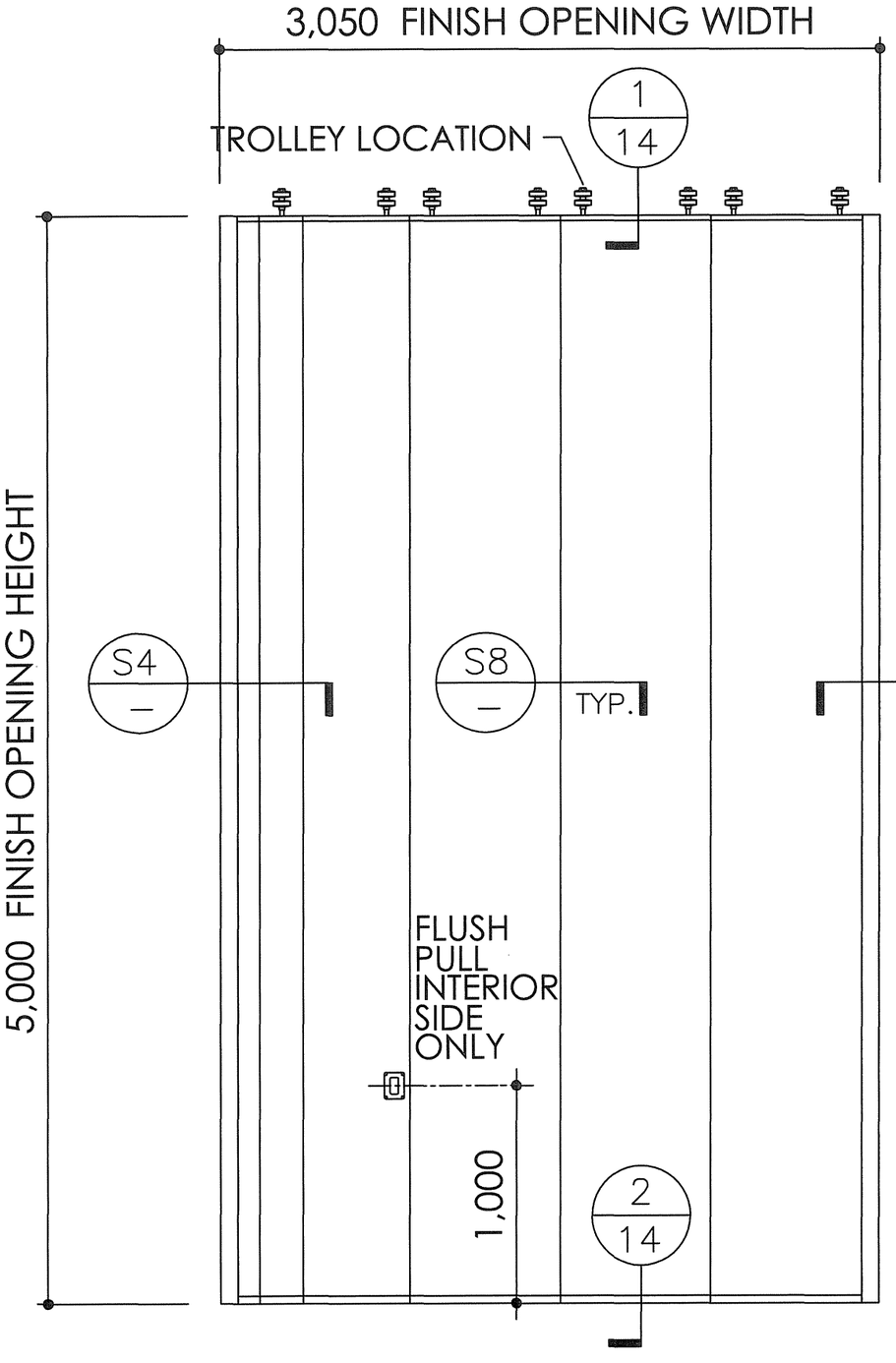
OVERALL PLAN VIEW

advanced equipment CORPORATION
2401 West Commonwealth Ave
Fullerton, CA 92833
Tel: (714) 635-5350 Fax: (714) 525-6083

ENGINEERING
BY: BOB DATE: 5/08/14
REV: DATE:
REV: DATE:

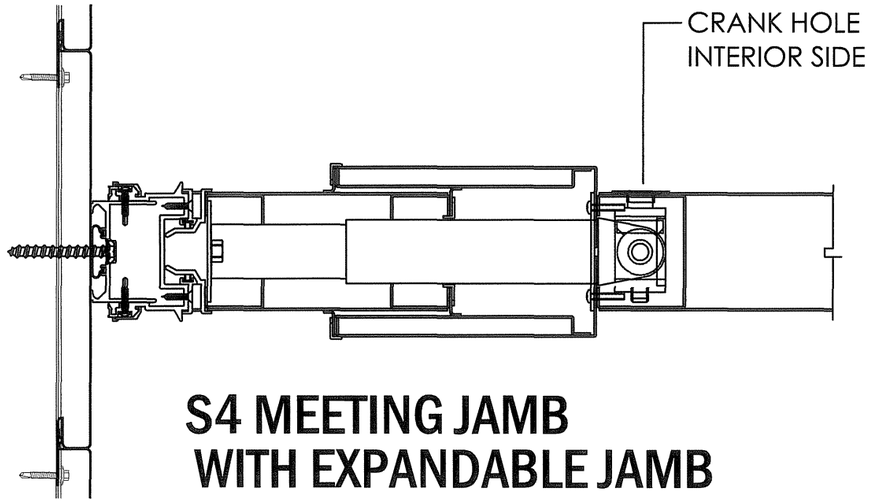
12444
JOB NUMBER

SHEET 2 OF 23



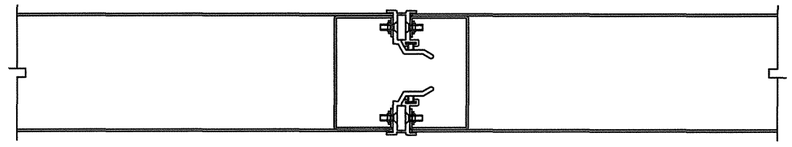
ELEVATION 10 thus

R1

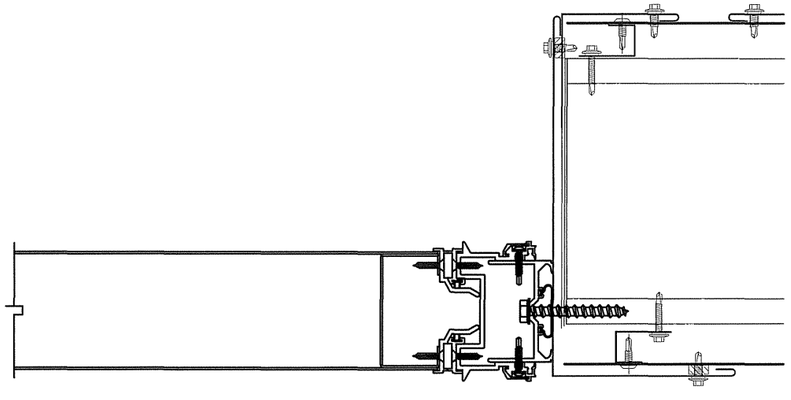


S4 MEETING JAMB WITH EXPANDABLE JAMB

DOOR "A"
DOOR "B"
DOOR "D"
DOOR "E"
DOOR "F"
DOOR "H"
DOOR "J"
DOOR "K"
DOOR "M"
DOOR "N"



S8 TYPICAL INTERSECTION



S9 MEETING JAMB

SECTIONS

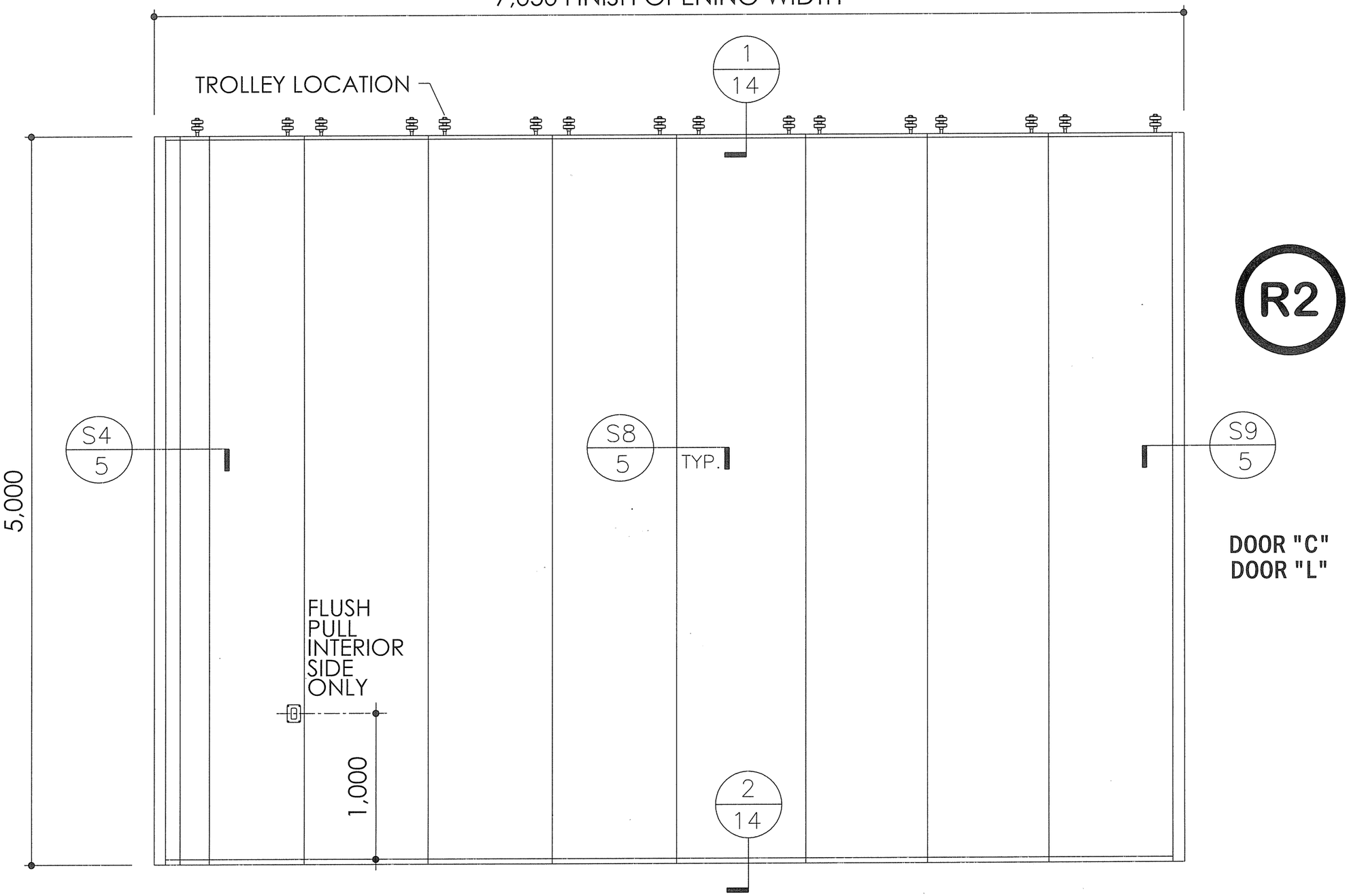
SHEET 5 OF 23

JOB NUMBER 12444

ENGINEERING
BY: BOB DATE: 5/08/14
REV:BOB DATE: 5/29/14
REV: DATE:

2401 West Commonwealth Ave
Fullerton, CA 92833
Tel: (714) 635-5350 Fax: (714) 525-6083

advanced equipment CORPORATION



ELEVATION 2 thus

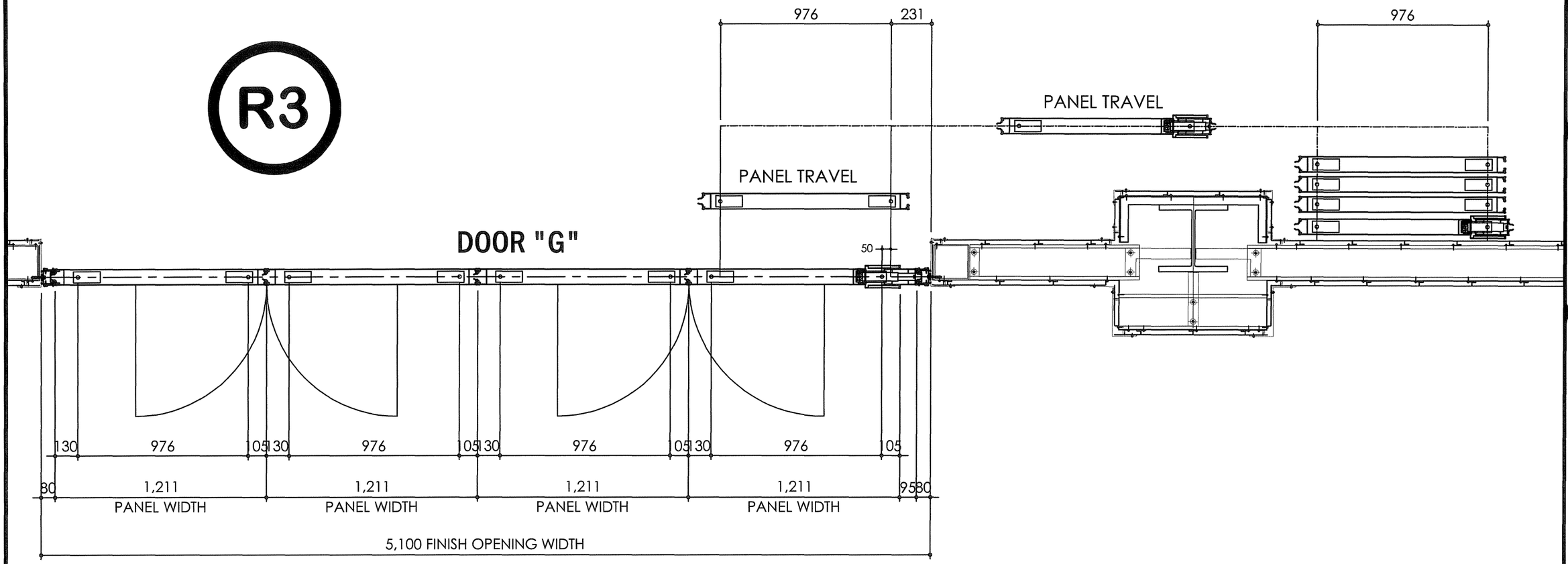
SHEET 8 OF 23

JOB NUMBER 12444

ENGINEERING
BY: BOB DATE: 5/29/14
REV:BOB DATE: 5/08/14
REV: DATE:

2401 West Commonwealth Ave
Fullerton, CA 92833
Tel: (714) 635-5350 Fax: (714) 525-6083

advanced equipment CORPORATION



PLAN VIEW
1 thus required as shown
DOOR "G"

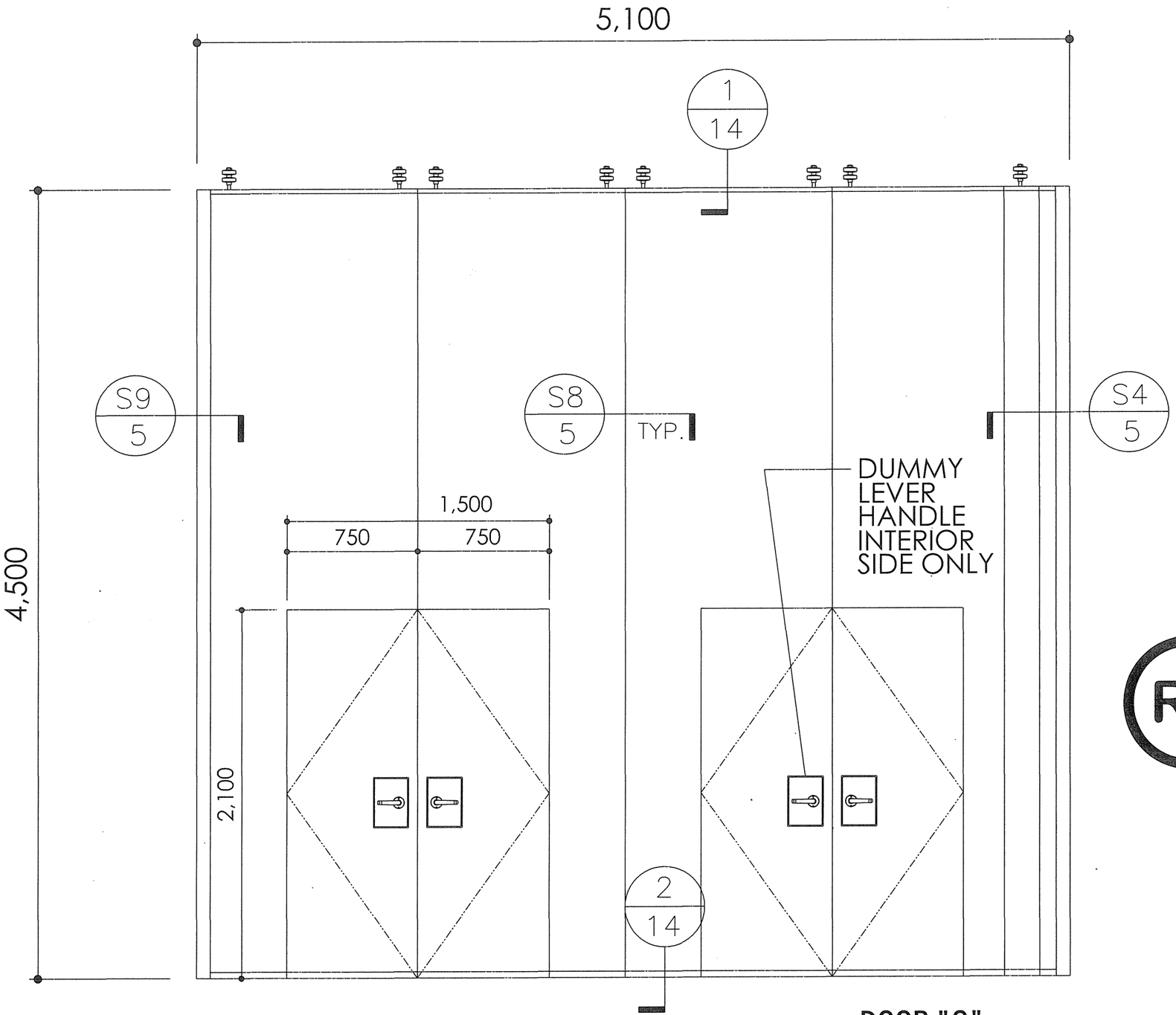
SHEET 9 OF 23

12444 JOB NUMBER

ENGINEERING
BY: BOB DATE: 5/08/14
REV:BOB DATE: 5/29/14
REV: DATE:

2401 West Commonwealth Ave
Fullerton, CA 92833
Tel: (714) 635-5350 Fax: (714) 525-6083

advanced equipment CORPORATION



R3

DOOR "G"

ELEVATION 1 thus

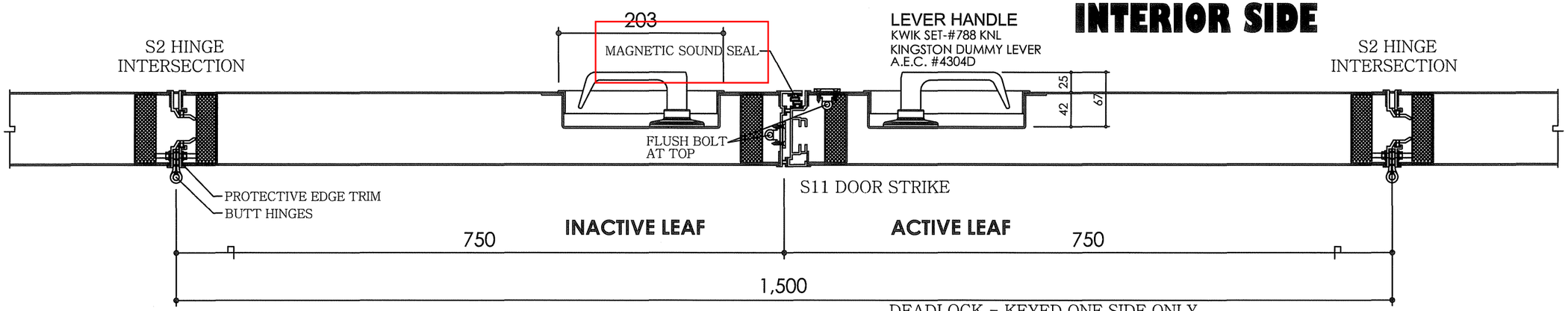
SHEET 10 OF 23

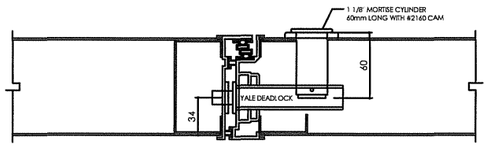
12444 JOB NUMBER

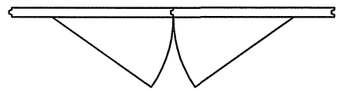
ENGINEERING
BY: BOB DATE: 5/08/14
REV:BOB DATE: 5/29/14
REV: DATE:

advanced equipment CORPORATION
2401 West Commonwealth Ave
Fullerton, CA 92833
Tel: (714) 635-5350 Fax: (714) 525-6083

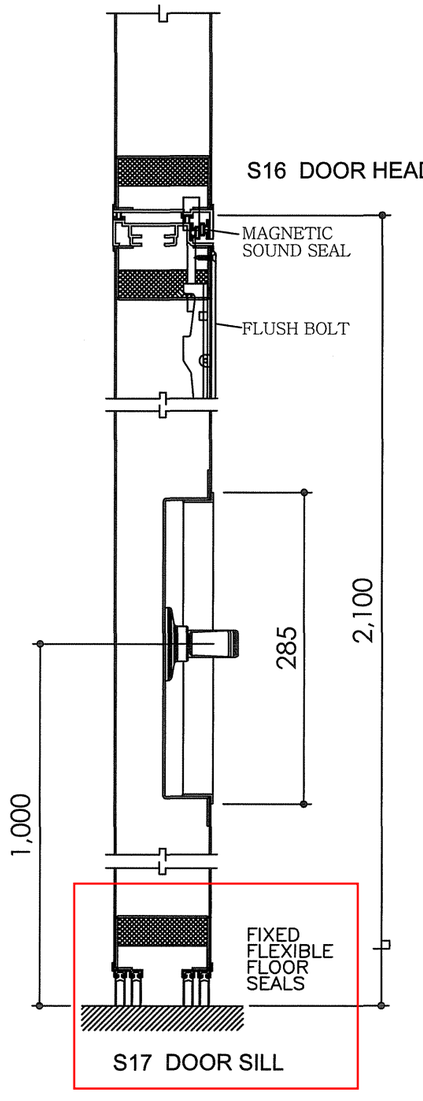
INTERIOR SIDE







PLAN VIEW

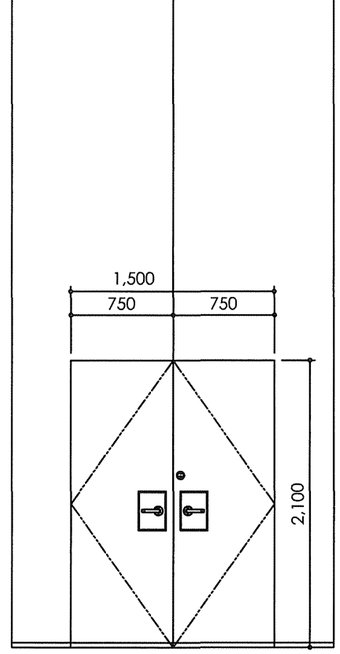


PASSDOOR SECTIONS

2 Thus Required

DOOR HARDWARE TO INCLUDE:

- ☒ TWO PAIR FULL MORTISE BUTT HINGES
- ☒ MAGNETIC DOOR SEALS
- ☐ FLUSH PULL - BOTH SIDES
- ☐ CONCEALED DOOR CLOSER
- ☐ EXIT SIGN - SELF-ILLUMINATING
  - FLUSH MOUNTED - PUSH SIDE ONLY
  - COLOR: ☐ RED ☐ GREEN
- ☒ YALE 300 SERIES DEADLOCK W/#2160 CAM
  - 1 1/8" DIA. CYLINDERS BY ☐ ADVANCED ☒ OTHERS
  - ☒ KEYED ONE SIDE ONLY (INTERIOR SIDE)
  - ☐ KEYED BOTH SIDES
  - 0 REQUIRED AT 1 3/8" LONG
  - 2 REQUIRED AT 2 5/8" LONG
- ☒ FIXED LEVER HANDLE
  - KWIK SET #788KNL
  - KINGSTON DUMMY LEVER



DOOR "G"

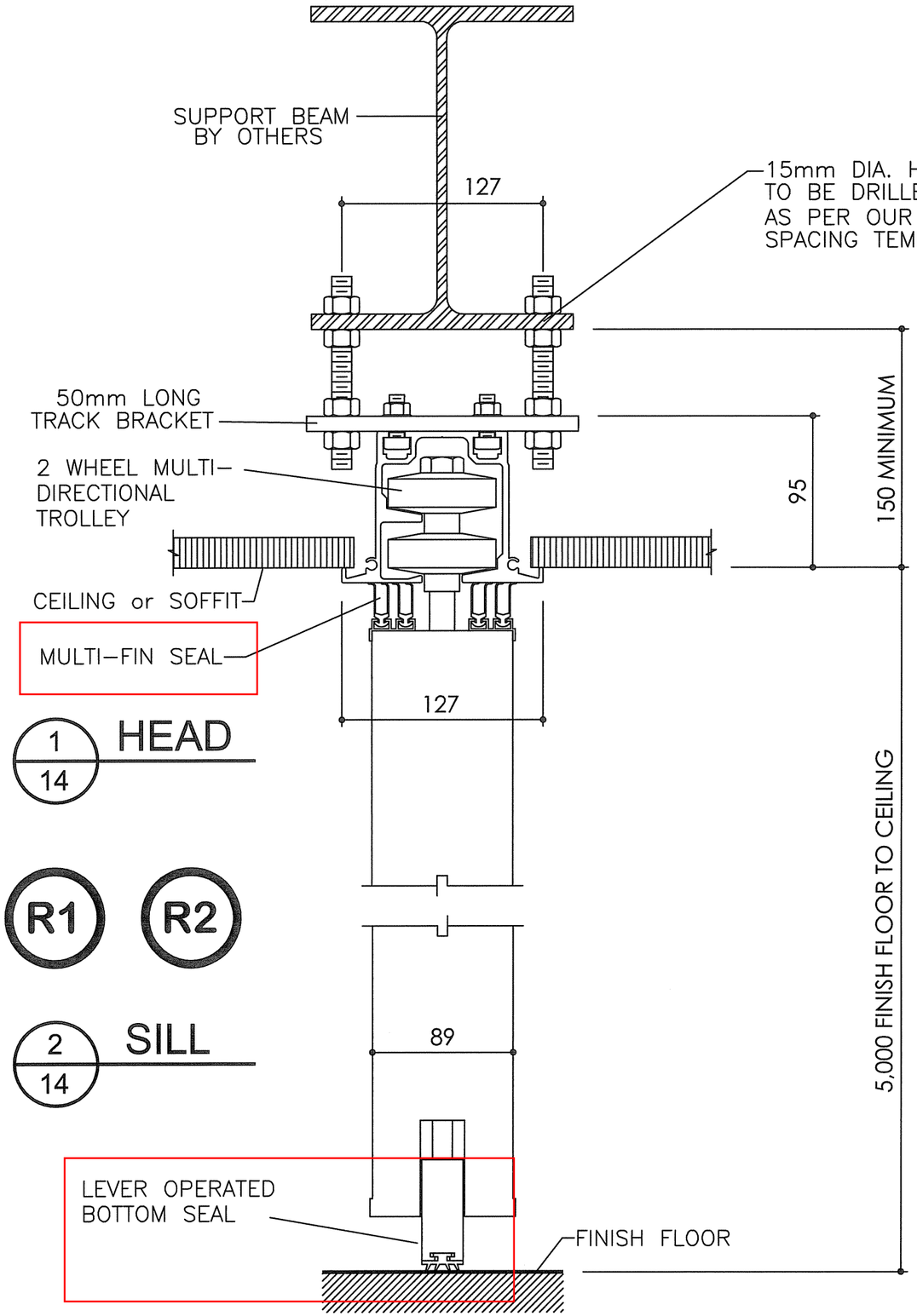
ELEVATION

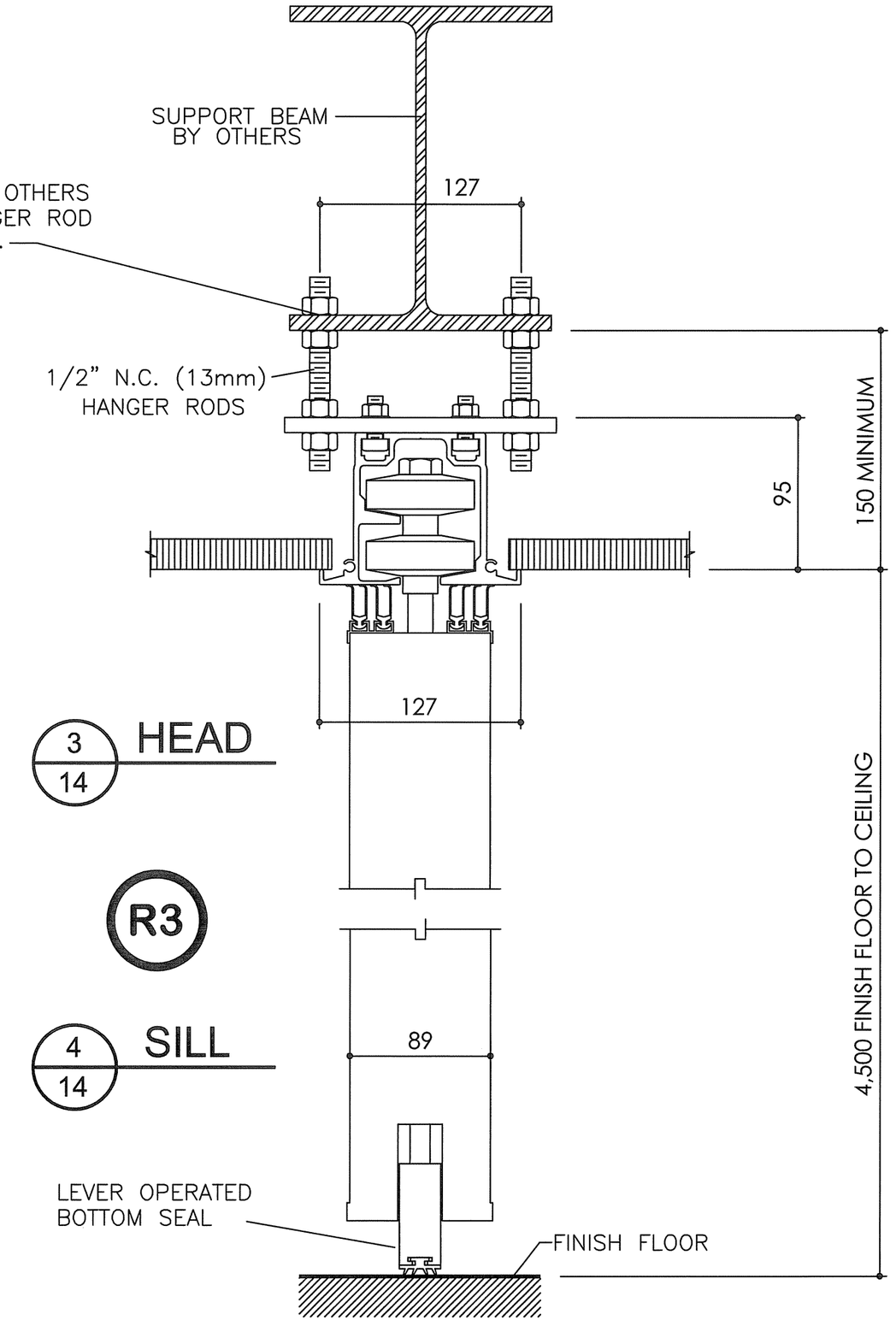
SHEET 11 OF 23

JOB NUMBER 12444

ENGINEERING BY: BOB DATE: 5/08/14
REV: DATE:
REV: DATE:

advanced equipment CORPORATION
2401 West Commonwealth Ave
Fullerton, CA 92833
Tel: (714) 635-5350 Fax: (714) 525-6083





SHEET 14 OF 23

12444 JOB NUMBER

ENGINEERING
BY: BOB DATE: 5/08/14
REV: DATE:
REV: DATE:

2401 West Commonwealth Ave
Fullerton, CA 92833
Tel: (714) 635-5350 Fax: (714) 525-6083

advanced equipment CORPORATION

Annex H

Laboratory Testing Report of Acoustic Door

聲學測試服務有限公司
Acoustic Testing Services Limited
Unit E, 2/F., Century Industrial Centre, 33-35 Au Pui Wan Street, Fo Tan, Shatin, New Territories, Hong Kong
Tel: (852) 2690 9126 Fax: (852) 2690 9125 E-mail: info@ATSL.com.hk http://www.ATSL.com.hk

HOKLAS 173 TEST

Test Report for Laboratory Measurement of Sound Transmission Loss

TEST REPORT REFERENCE NUMBER:	**ATS13-101-RP001(R)**
DATE OF REPORT:	**06 June 2013**
TESTED FOR:	**Architectural Acoustics (Holdings) Ltd.** **2/F., Po Cheong Comm. Bldg.,** **29 Prat Avenue,** **T.S.T., Hong Kong**
ATTENTION:	**Ms. Polly Ip**
UNIT UNDER TEST:	**NOISESTOP® 48dB Acoustic & Fire Door** **声默® 48 分贝防火隔音门**
TEST STANDARD	**ASTM E90 – 09**
TESTED AT:	**Jiangmen Laboratory of ATSL** **No. 1, 1st Industrial Area, Lile,** **Wusha, Jianghai District, Jiangmen City,** **Guangdong Province, PRC**

Approved by:

Ir Dr. CHONG Fan / Managing Director
CEng, RPE, MHKIE, MIMechE, MCIBSE,
MASHRAE, MIOA, MHKIOA

This report ATS13-101-RP001(R) supersedes the report ATS13-101-RP001.

HKAS has accredited Acoustic Testing Services Limited (Reg. No.: 173 - TEST) under HOKLAS for specific laboratory activities as listed in the HOKLAS directory of accredited laboratories.

1. METHOD OF TEST

The test was conducted in accordance with ASTM E90 – 09 "Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions" in the reverberation rooms of Acoustic Testing Services Limited. And the single number rating of airborne Sound Transmission Loss is given as Sound Transmission Class (STC) by evaluated in accordance with ASTM E413 – 10 "Classification for Rating Sound Insulation".

2. INSTRUMENTATION

Description:	Serial Number:
Bruel & Kjaer Type 2270 Real Time Frequency Analyzer	2679277
Ultragraph Pro Equalizer	N0292084088
Power Amplifier Bruel Kjaer Type 2716	2461258
Bruel & Kjaer Type 4292 OmniPower Sound Source	013004
Bruel & Kjaer Type 4189 ½" Microphone (Source Room)	2662851
Bruel & Kjaer Type 4189 ½" Microphone (Receiving Room)	2676603
Bruel & Kjaer Type 4231 Sound Level Calibrator	2052566

The measuring equipment has been calibrated by an external HOKLAS laboratory, and is in current calibration.

3. PRINCIPLE OF TEST

The Sound Transmission Loss of a partition is usually measured in a laboratory by placing the element in an opening between two adjacent reverberant rooms designed for such tests. Noise is introduced into one of the rooms, referred to as the source room, and part of the sound energy is transmitted through the test element into the second room, referred to as the receiving room. The resulting mean space-average sound pressure levels in the source room and the receiving room is L_1 and L_2, respectively.

The Sound Transmission Loss is given by

$$TL = L_1 - L_2 + 10\log(S/A)$$

where

L_1 is the average sound pressure level in the source room, in dB;
L_2 is the average sound pressure level in the receiving room, in dB;
S is the area of the test specimen, in m^2;
A is the equivalent absorption area in the receiving room, in metres sabins.

$$A = (0.9210Vd / c)$$

and where

V is the receiving room volume, in m^3;
d is the rate of decay of sound pressure level in receiving room, dB/s;
c is the speed of sound in the medium , m/s.

The speed of sound changes with temperature and shall be calculated for the conditions existing at the time of test from the equation:

$$c = 20.047\sqrt{273.15 + t}$$

where

t is the receiving room temperature, measured to nearest degree.

The Sound Transmission Class (STC) of test specimen is calculated by comparing the sixteen values of Sound Transmission Loss from 125 Hz to 4000 Hz with a defined reference curve which is incremented until the requirements of ASTM E413 – 10 are met.

4. RESULTS APPLICATION

The results obtained can be used to design building elements with appropriate acoustic properties, to compare the sound insulation properties of building elements and to classify such elements according to their sound insulation capabilities.

The test was performed in laboratory facilities in which transmission of sound on flanking paths is suppressed. Results of measurements shall not be applied directly in the field without accounting for other factors affecting sound insulation, especially flanking transmission and loss factor.

The test results obtained relate only to the Unit Under Test.

5. DETAILS OF TEST

Date of receipt of Unit Under Test:	28 April 2013
Date of test:	29 April 2013
Unit Under Test:	NOISESTOP® 48dB Acoustic & Fire Door 声默® 48分贝防火隔音门
Sample I. D.:	ATS13-101-TS001
Dimensions use for calculation:	2140 mm (width) X 2430 mm (height)
Manufacturer:	Architectural Acoustics (Holdings) Ltd.
Installed by:	Architectural Acoustics (Holdings) Ltd.
Additional Description:	--

The details of the Unit Under Test are referring to the drawings given in Appendix 1.

The information shown on the drawing is not verified by the laboratory.

6. TEST RESULTS

Source Room:		
Temperature:	26	°C
Humidity:	70	%
Volume:	208	m^3
Receiving Room:		
Temperature:	26	°C
Humidity:	70	%
Volume:	117	m^3
Specimen Dimension used for calculation:		
Width:	2140	mm
Height:	2430	mm

Freq. (Hz)	1/3 Oct, TL (dB)	1/1 Oct, TL (dB)
100	31	
125	34	30
160	27	
200	28	
250	33	31
315	33	
400	38	
500	40	40
630	43	
800	46	
1000	49	48
1250	50	
1600	53	
2000	55	54
2500	55	
3150	54	
4000	54	55
5000	56	

Measurement marked with a "*", if any, is affected by flanking transmission.

STC = 44

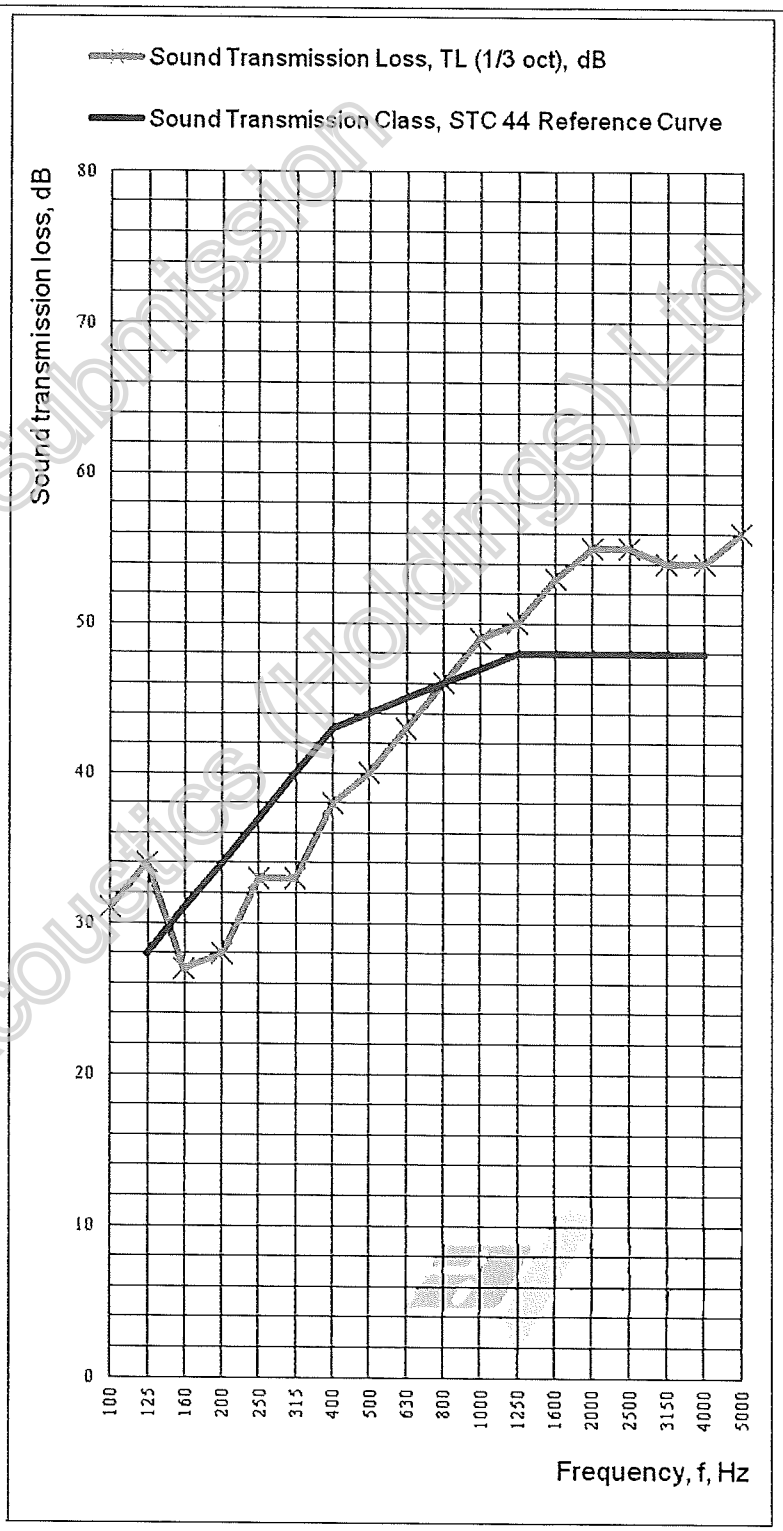


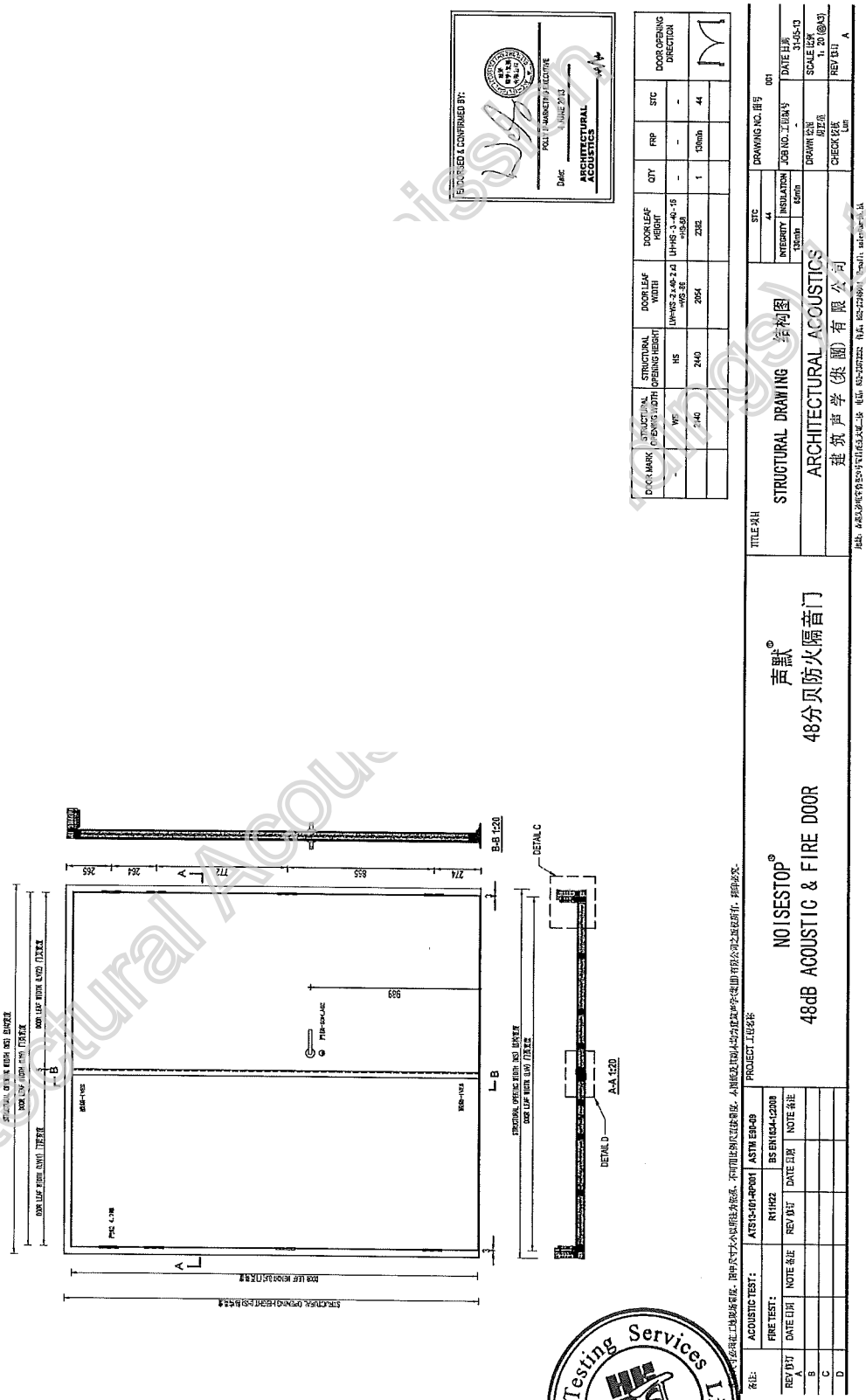
Figure 1. Sound Transmission Loss against Frequency

APPENDIX LIST

APPENDIX 1	Details of Unit Under Test
APPENDIX 2	Photographic Records

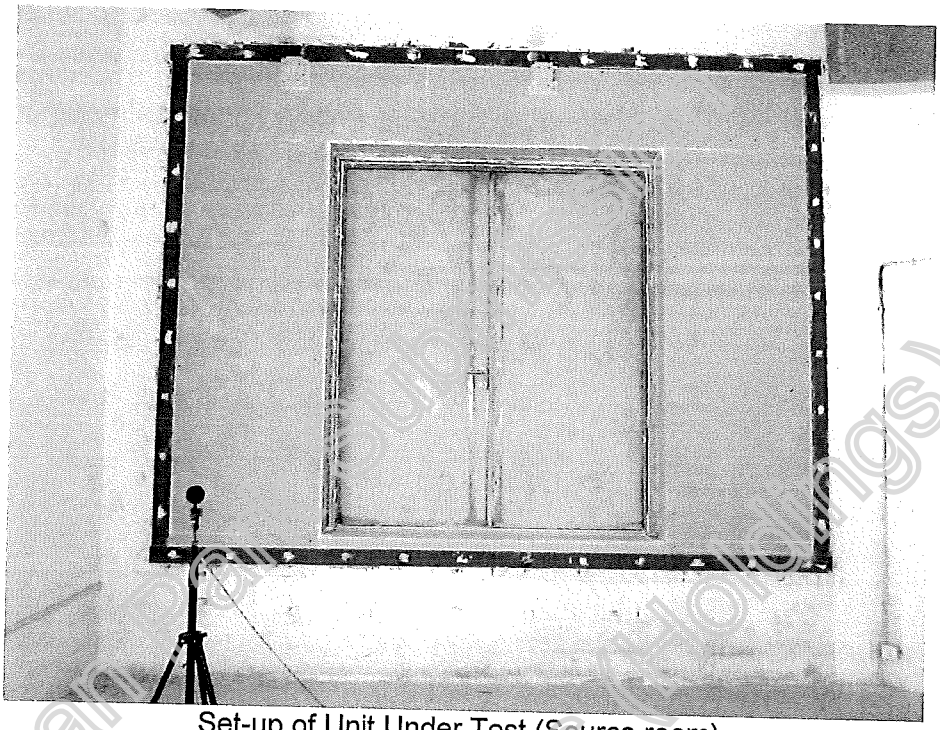
APPENDIX 1

Details of Unit Under Test

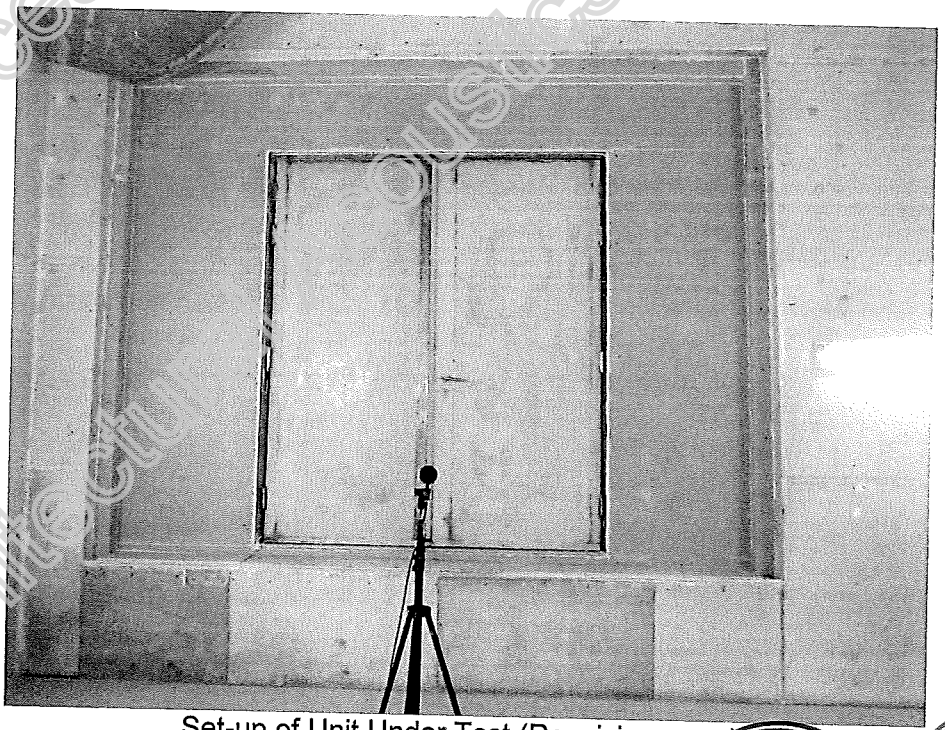


APPENDIX 2

Photographic Records



Set-up of Unit Under Test (Source room)



Set-up of Unit Under Test (Receiving room)

End of Report

Project	Ocean Park Door
Door No.	D2

SPECIFICATION

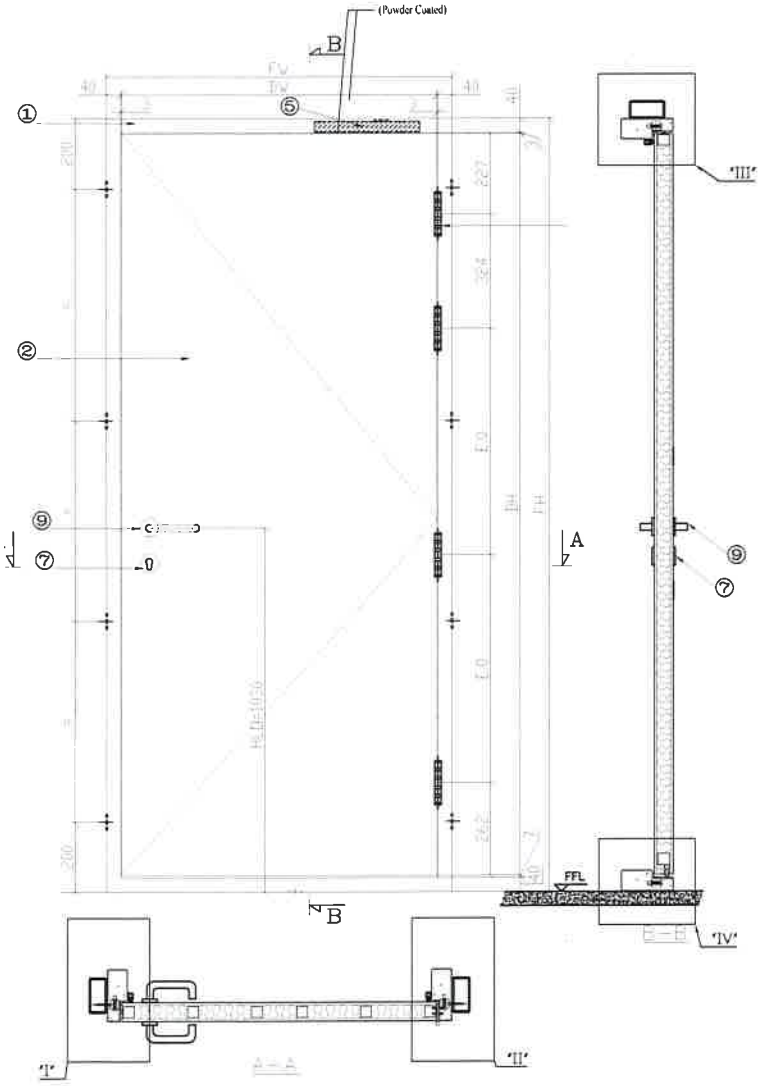
Frame Size		Leaf Size			Hand	QTY.
FW	FH	DW	DH	DT		
986	2190	900	2100	53	LH	1
986	2190	900	2100	53	RH	1

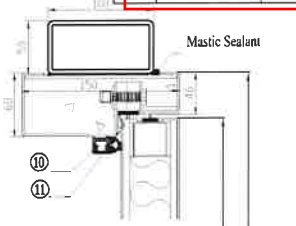
OPENING SIZE

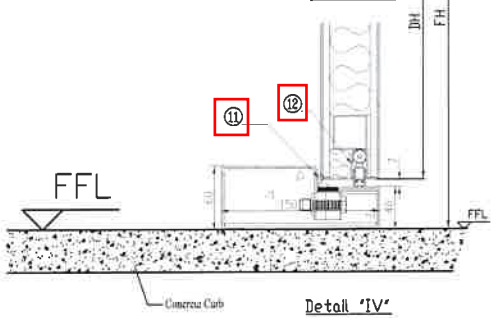
W 994	H 2200

PARTS / IRONMONGERY LIST

ITEM	DESCRIPTION	SPECIFICATION	QTY.
1	DOOR FRAME	1.5mm G.I W/POWDER COATED	1 set
2	DOOR LEAF	900 (53MM THK.)	1 set
3	HINGE	"HIKARI" SB-186-7 SS - SATIN FINISH 114x114x3.5mm	4 nos.
5	CLOSER	"DORMA" TS72 EN2-4 SILVER	1 set
6	DOOR STOP	"RAM" 502 x SC - SATIN CHROME PLATED FINISH	1 set
7	LOCKSETS	"SURER-LOC" 906.AP.32D - SATIN FINISH	1 set
8	CYLINDERS	"YALE" 214G.80 x SN	1 set
9	LEVER HANDLE	"RAM" 781T x SSS Z120 SPLIT SPINDLE - SATIN FINISH	1 set
10	DOOR SEAL	RAVEN "RP10" (L 986mm x 1pcs, L 2190m x 2pcs)	1 set
11	DOOR SEAL	PR Seal (By R&R)	1 set
12	DOOR SEAL	CCE-ASPLU (By R&R)	1 set







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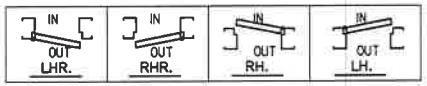
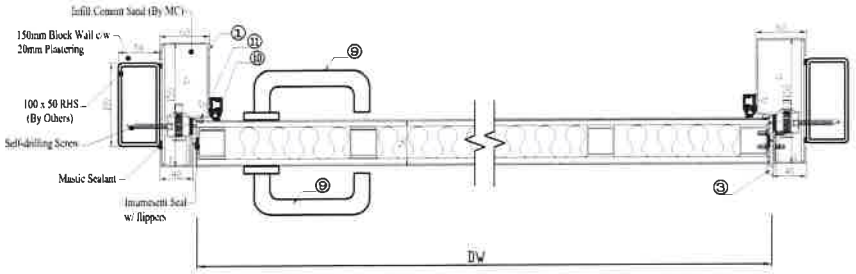




No	Amendments	Date

Job No.

Job Title

Ocean Park Waterfront Performance Venue

Drawing Title

ACOUSTIC DOOR D2 DETAIL

Scale

Date 30 APRIL 2014

DRAWING NO.

CDL-OP-WF-002

Drawn By :	Checked By :	REV.
EC		3

CDL STUDIO LIMITED
UNIT 5N, CENTURY CENTRE, 33
AU PUI WAN STREET, FO TAN,
SHATIN,
HONG KONG
TEL: (852) 3590 2408
FAX: (852) 3013 9667

Project	Ocean Park Door
Door No.	D3

SPECIFICATION

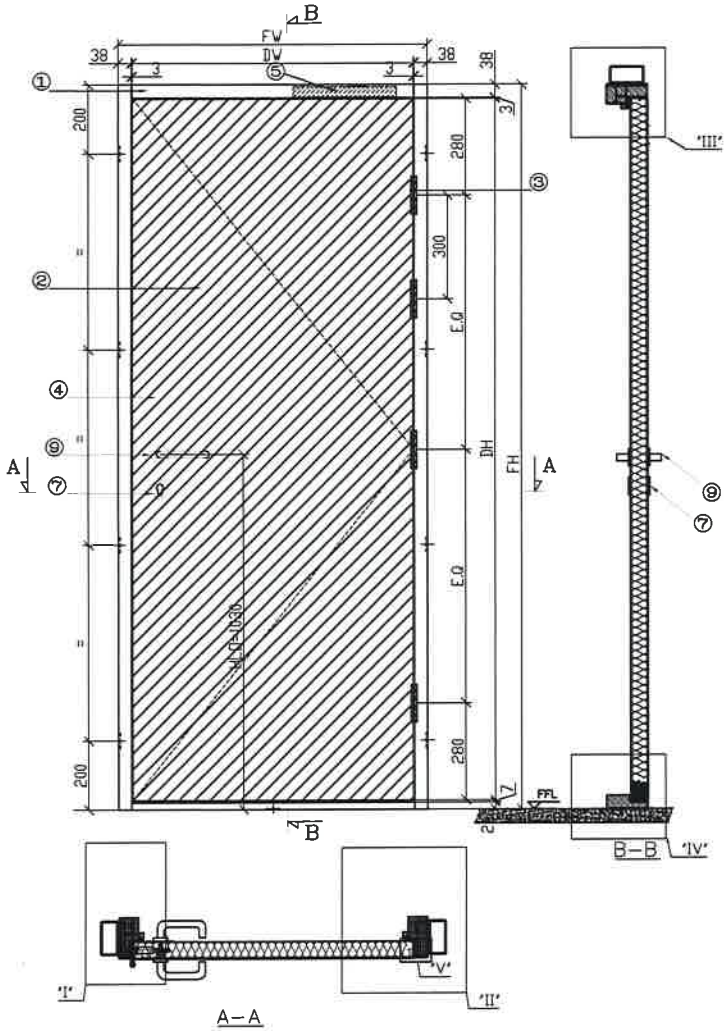
Frame Size		Leaf Size			Hand	QTY.
FW	FH	DW	DH	DT		
982	2163	900	2100	50	LH.	1
982	2163	900	2100	50	RH.	1

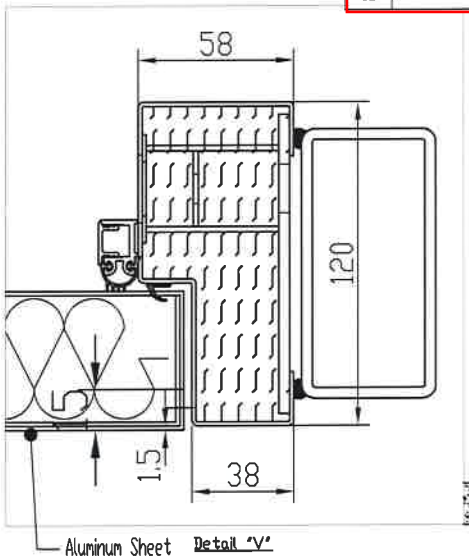
Opening Size

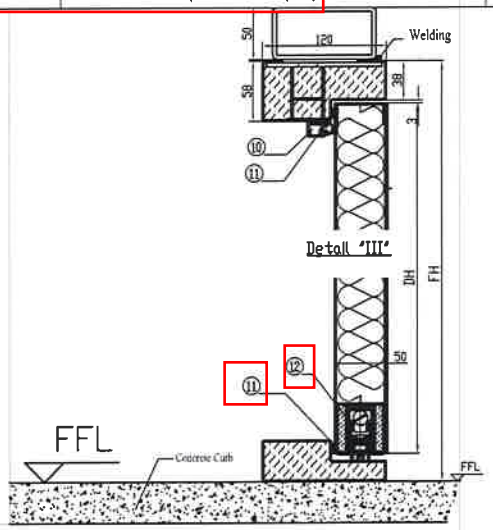
990	2171

PARTS / IRONMONGERY LIST

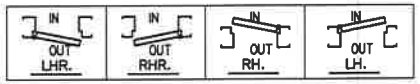
ITEM	DESCRIPTION	SPECIFICATION	QTY.
1	DOOR FRAME	1.5 G.I W/ POWDER COATED	1 set
2	DOOR LEAF	900 (50MM THK.)	1 set
3	HINGE	"HIKARI" SB-186-2 SS - SATIN FINISH 102x102x3.0mm	4 nos.
5	CLOSER	"DORMA" TS72 EN2-4 SILVER	1 set
6	DOOR STOP	"RAM" 502 x SC - SATIN CHROME PLATED FINISH	1 set
7	LOCKSETS	"SURER-LOC" 906.AP.32D - SATIN FINISH	1 set
8	CYLINDERS	"YALE" 214G.80 x SN	1 set
9	LEVER HANDLE	"RAM" 781T x SSS Z120 SPLIT SPINDLE - SATIN FINISH	1 set
10	DOOR SEAL	RAVEN "RP10" (L 982mm x 1pcs, L 2163m x 2pcs)	1 set
11	DOOR SEAL	RAVEN "RP55" (L 982mm x 2pcs, L 2163m x 2pcs)	1 set
12	DOOR SEAL	RAVEN "RP70" (L 982mm x 1pcs)	1 set

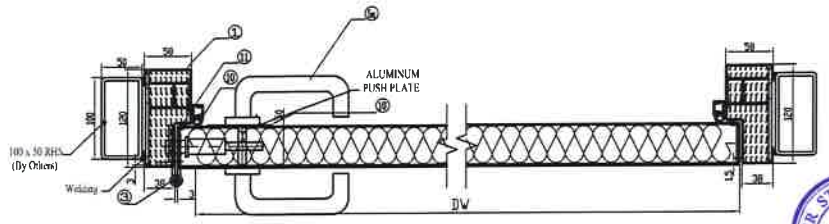






HAND TYPE





No	Amendments	Date

Job No.

Job Title
Ocean Park Waterfront Performance Venue

Drawing Title
ACOUSTIC DOOR D3
DETAIL 1 of 2

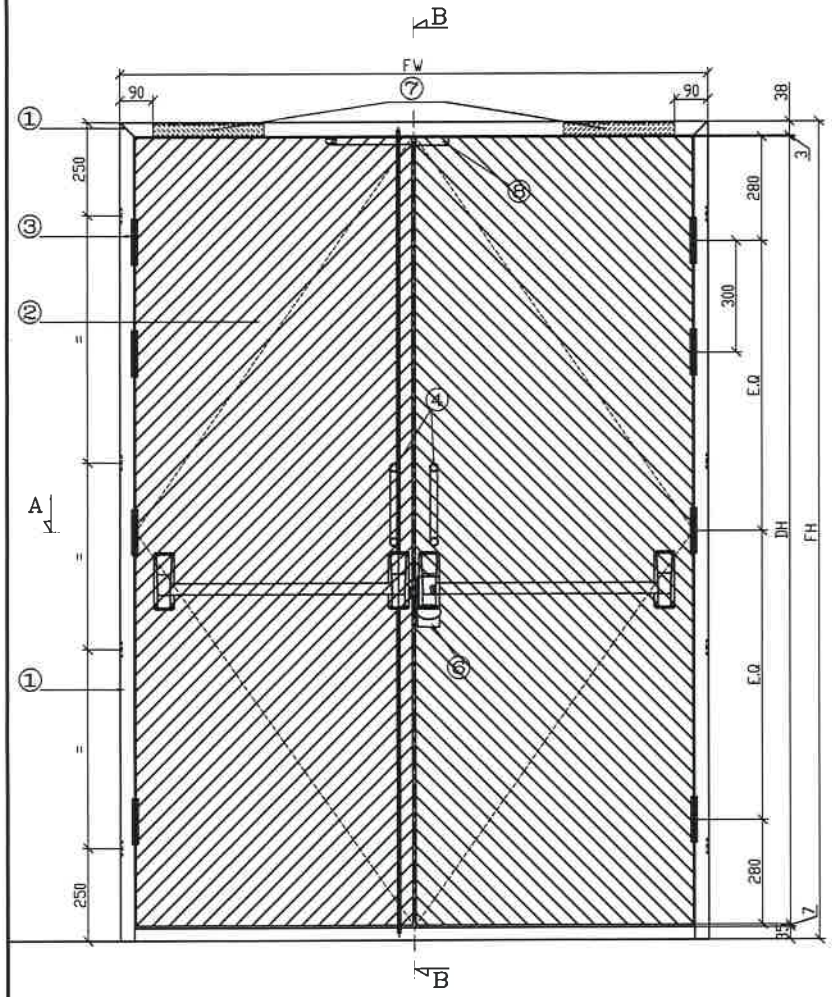
Scale

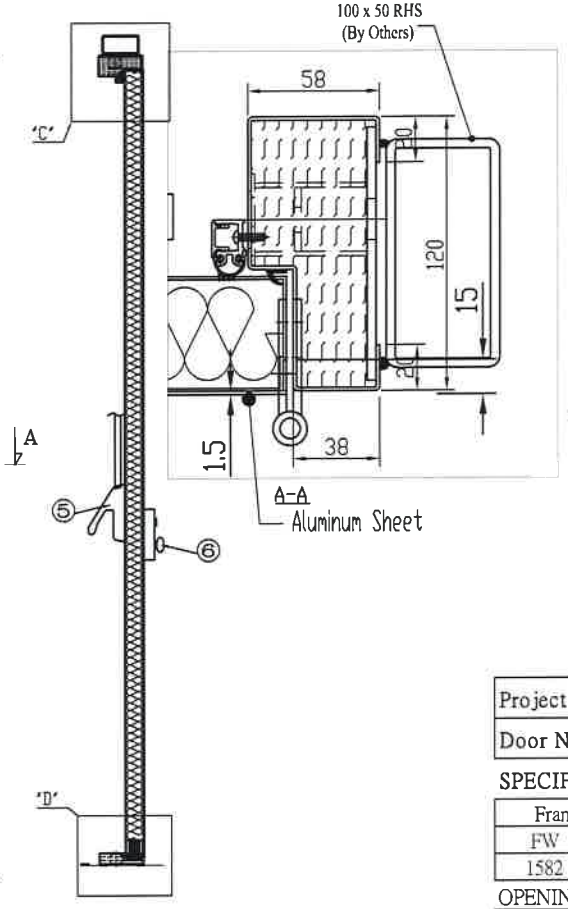
Date 30 APRIL 2014

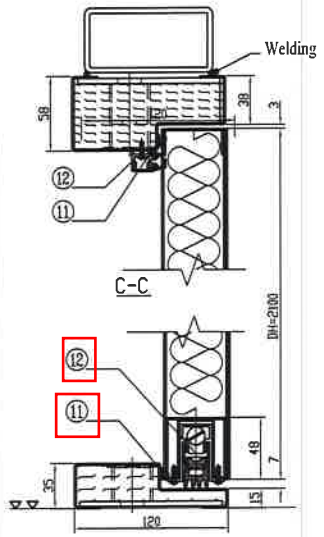
DRAWING NO.
CDL–OP–WF–003

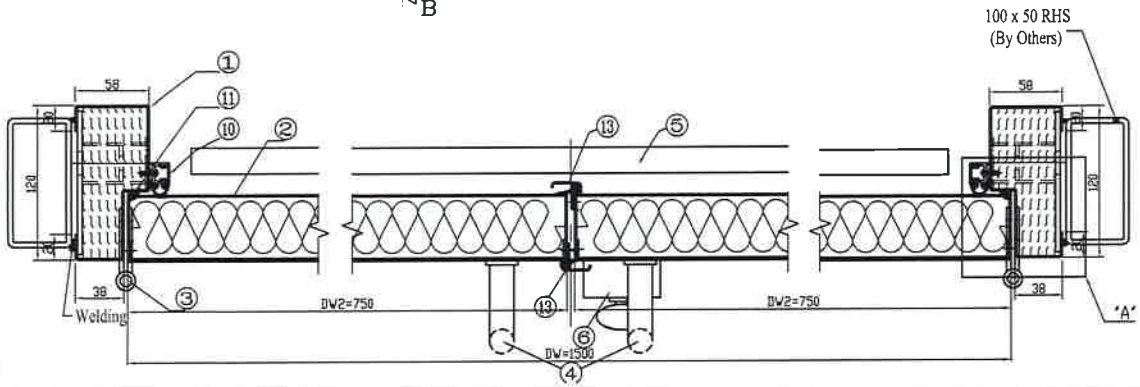
Drawn By :	Checked By :	REV.
EC		3

CDL STUDIO LIMITED
UNIT 5N, CENTURY CENTRE, 33
AU PUI WAN STREET, FO TAN,
SHATIN,
HONG KONG
TEL: (852) 3590 2408
FAX: (852) 3013 9667









Project	Ocean Park Door
Door No.	D1

SPECIFICATION

Frame Size		Leaf Size			QTY.
FW	FH	DW	DH	DT	
1582	2163	1500	2100	50	8

OPENING SIZE

1590	2171

PARTS / IRONMONGERY LIST

ITEM	DESCRIPTION	SPECIFICATION	QTY.
1	DOOR FRAME	1.5 G.I W/ POWDER COATED	1 set
2	DOOR LEAF	900 (53MM THK.)	1 set
3	HINGE	"HIKARI" SB-186-2 SS - SATIN FINISH 102x102x3.0mm	8 nos.
4	PULL HANDLES	"RAM" 401S086-RO SS - SATIN FINISH 205x19mm dia	2 set
5	DOUBLE REBATED PANIC SET	"YALE" Y802 x SILVER PANIC DEVICES C/W VERTICAL BOLT & LATCH - SILVER FINISH	1 set
6	OUTSIDE ACCESS DEVICES	"YALE" Y805 x SILVER OUTSIDE ACCESS TRIM WITH KNOB HANDLE AND 212G.45xSN NICKEL PLATED SINGLE CYLINDER UNDER EXISTING MASTER-KEYING SYSTEM	1 set
7	CLOSER	"DORMA" TS72 EN2-4 SILVER	2 set
8	SELECTOR	"RAM" CO-001S - SATIN FINISH	1 set
9	DOOR STOP	"RAM" 502 x SC - SATIN CHROME PLATED FINISH	2 set
10	DOOR SEAL	RAVEN "RP10" (L 1582mm x 1pcs, L 2163m x 2pcs)	1 set
11	DOOR SEAL	RAVEN "RP55" (L 1582mm x 2pcs, L 2163m x 2pcs)	1 set
12	DOOR SEAL	RAVEN "RP70" (L 750mm x 2pcs)	1 set
13	DOOR SEAL	RAVEN "RP16" (2100mm)	1 set

No	Amendments	Date

Job No.

Job Title
Ocean Park Waterfront Performance Venue

Drawing Title
ACOUSTIC DOOR D1
DETAIL 1 of 2

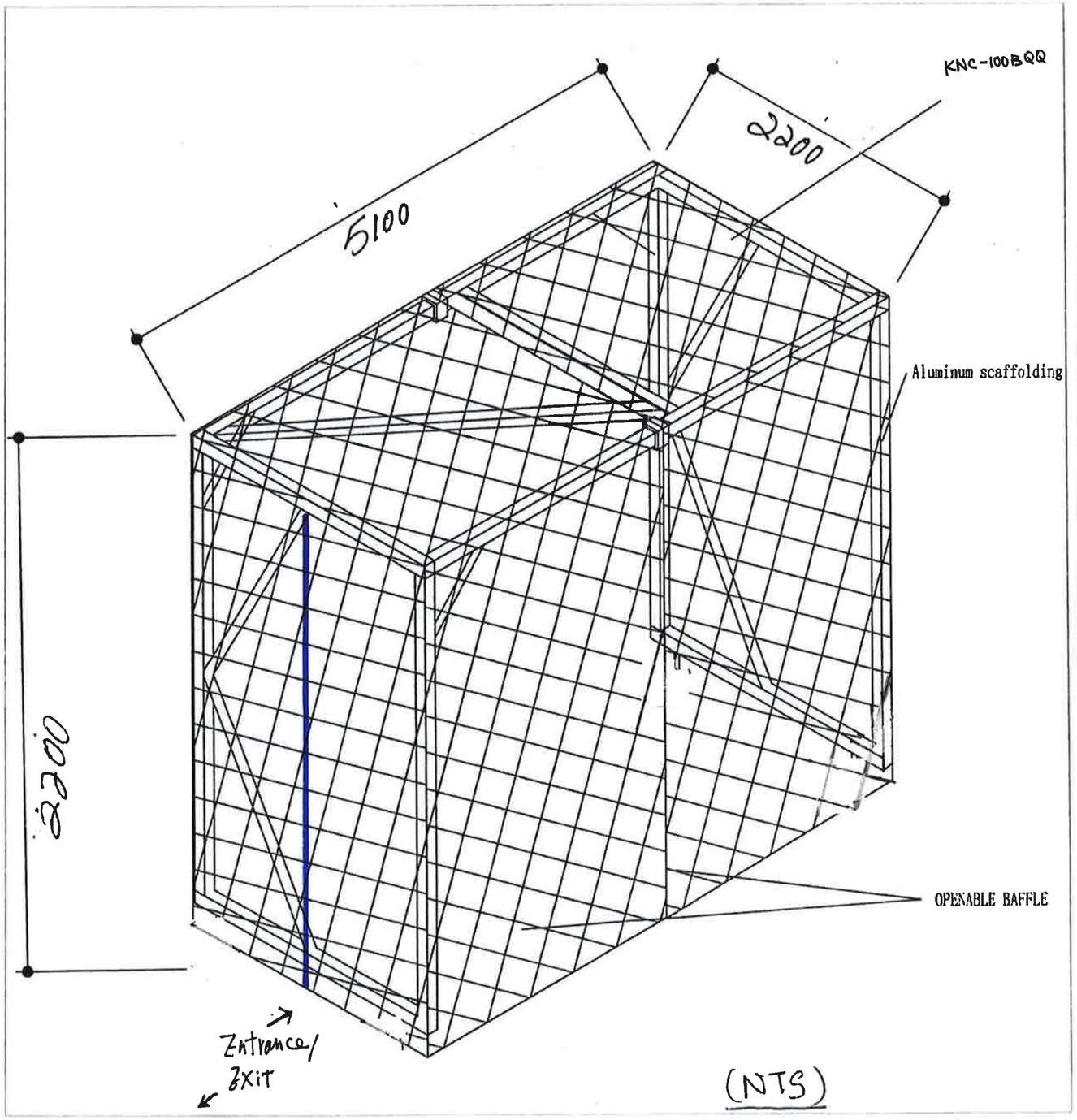
Scale NTS
Date 30 APRIL 2014
DRAWING NO.
CDL-OP-WF-001

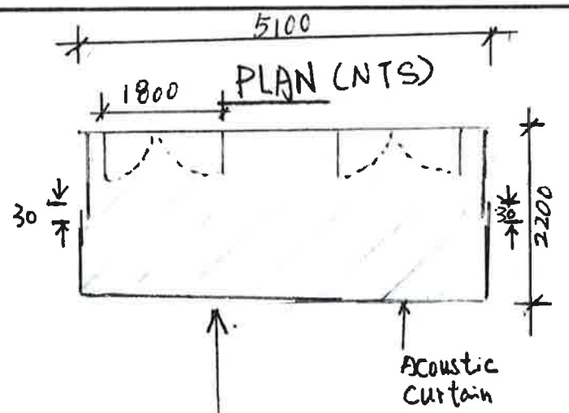
Drawn By :	Checked By :	REV.
EC		3

CDL STUDIO LIMITED
UNIT 5N, CENTURY CENTRE, 33
AU PUI WAN STREET, FO TAN,
SHATIN,
HONG KONG
TEL: (852) 3598 2408
FAX: (852) 3013 9667

Annex I

Acoustic Performance of the Curtain Door





"KINETICS"
KNC-100BQQ

No	Amendments	Date

Job No.

Job Title

OCEAN PARK - WATERFRONT PLAZA

Drawing Title

DETAILS OF
REMOVABLE ACOUSTIC
ENCLOSURE

Scale	NTS (A3)
Date	07 MAY 2014
DRAWING NO.	KNC-OME-02

Drawn By :	Checked By :	REV.
TKL		B

KINETICS NOISE CONTROL (ASIA) LTD.
Unit E, 9/F., World Tech Centre,
95 How Ming St., Kwun Tong, Hong Kong.
http://www.kineticsnoise.com
Tel.: 21912488 Fax : 21912477

KINETICS™
Noise Control Curtains
Model KNC

Kinetics model KNC Noise Control Curtains are modular, reinforced limp-mass and quilted fiberglass composites designed to block noise or to act as a movable barrier between noisy and quiet areas. Kinetics Noise Control Curtain Systems incorporate a self-supporting track which allows the curtain to open for access at virtually any point along the barrier or enclosure.

Kinetics curtains are available from 0.50 to 2.50 PSF (2.5 to 12.5 kg/m^2) surface weight. The systems are typically used for applications where accessibility, toughness, oil and chemical resistance, and an attractive appearance are required. A curtain system can yield noise reduction of 12-15 dBA.

Each curtain panel is furnished with Velcro®, self-adhering, nylon closures along the entire length of each edge and heavy-duty grommets along the top.

Kinetics models KNC-50C and 100C Clearview Curtains or windows are available. Models KNC-50RB and 100RB are reinforced vinyl barriers. Models KNC-50RBQ and 100RBQ have an aluminum-faced, quilted fiberglass absorber towards the noise source to block sound from escaping and to absorb sound that is reflected. Models KNC-50BQQ and 100BQQ are vinyl barriers completely encased in quilted fiberglass absorber.

Channel support systems for curtains are standard 1.625" x 1.625" (41 mm x 41 mm), 12-gauge rolled channel that can be floormounted or suspended. Curtain panels can be attached to the support system by trolly assemblies for movable curtains or fixed to the support system by mechanical fasteners for non-movable curtains. Standard BQQ curtain panels are 48" (1219 mm) wide and standard RBQ curtain panels are 54" (1372 mm) wide. BQQ and RBQ are available in lengths of up to 20' (6096 mm). Kinetics model KSD strip doors and clear vinyl windows are easily incorporated into model KNC curtain systems for visual and personnel access. We are also able to design structured steal support frames when needed.

Application

Model KNC Curtain Systems can be used as a partial or complete enclosure around noise sources. Curtains are especially useful for enclosures around industrial equipment since the enclosure is more versatile and economical than a rigid enclosure. Typical applications include enclosures around punch presses, compressors, pumps, granulators, blowers, and generators, etc.



Absorption Characteristics

	Octave Band Frequency (Hz)						
Product	**125**	**250**	**500**	**1000**	**2000**	**4000**	**NRC**
Q - 1" Quilt	0.12	0.47	0.85	0.84	0.64	0.62	0.70
Q2 - 2" Quilt	0.08	0.33	0.79	1.02	1.04	1.02	0.80
Q4 - 4" Quilt	0.30	0.83	1.16	1.18	1.10	1.07	1.10

Sound Transmission Loss (dB)

	Weight	Frequency (Hz)						
Product	**lbs./sq.ft. (kg/sq.m)**	**125**	**250**	**500**	**1000**	**2000**	**4000**	**STC**
KNC-50RB	0.5 (2.44)	12	13	16	21	27	32	21
KNC-100RB	1.0 (4.89)	13	17	21	28	33	40	26
KNC-50RBQ	0.7 (3.42)	6	12	17	27	38	46	23
KNC-100RBQ	1.3 (6.36)	10	16	22	30	42	49	27
KNC-50BQQ	1.0 (4.89)	7	12	18	31	46	50	24
KNC-100BQQ	1.5 (7.34)	9	14	22	35	48	53	26
KNC-200BQQ	2.5 (12.5)	16	20	30	40	51	55	33
KNC-50C	0.5 (2.44)	8	13	17	22	27	31	20
KNC-100C	1.0 (4.89)	4	19	23	28	33	37	26

Specifications

Curtain systems shall consist of panels which meet the specifications and physical properties of the curtain material above. Each panel shall be furnished with Velcro® self-adhering nylon closures along the entire length of each edge. Support points at the top of each panel shall be reinforced at grommet locations not more than 12" (305 mm) apart. Support systems for curtains shall be 1.625" x 1.625" (41 mm x 41 mm) 12-gauge formed channel with associated hardware as designed by Kinetics Noise Control. Entire system shall be model KNC as manufactured by Kinetics Noise Control, Inc.

Product Descriptions

KNC-50RB: Reinforced barrier

KNC-100RB: Reinforced barrier

KNC-50RBQ: Reinforced barrier with quilting on one (1) side

KNC-100RBQ: Reinforced barrier with quilting on one (1) side

KNC-50BQQ: Barrier quilting on both sides

KNC-100BQQ: Barrier quilting on both sides

KNC-200BQQ: Barrier quilting on both sides

KNC-50C: Clearview barrier

KNC-100C: Clearview barrier

KEY
RB (Reinforced Barrier);
B (Non-Reinforced Barrier) ;
Q (Quilt)

Silicone Faced Quilt is also available

KINETICS Noise Control

United States
6300 Irelan Place
P.O. Box 655
Dublin, Ohio 43017
Phone: 614-889-0480
Fax: 614-889-0540

Canada
3570 Nashua Drive
Mississauga, Ontario
L4V 1L2
Phone: 905-670-4922
Fax: 905-670-1698

www.kineticsnoise.com/industrial/knc.html
sales@kineticsnoise.com

聲學測試服務有限公司
Acoustic Testing Services Limited
Unit E, 2/F., Century Industrial Centre, 33 –35 Au Pui Wan Street, Fo Tan, Shatin, New Territories, Hong Kong
Tel: (852) 2690 9126 Fax: (852) 2690 9125 E-mail: info@ATSL.com.hk http://www.ATSL.com.hk

HOKLAS 173 TEST

Test Report for Laboratory Measurement of Airborne Sound Reduction

TEST REPORT REFERENCE NUMBER:	**ATS12-045-RP001**
DATE OF REPORT:	**29 October 2012**
TESTED FOR:	**Modern (Int'l) Access & Scaffolding Ltd.** **Room 603, Tower 2, Cheung Sha Wan Plaza,** **833 Cheung Sha Wan Road,** **Kowloon, Hong Kong**
ATTENTION:	**Mr. Steven Chan**
UNIT UNDER TEST:	**0.4mm thick Sound Proof Sheet** **(Code: SPS2030-04)**
TEST STANDARD:	**BS EN ISO 140-3: 1995**
TESTED AT:	**Unit E, 2/F., Century Industrial Centre,** **33-35 Au Pui Wan Street,** **Fo Tan, Shatin,** **New Territories, Hong Kong.**

Approved by:

Ir Dr. CHONG Fan / Managing Director
CEng, RPE, HHKIE, MIMechE, MCIBSE,
MASHRAE, MIOA, MHKIOA

Hong Kong Accreditation Service (HKAS) has accredited this laboratory under Hong Kong Laboratory Accreditation Scheme (HOKLAS) for specific laboratory activities as listed in the HOKLAS directory of accredited laboratories. The results shown in this report (or certificate, where appropriate) were determined by this laboratory in accordance with its terms of accreditation.

1. METHOD OF TEST

The test was conducted in accordance with BS EN ISO 140-3:1995 (E) "Acoustics — Measurement of sound insulation in buildings and of building elements — Part 3: Laboratory measurements of airborne sound insulation of building elements" (equivalent to BS 2750 Part 3: 1995 and GB/T 19889.3-2005) in the reverberation chamber of Acoustic Testing Services Limited. The single-figure quantity for airborne sound insulation rating, Weighted Sound Reduction Index, was evaluated in accordance with BS EN ISO 717-1:1997 "Acoustics — Rating of sound insulation in buildings and of building elements — Part 1: Airborne sound insulation".

2. INSTRUMENTATION

Description:	Serial Number:
Bruel & Kjaer Type 3560-B Real Time Frequency Analyzer	2454296
Ultragraph Pro Equalizer	N0517513166
STK V-6 Amplifier	C04OM013
Bruel & Kjaer Type 4292 OmniPower Sound Source	021005
Bruel & Kjaer Type 4942 Random Incident ½" Microphone (Source Room)	2497997
Bruel & Kjaer Type 4942 Random Incident ½" Microphone (Receiving Room)	2497998
Bruel & Kjaer Type 4231 Sound Level Calibrator	2478237

The measuring equipment has been calibrated by an external HOKLAS laboratory, and is in current calibration.

3. PRINCIPLE OF TEST

The Sound Reduction Index of building element can be measured in a laboratory by placing the element in an opening between two adjacent reverberant rooms designed for such tests. Random noise is introduced into one of the rooms, referred to as the source room, and part of the sound energy is transmitted through the test element into the second room, referred to as the receiving room. In each one-third octave band of centre frequency 100 to 5000 Hz, the resulting space-average sound pressure levels in the source room and receiving room is L_1 and L_2, respectively. The noise reduction index is given by

$$R = L_1 - L_2 + 10\log(S/A)$$

where

S is the area of the test specimen, in square metres.

A is the equivalent absorption area in the receiving room, in square metres.

$$A = \frac{0.16V}{T}$$

Where,

V is the receiving room volume, m^3;
T is reverberation time in the receiving room, s.

According to BS EN ISO 717-1: 1997, the Weighted Sound Reduction Index (R_w) in decibels (dB) is calculated by comparing the sixteen measured noise reduction index from 100 Hz to 3150 Hz with a defined reference curve by shifting the relevant reference curve in steps of 1 dB towards the measured curve until the sum of unfavourable deviations is as large as possible but not more than 32 dB. An unfavourable deviation at a particular frequency occurs when the result of measurements is less than the reference value. Only the unfavourable deviations shall be taken into account. The value, in decibels, of the reference curve at 500 Hz, after shifting it in accordance with this procedure, is R_w.

According to BS EN ISO 717-1: 1997, spectrum adaptation terms C, C_{tr}, $C_{100\text{-}5000}$ and $C_{tr,100\text{-}5000}$, which are to be added to the single-number rating to take account of the characteristics of particular sound spectra, are also calculated, in decibels. C is calculated with spectrum No. 1 (A-weighted pink noise); C_{tr} is calculated with spectrum No. 2 (A-weighted urban traffic noise). C and C_{tr} are calculated in frequency range 100 Hz – 3150 Hz. While $C_{100\text{-}5000}$ and $C_{tr,100\text{-}5000}$ are calculated in frequency range 100 Hz – 5000 Hz.

4. RESULTS APPLICATION

The results obtained can be used to design building elements with appropriate acoustic properties, to compare the sound insulation properties of building elements and to classify such elements according to their sound insulation capabilities.

The test was performed in laboratory facilities in which transmission of sound on flanking paths is suppressed. Results of measurements shall not be applied directly in the field without accounting for other factors affecting sound insulation, especially flanking transmission and loss factor.

The test results obtained relate only to Unit Under Test.

5. DETAILS OF TEST

Date of receipt of Unit Under Test:	20 September 2012
Date of test:	25 September 2012
Unit Under Test:	0.4mm thick Sound Proof Sheet (Code: SPS2030-04)
Sample I. D.:	ATS12-045-TS001
Dimensions used to calculate SRI:	3500 mm (width) X 3000 mm (height)
Supplier:	Modern (Int'l) Access & Scaffolding Ltd.
Installed by:	Modern (Int'l) Access & Scaffolding Ltd.
Additional Description:	Unit Weight: 500g/m^2

The details of the Unit Under Test are referring to the drawings given in Appendix 1.

The information shown in the additional description is not verified by the laboratory.

Acoustic Testing Services Limited

6. TEST RESULTS

Source Room:		
Temperature:	28	°C
Humidity:	70	%
Volume:	221	m^3
Receiving Room:		
Temperature:	28	°C
Humidity:	70	%
Volume:	80	m^3
Specimen Dimension used for calculation:		
Width:	3500	mm
Height:	3000	mm

Freq. (Hz)	1/3 Oct, R (dB)	1/1 Oct, R (dB)
100	7.2	
125	10.0	8.6
160	9.0	
200	8.2	
250	7.8	8.2
315	8.7	
400	8.1	
500	8.8	8.7
630	9.4	
800	10.4	
1000	10.5	10.7
1250	11.4	
1600	12.4	
2000	14.4	13.9
2500	15.7	
3150	17.6	
4000	18.8	18.9
5000	20.7	

The Weighted Sound Reduction Index calculated in accordance with BS EN ISO 717-1: 1997 and the spectrum adaptation terms were shown as follow:-

R_w (C;C_{tr})	=	**12 (0;-2)dB**
$C_{100\text{-}5000}$	=	**0 dB**
$C_{tr,100\text{-}5000}$	=	**-2 dB**

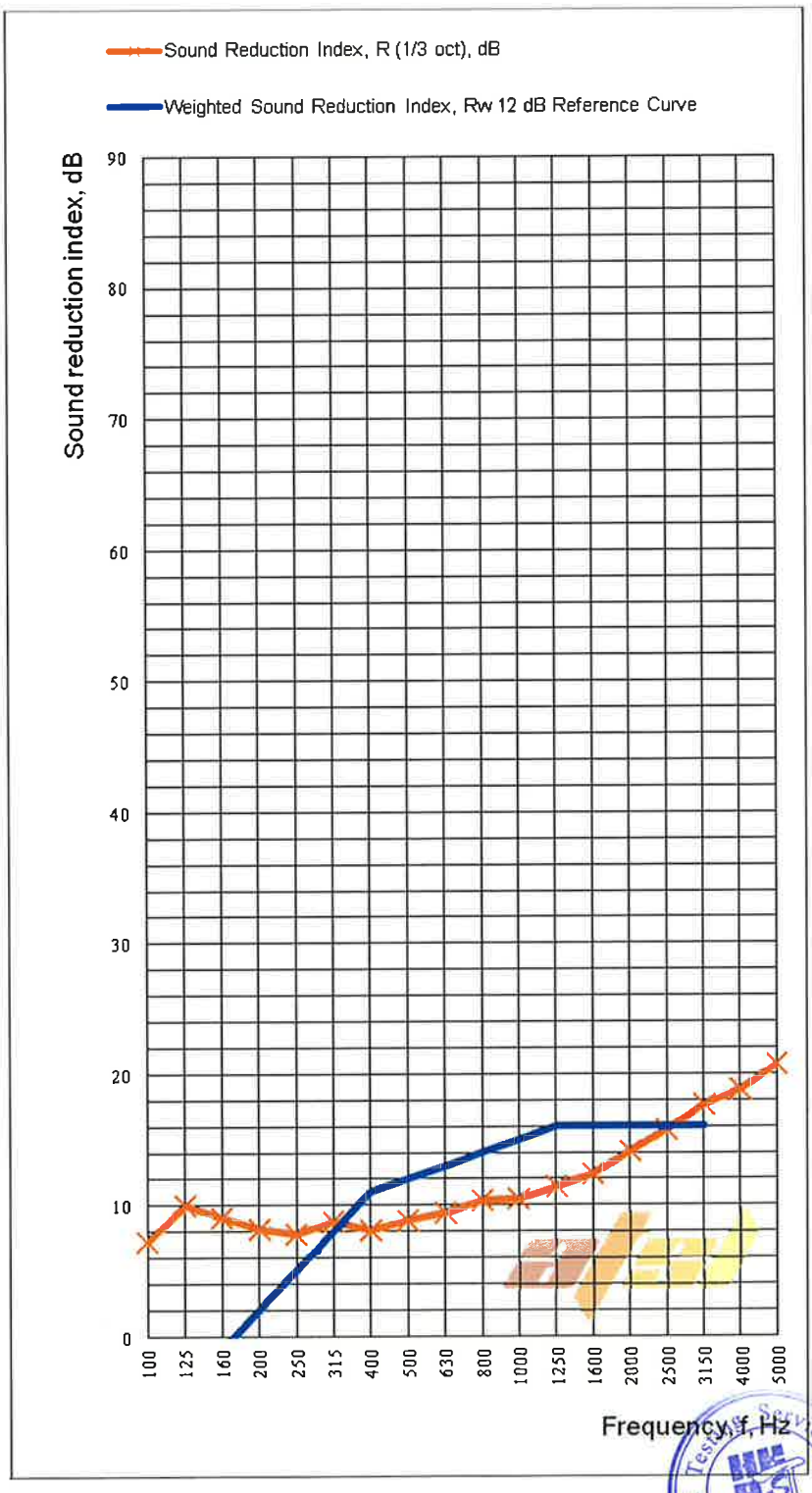


Figure 1. Sound Reduction Indexes against Frequency

APPENDIX LIST

APPENDIX 1	Details of Unit Under Test
APPENDIX 2	Photographic Records

APPENDIX 1

Details of Unit Under Test

(Not provided by the client)

APPENDIX 2

Photographic Records

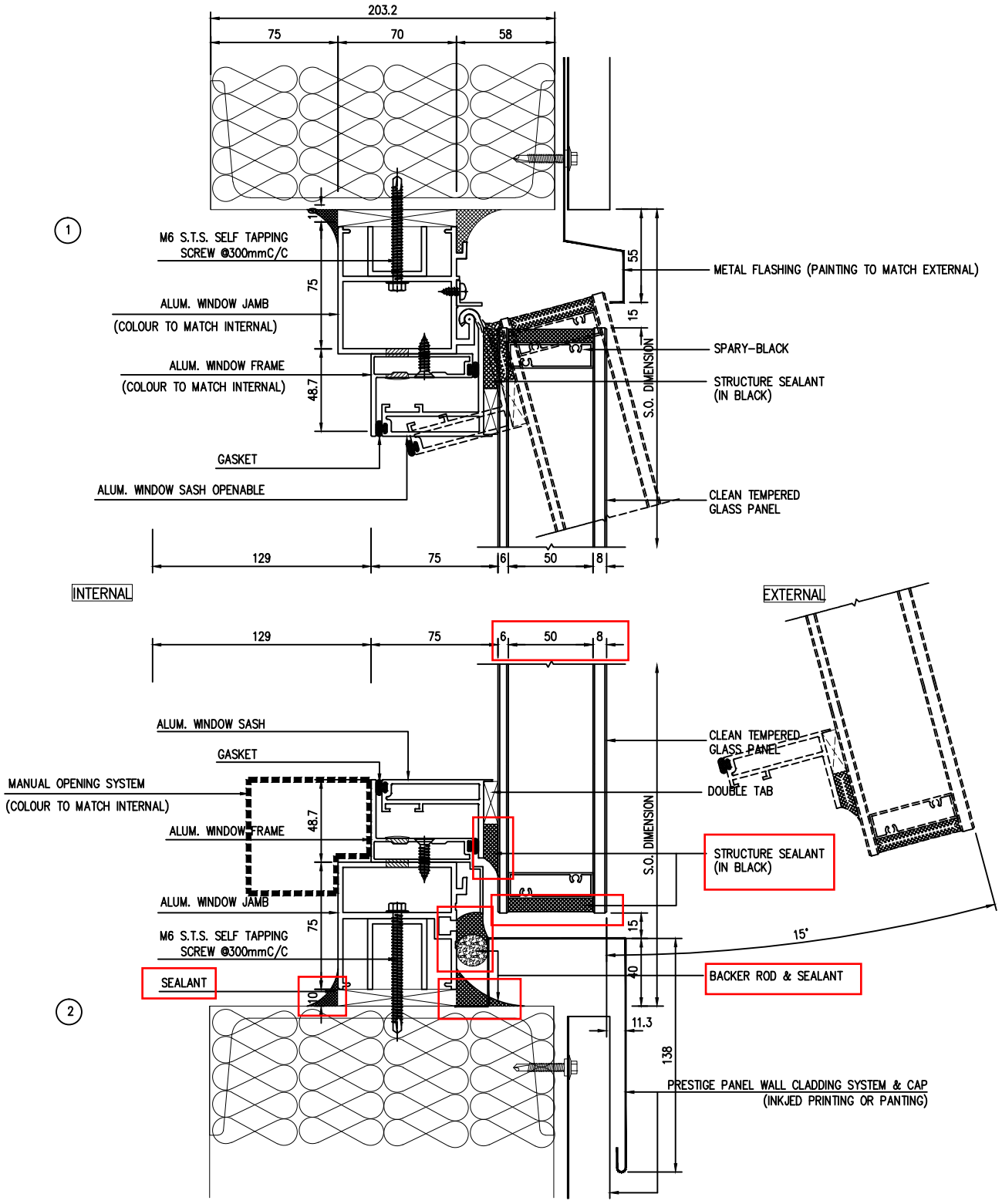
Set-up of Unit Under Test (Source room)

Set-up of Unit Under Test (Receiving room)

End of Report

Annex J

Drawing and Reference of the Window Panel



PROJECT
OCEAN PARK HONG KONG
WATERFRONT PLAZA
PERFORMANCE VENUE
FORMATION, WATERFRONT

DRAWING TITLE
VERTICAL SECTION OF
WINDOW

MARK	REVISION	DATE	INIT

DRAWN	M.L.
CHECKED	
APPROVED	
DATE	10-MAY-2014
SCALE	1:2(A3)
JOB NO.	
DWG. NO.	JD02
REV.	01

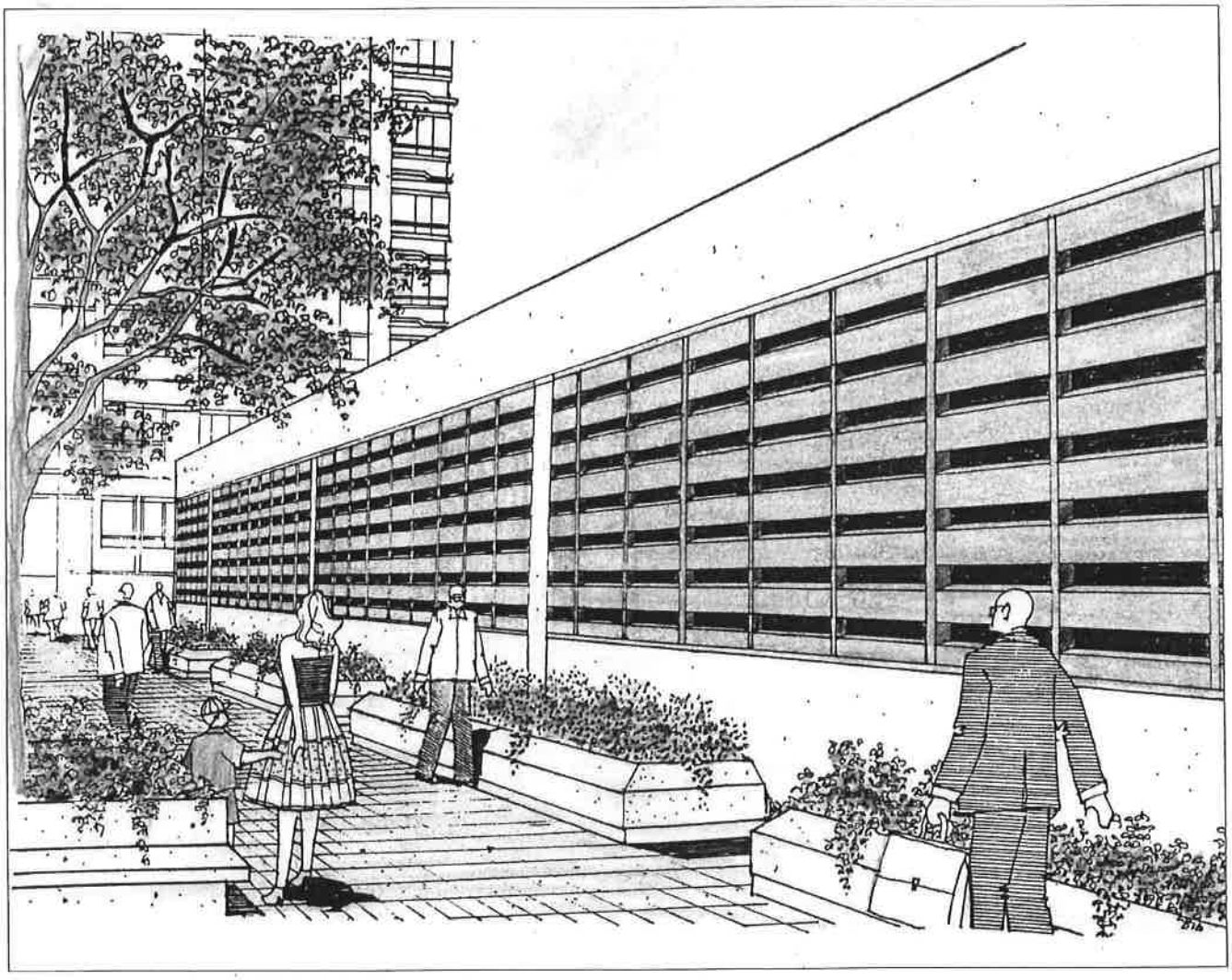
Table 8.2 (Continued)

Panel construction	Thick-ness (mm)	Superficial weight (kg/m^2)	Octave band centre frequency (Hz)							
			63	125	250	500	1000	2000	4000	8000
6 mm and 5 mm glass, 100 mm cavity	112	34	–	27	37	45	56	56	60	–
6 mm and 8 mm glass, 100 mm cavity	115	40	–	35	47	53	55	50	55	–
Doors										
Flush panel, hollow core, normal cracks as usually hung	43	9	1	12	13	14	16	18	24	26
Solid hardwood, normal cracks as usually hung	43	28	13	17	21	26	29	31	34	32
Typical proprietary "acoustic" door, double heavy sheet steel skin, absorbent in air space, and seals in heavy steel frame	100	–	37	36	39	44	49	54	57	60
2-skin metal door	35	16	–	26	26	28	32	32	40	–
Plastic laminated flush wood door	44	20	–	14	18	17	23	18	19	–
Veneered surface, flush wood door	44	25	–	22	26	29	26	26	32	–
Metal door; damped skins, absorbent core, gasketing	100	94	–	43	47	51	54	52	50	–
Metal door; damped skins, absorbent core, gasketing	180	140	–	46	51	59	62	65	62	–
Metal door; damped skins, absorbent core, gasketing	250	181	–	48	54	62	68	66	74	–
Two 16g steel doors with 25 mm sound-absorbing material on each, and separated by 180 mm air gap	270	86	–	50	56	59	67	60	70	–
Hardwood door	54	20	–	20	25	22	27	31	35	–
Hardwood door	66	44	–	24	26	33	38	41	46	–

Annex K

Specification of the Acoustic Louvre for Chillers

Acoustic Louvres



J.P. ENVIRONMENTAL PRODUCTS INC.

the service you expect:
The products you need

Acoustic Louvres
* ALC Acoustic Louvres

Introduction

The J.P. Environmental ALC range of acoustic louvres have been developed to serve as both noise and weather barriers, while permitting the efficient transfer of air.

As aesthetics is an important aspect of any building design, the ALC louvres will, at the same time, provide an attractive facade compatible with the architect's design concept.

Aerodynamically designed for reduced pressure drop, this multi-purpose louvre will meet a wide range of performance requirements for commercial and industrial applications.

With six models to choose from, this ensures the most accurate selection possible with the minimum amount of interpolation and offers practical solutions within the constraints of the space permitted.

Applications

Buildings

- Ventilation Systems Openings
- Air Conditioning Plants
- Standby Generator Rooms
- Carparks

Barriers

- Chiller Plants
- Cooling Towers
- Sewage Treatment Plants
- Substation Transformers
- Power Generating Plants

ALC Louvre Range

ALC Acoustic Louvres are available in six models.

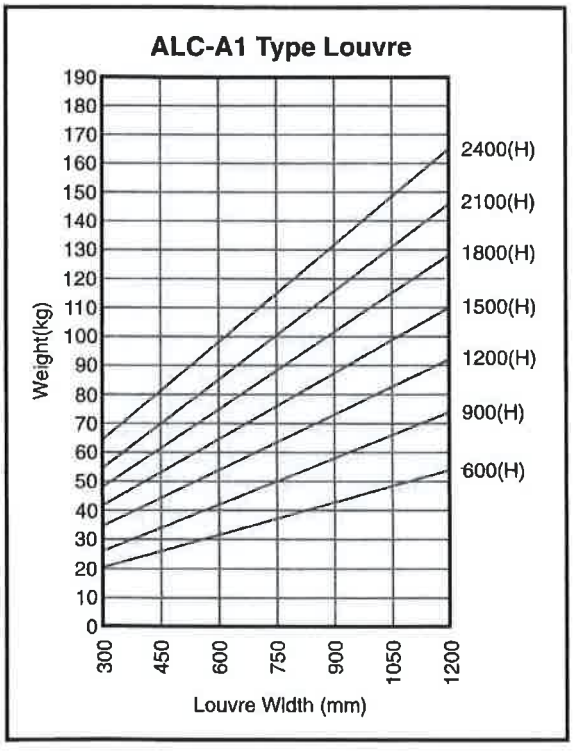
MEDIUM SOUND TRANSMISSION LOSS / LOW AIRFLOW RESISTANCE

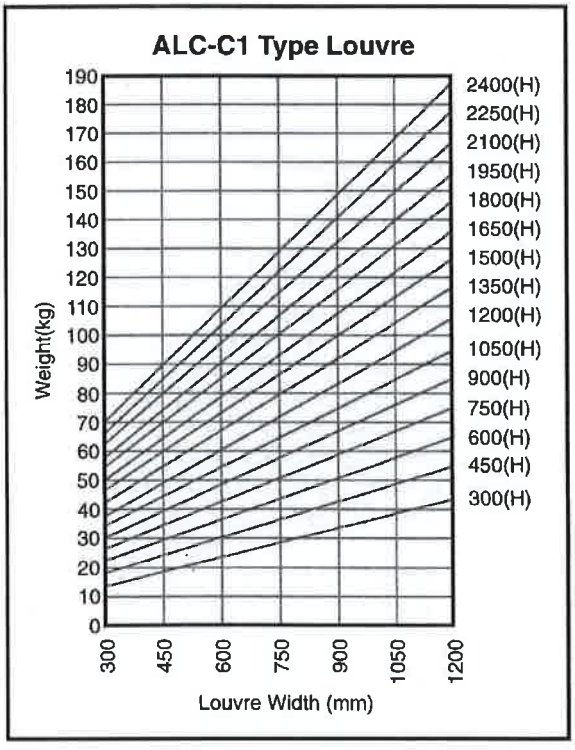
Model	Thickness	Louvre Blade Centres
ALC-C.5	150mm	150mm
ALC-C1	300mm	150mm
ALC-C2	600mm	150mm

HIGH SOUND TRANSMISSION LOSS / MEDIUM AIRFLOW RESISTANCE

Model	Thickness	Louvre Blade Centres
ALC-A.5	150mm	300mm
ALC-A1	300mm	300mm
ALC-B2	600mm	300mm

Louvre Weights





For ALC-A.5 and ALC-B2 Models, take the weight from the ALC-A1 Chart and Multiply by 0.5 and 2 respectively
For ALC-C.5 and ALC-C2 Models, take the weight from the ALC-C1 Chart and Multiply by 0.5 and 2 respectively

Acoustic Performance

The acoustic performance (Sound Transmission Loss) of J.P. Environmental ALC Acoustic Louvres has been tested and certified by independent test laboratories, carried out in accordance with the following standards:-

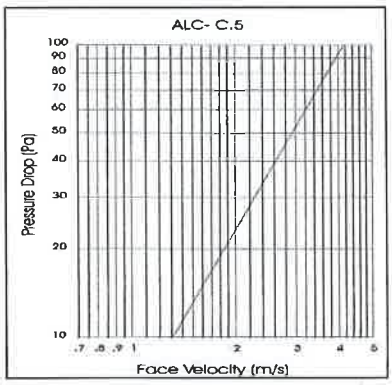
- ISO - 140 Measurement of Sound Insulation in Buildings and of Building Elements.
- ASTM E - 90 Standard Method of Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions.

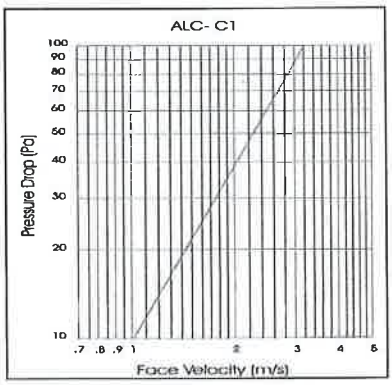
Sound Transmission Loss (dB)

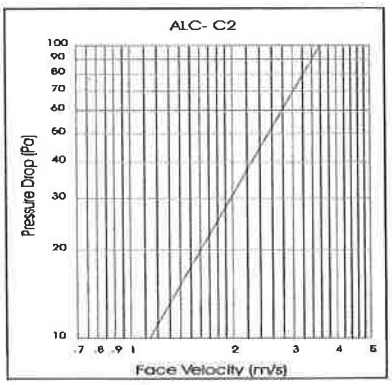
Model	Thickness	Octave Band Centre Frequency in Hz						
		125	250	500	1k	2k	4k	8k
ALC-C.5	150mm	3	5	8	9	8	6	5
ALC-C1	300mm	4	7	12	13	11	10	9
ALC-C2	600mm	8	12	20	22	29	20	11
ALC-A.5	150mm	5	8	13	15	13	10	8
ALC-A1	300mm	7	11	20	22	19	16	15
ALC-B2	600mm	12	17	24	28	34	26	14

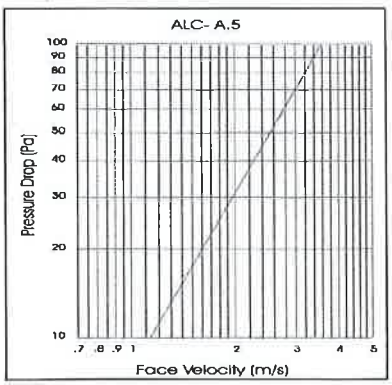
The figures presented above are Transmission Loss (TL) data. To obtain Noise Reduction (NR) of louvres, add 6 dB to each octave band.

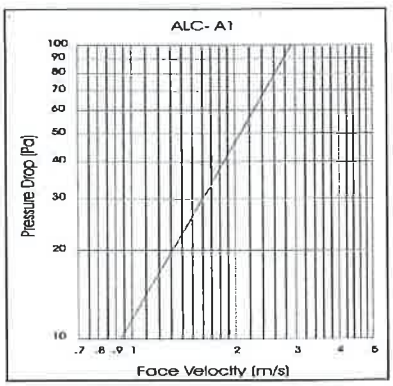
Aerodynamic Performance

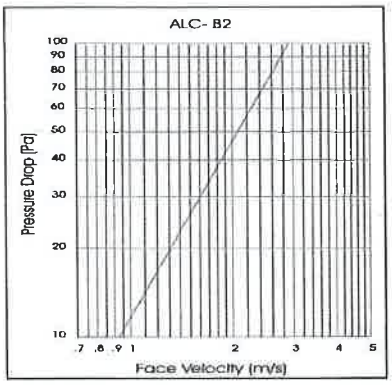












Standard Construction

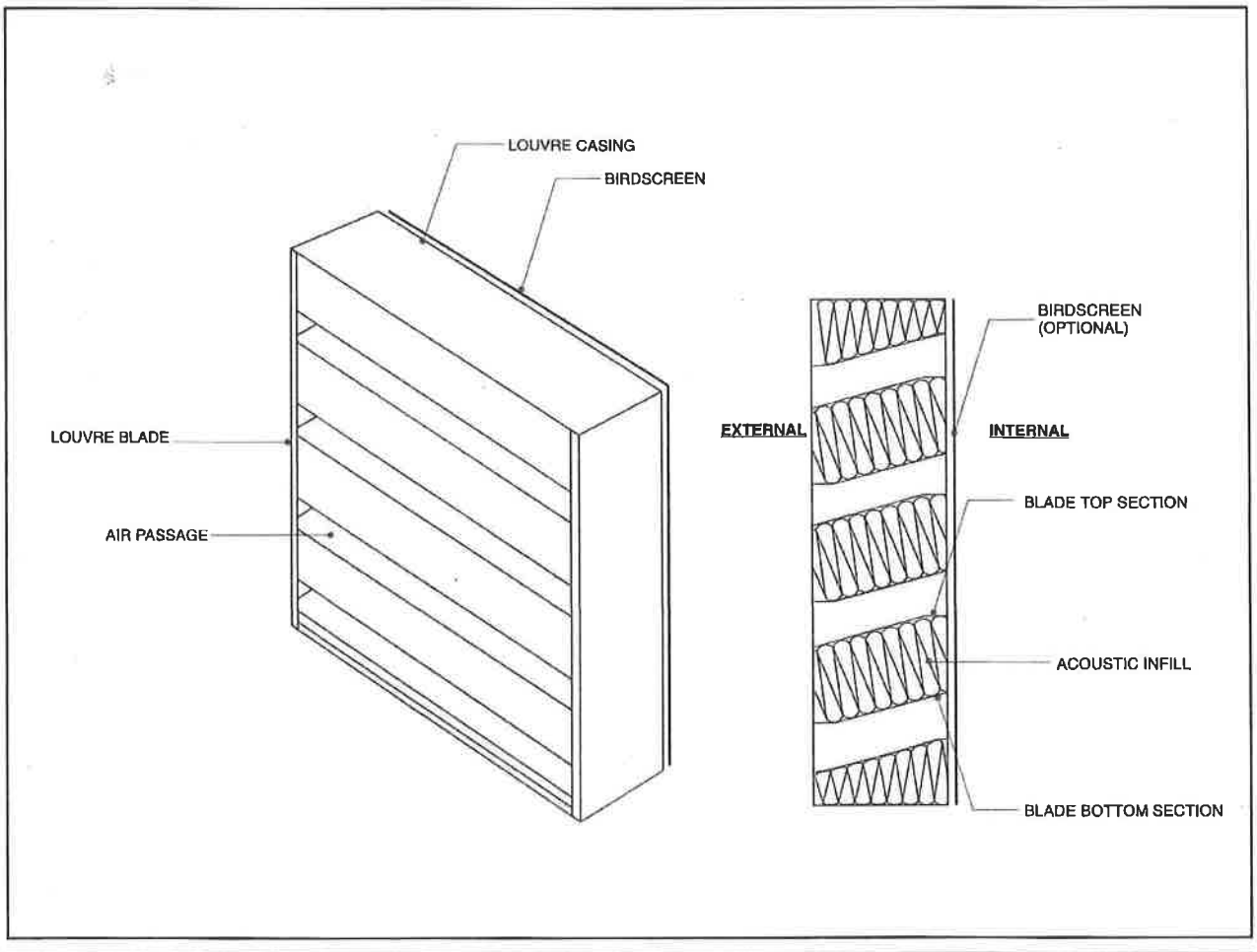
The four sided casing is fabricated from 1.5mm thick galvanized mild steel with a folded lip on the vertical sides. This provides added rigidity and is used for attaching the louvre blades.

The louvre blades are constructed with 0.8mm galvanized steel for the top (external) section and 0.5mm thick perforated galvanized steel sheet for the bottom (internal) section.
The top of the louvre blades have an integral lip at the rear edge to prevent water entry.

The louvre blades are packed with inert, non-combustible infill held secure under 5-10% compression to prevent settling or compacting.

The maximum module size is 1200mm (Width) x 2440mm (Height), to enable ease of handling and assembly. Larger opening sizes can be easily formed by using a combination of modules.

The full range of ALC Acoustic Louvres can also be manufactured from varying material thicknesses, and in aluminium or stainless steel, for use in extreme environmental conditions, or to meet with the specific acoustic design requirements of the project.



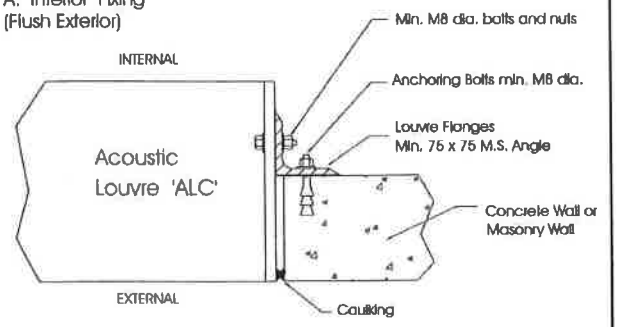
Options

Finishes	Galvanized steel louvres can be supplied etch prime coated, ready for paint finishing on site to any specific colour. Aluminium louvres can be supplied in natural or anodized finishes. Stainless steel louvres can be supplied in 304SS or 316SS grade, with satin or polished finish.
Louvre Doors	The door consists of a galvanized steel frame to which the louvre blades are fixed in alignment with the adjacent louvres. Louvre doors are available in either 150mm or 300mm thickness, supplied complete with standard hardware.
Infill Protection	A polyester film or fibreglass cloth can be applied between the acoustic infill and perforated steel section of the blade for added protection.
Birdscreen	Louvres can be fitted with a steel birdscreen if required. This is fixed to the rear face of the louvre by means of screw fixing to the casing.

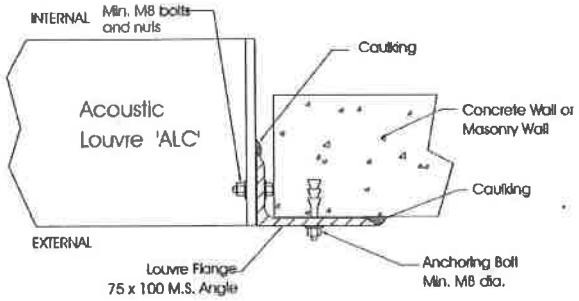
Method of Installation

TYPICAL INSTALLATIONS

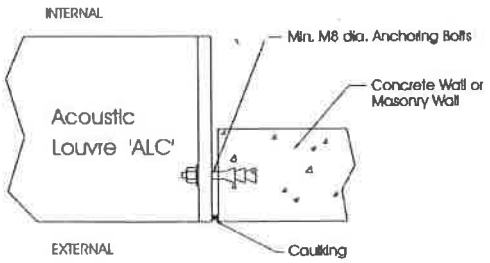
A. Interior Fixing
(Flush Exterior)



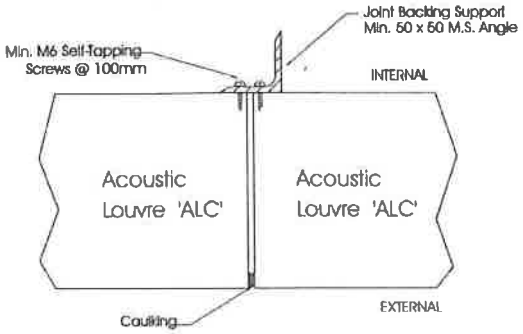
B. External Fixing



C. Side Fixing



D. Module Assembly



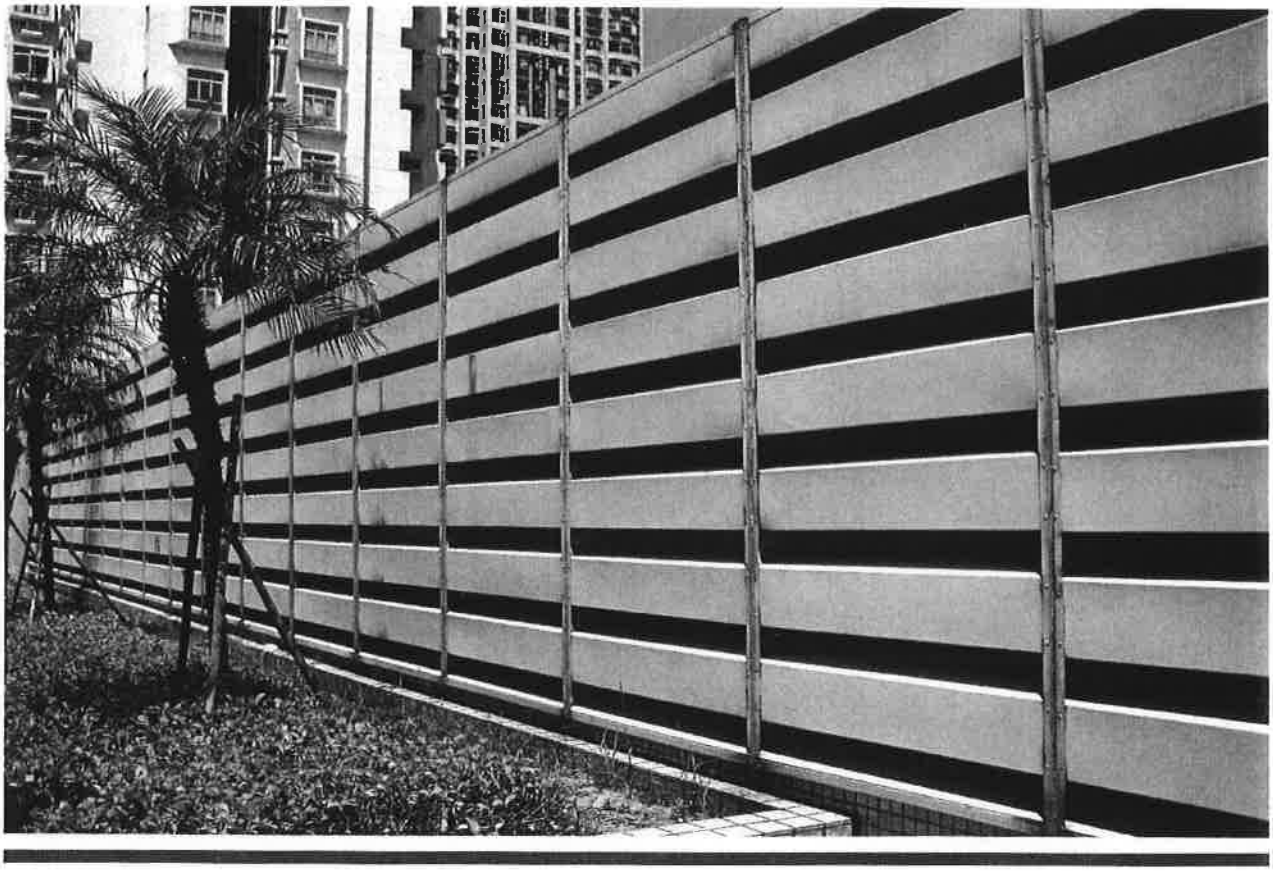
Suggested Specifications

Supply and install J.P. Environmental ALC Acoustic Louvres, (exclusive HK agent: Enviro-Tech Engineering Co., Ltd.) or approved equivalent.

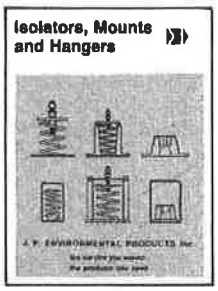
The acoustic and aerodynamic performance of the louvres shall be tested and certified by an independent testing laboratory in accordance with ASTM E-90. Acoustic Louvres shall be selected to meet the specified Noise Criteria and shall have the following minimum acoustic performance.

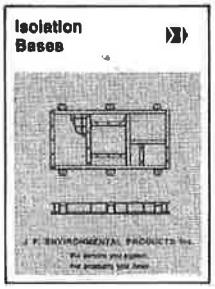
	Octave Band Center Frequency, (Hz)							
	63	125	250	500	1k	2k	4k	8k
Min. Sound Transmission Loss, dB	–	–	–	–	–	–	–	–

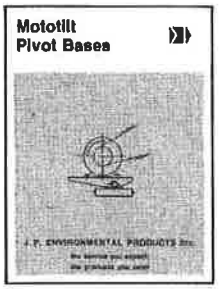
The louvre casing shall be fabricated from min 1.5mm thick galvanized steel sheet (or aluminium or stainless steel.). Louvre blades shall be of aerodynamic design to give minimum pressure drop and resistance to air flow. Louvre blades shall be constructed from min. 0.8mm thick galvanized steel sheet (or aluminum or stainless steel) as top section and min. 0.5mm thick and 23% perforated galvanized steel sheet (or aluminium or stainless steel) as bottom section. Acoustic infill shall be packed with inert, non-combustible acoustic media held secure under 5-10% compression.



OTHER PRODUCTS







For specific applications and selection data contact your J.P. Environmental Products Inc. representative

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Exclusive Distributor for Hong Kong, Macau, China and S.E. Asia

ENVIRO-TECH ENGINEERING CO., LTD.

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Kwun Tong, Kowloon, H.K.
Telephone:(852) 2827-0688
Telefax: (852) 2598-6203

(AL-96)

Annex L

Specification of the Exhaust Silencer for Chiller Enclosure

J. P. ENVIRONMENTAL PRODUCTS INC.
"RECTANGUALR SILENCERS"

MODEL	MODULE SIZE (mm)	STATIC INSERTION LOSS (dB)								PRESSURE DROP (Pa) vs. FACE VELOCITY (m/s)							k-factor
		1	2	3	4	5	6	7	8	12.5	25	50	75	125	200	250	
CSR10-4A		7	12	26	40	50	50	46	35	1.4	1.9	2.7	3.3	4.3	5.4	6.0	6.8
CSR10-4B		6	10	22	35	44	49	47	28	2.0	2.9	4.1	5.0	6.4	8.1	9.1	3.03
CSR10-4C		5	8	18	29	43	43	42	23	2.7	3.9	5.4	6.7	8.6	10.9	12.2	1.69
CSR10-4D	250	5	8	17	28	43	42	38	21	3.3	4.7	6.6	8.1	10.4	13.1	14.7	1.15
CSR10-4E		4	7	15	27	42	40	33	19	4.0	5.6	7.9	9.7	12.4	15.7	17.6	0.8
CSR10-4F		4	6	13	24	40	33	29	17	5.1	7.3	10.3	12.5	16.2	20.5	23.0	0.48
CSR10-4G		3	5	12	23	37	31	27	16	6.6	9.6	13.6	16.6	21.4	27.1	30.3	0.27
CSR12-4A		7	11	23	37	45	48	43	28	1.4	2.0	2.8	3.5	4.5	5.6	6.3	6.28
CSR12-4B		6	10	20	33	43	43	36	20	2.1	3.0	4.2	5.1	6.7	8.4	9.4	2.83
CSR12-4C		4	7	15	29	40	37	31	17	2.8	4.0	5.6	6.9	8.9	11.2	12.6	1.58
CSR12-4D	300	4	7	14	26	37	34	27	15	3.4	4.8	6.8	8.3	10.8	13.6	15.2	1.08
CSR12-4E		4	6	13	23	34	30	25	14	4.1	5.7	8.1	10.0	12.9	16.2	18.1	0.76
CSR12-4F		3	5	10	20	28	24	17	11	5.3	7.5	10.6	13.0	16.8	21.2	23.7	0.44
CSR12-4G		2	4	9	18	26	22	16	10	7.1	10.0	14.1	17.3	22.3	28.1	31.5	0.25
CSR14-4A		7	12	22	34	43	43	34	22	1.5	2.0	2.9	3.6	4.6	5.8	6.5	5.9
CSR14-4B		6	10	18	27	41	39	31	15	2.1	3.0	4.3	5.3	6.8	8.6	9.6	2.73
CSR14-4C		5	8	14	23	34	30	22	14	2.9	4.1	5.7	7.1	9.1	11.5	12.9	1.5
CSR14-4D	350	4	7	13	22	31	26	19	13	3.5	4.9	7.0	8.5	11.0	13.9	15.5	1.03
CSR14-4E		4	6	11	20	28	22	15	11	4.2	5.9	8.3	10.2	13.2	16.6	18.6	0.72
CSR14-4F		2	4	9	16	22	16	10	8	5.4	7.7	10.9	13.4	17.2	21.7	24.3	0.42
CSR14-4G		2	3	8	15	20	14	9	7	7.3	10.3	14.5	17.8	23.0	28.9	32.5	0.24
CSR16-4A		8	13	20	32	42	39	29	19	1.5	2.1	2.9	3.6	4.7	5.9	6.6	5.73
CSR16-4B		6	10	15	25	35	31	26	15	2.2	3.1	4.4	5.4	6.9	8.7	9.8	2.6
CSR16-4C		5	8	12	21	29	24	16	12	2.9	4.1	5.8	7.2	9.2	11.7	13.1	1.47
CSR16-4D	400	4	7	11	19	27	21	15	11	3.6	5.0	7.1	8.6	11.2	14.1	15.8	1
CSR16-4E		4	6	10	17	24	18	12	9	4.2	6.0	8.5	10.4	13.4	16.9	18.9	0.7
CSR16-4F		2	4	8	14	19	12	9	7	5.5	7.9	11.1	13.6	17.6	22.2	24.8	0.41
CSR16-4G		2	3	7	13	17	11	8	6	7.4	10.5	14.8	18.1	23.4	29.6	33.1	0.23
CSR18-4A		8	13	19	29	39	37	31	17	1.5	2.1	3.0	3.7	4.8	6.0	6.7	5.54
CSR18-4B		5	9	14	23	31	27	22	13	2.2	3.1	4.4	5.4	7.0	8.8	9.9	2.57
CSR18-4C		4	7	11	19	25	20	17	10	2.9	4.2	5.9	7.3	9.4	11.8	13.3	1.43
CSR18-4D	450	4	6	10	18	23	17	14	9	3.6	5.1	7.2	8.8	11.3	14.3	16.1	0.97
CSR18-4E		3	5	9	16	21	14	10	8	4.3	6.1	8.6	10.5	13.6	17.1	19.2	0.68
CSR18-4F		2	4	7	13	17	10	8	6	5.6	8.0	11.3	13.8	17.8	22.5	25.2	0.39
CSR18-4G		2	3	6	12	16	9	7	5	7.5	10.6	15.0	18.4	23.8	30.0	33.6	0.22
CSR20-4A		8	13	17	26	36	29	26	14	1.5	2.1	3.0	3.7	4.8	6.1	6.8	5.5
CSR20-4B		5	9	14	22	28	22	17	12	2.2	3.1	4.5	5.5	7.1	8.9	10.0	2.52
CSR20-4C		4	6	10	18	23	17	12	8	3.0	4.3	6.0	7.4	9.5	12.0	13.4	1.38
CSR20-4D	500	4	6	9	17	21	15	10	8	3.6	5.1	7.3	8.9	11.3	14.5	16.2	0.96
CSR20-4E		3	5	9	15	19	12	8	8	4.4	6.1	8.7	10.7	13.8	17.3	19.5	0.66
CSR20-4F		2	4	8	13	16	10	7	8	5.7	8.1	11.4	14.0	18.0	22.8	25.5	0.38
CSR20-4G		2	3	7	11	15	9	6	5	7.6	10.8	15.2	18.6	24.1	30.4	34.0	0.22
CSR22-4A		8	14	17	26	35	27	22	14	1.5	2.2	3.1	3.8	4.9	6.1	6.9	5.28
CSR22-4B		6	10	13	20	26	20	15	11	2.3	3.2	4.5	5.5	7.2	9.1	10.1	2.43
CSR22-4C		4	7	11	17	22	14	11	8	3.0	4.3	6.0	7.4	9.6	12.1	13.6	1.37
CSR22-4D	550	4	6	10	16	20	13	10	8	3.7	5.2	7.3	9.0	11.6	14.6	16.4	0.93
CSR22-4E		3	5	9	15	18	11	8	7	4.4	6.2	8.8	10.7	13.9	17.5	19.6	0.65
CSR22-4F		3	5	8	14	16	8	7	7	5.7	8.1	11.5	14.1	18.2	22.9	25.7	0.38
CSR22-4G		2	3	7	12	13	6	5	5	7.7	10.9	15.4	18.8	24.3	30.7	34.4	0.21
CSR24-4A		8	13	16	23	28	24	20	12	1.6	2.2	3.1	3.8	4.9	6.2	6.9	5.16
CSR24-4B		6	10	13	18	24	18	14	9	2.3	3.3	4.6	5.6	7.2	9.1	10.2	2.38
CSR24-4C		4	6	11	17	21	13	10	8	3.0	4.3	6.1	7.5	9.7	12.2	13.7	1.35
CSR24-4D	600	4	6	11	16	20	12	9	8	3.7	5.2	7.4	9.0	11.7	14.7	16.5	0.92
CSR24-4E		3	5	10	15	19	10	8	8	4.4	6.2	8.8	10.8	14.0	17.6	19.7	0.64
CSR24-4F		2	4	9	14	15	8	7	7	5.8	8.2	11.6	14.2	18.3	23.1	25.9	0.37
CSR24-4G		2	4	7	13	12	6	6	5	7.8	11.0	15.5	19.0	24.5	31.0	34.7	0.21

Annex M

Specification of the AHU Casing and Acoustic Plenum

(2) AIR HANDLING UNIT (Cont'd)

Particular : AHU-PV-G-01 & AHU-PV-G-02 (Cont'd)

Description	Specified	Offered
- Octave Band SWL (dB) (in-duct)		
125 Hz	100	88
250 Hz	101	96
500 Hz	100	94
1000 Hz	94	92
2000 Hz	88	84
4000 Hz	84	81
8000 Hz	81	80
- Octave Band SWL (dB) (Break out)		
125 Hz	75	63
250 Hz	69	64
500 Hz	61	55
1000 Hz	52	50
2000 Hz	43	39
4000 Hz	41	38
8000 Hz	44	43
Casing		
- Overall Length (mm)		2053
- Width (mm)		4100
- Height (mm)		7200
- Frame Type	Aluminium Alloy	Yes
- Outer Skin Material	Pre-painted Galvanized Steel	
- Outer Skin Thickness (mm)	1	
- Inner Skin Material	Pre-painted Galvanized Steel	
- Min. Inner Skin Thickness (mm)	1	
- Insulation Materials	Injected PU Foam	
- Insulation Thickness (mm)	88	
- Insulation Density (kg/m^3)	40	

(2) AIR HANDLING UNIT (Cont'd)

Particular : AHU-PV-G-01 & AHU-PV-G-02 (Cont'd)

Description	Specified	Offered
Acoustic Intake Plenum		
- Panel and Frame	Same as Casing Construction	Yes
- Double Skin Material and Thickness	Same as Casing Construction	
- Insulation Material and Thickness	Same as Casing Construction	
- Additonal Internal Acousitc Lining Material	100mm thick rockwool	
- Fresh air intake camber complete with louver, VCD (motorized) and bird screen build-in	Required	
- Return air chamber complete with louver, build-in VCD (motorized)	Required	
Acoustic Discharge Plenum		
- Panel and Frame	Same as Casing Construction	
- Double Skin Material and Thickness	Same as Casing Construction	
- Insulation Material and Thickness	Same as Casing Construction	
- Additonal Internal Acousitc Lining Material	100mm thick rockwool	
Built-in Silencer in Return Section	Required	
Built-in Silencer in Supply Section	Required	

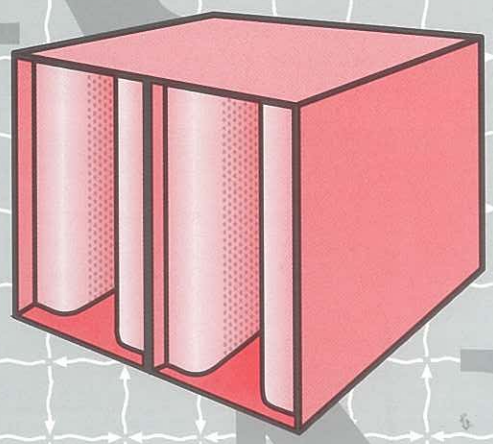
- Remark:

Annex N

Specification of Silencer for AHU

VIBRN

Rectangular Duct Silencers



Vibron Rectangular Silencers

Performance Versatility

Vibron rectangular silencers are available with hundreds of choices of standard insertion loss and pressure drop combinations. Most common airborne noise control requirements for ventilation ductworks and mechanical plant room openings are solved easily with VIBRON silencers at optimum performance and cost. And because of the abundance of choices, it is almost always possible to select a silencer matching the size of ductwork or openings. Hence, transition pieces are saved, and the noise breakin/breakout and extra pressure loss associated with such transitions are eliminated.

Features of Vibron Silencers

1. Galvanised steel casing constructed to various international ductwork standards.
2. Acoustic baffles constructed of perforated galvanised steel and vermin-proof absorptive media.
3. Solid and smooth rounded noses at baffles' leading end with radius of curvature of 57mm to minimise inlet pressure loss.

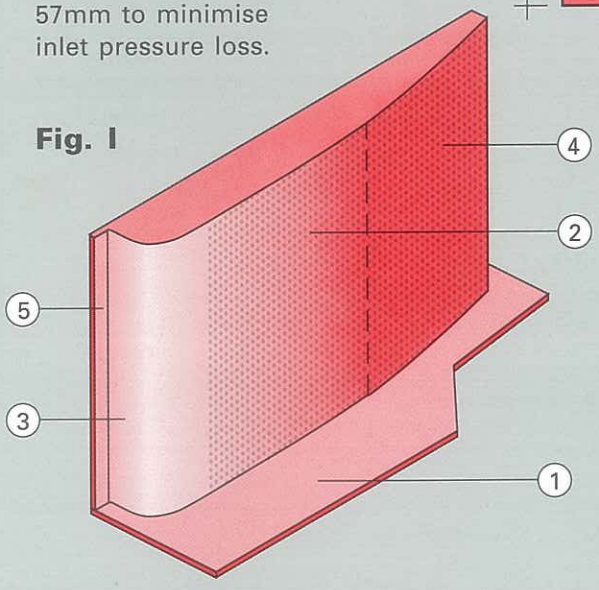


Fig. I

4. 'Evase' shape at baffles' trailing end to achieve static re-gain and optimum attenuation to pressure drop ratio.
5. Slip flange design at inlet and outlet of silencer to suit different varieties of flange joints, and Verromez rolled form flanges.

Alternative Choices of Construction Materials

1. Stainless steel outer casing and/or stainless steel baffles.
2. "VIBRON VISCO" acoustic baffles can be used to prevent the ingress of dust, oil and water into the absorptive media for clean flow and kitchen extract application.

   "VIBRON VISCO" acoustic baffles are tested to comply BS476: Part 7, Class 1.

Description of Silencers

The building block of a silencer is the silencer unit. One full unit consists of two half-size acoustic baffles spaced deliberately to form a central air passage (see Fig II). A full size unit is virtually made up of two half size unit with the central plane of the air passage as axis of symmetry.

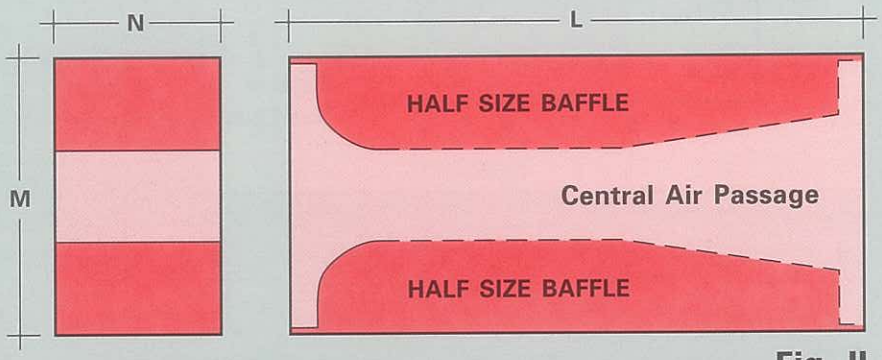


Fig. II

'L' being the length of the silencer

'M' being the width of the silencer

'N' being the height of the silencer

A silencer may consist of single or multiple (full and and half) silencer units. Fig. III illustrates a silencer of two units.

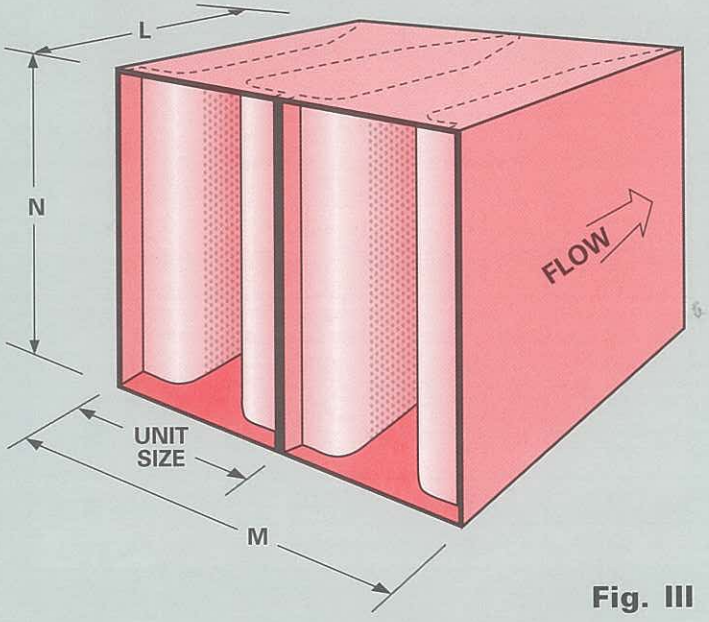


Fig. III

STANDARD AND LOW FREQUENCY MODELS

Two versions of rectangular duct silencers are developed through extensive research by VIBRON. Standard models, RDS series, offer conventional insertion loss; Low frequency models, RDL series, gives higher insertion loss at the lower octave bands at the expense of sound absorption at higher octaves. Fig. IV shall illustrate the achievement.

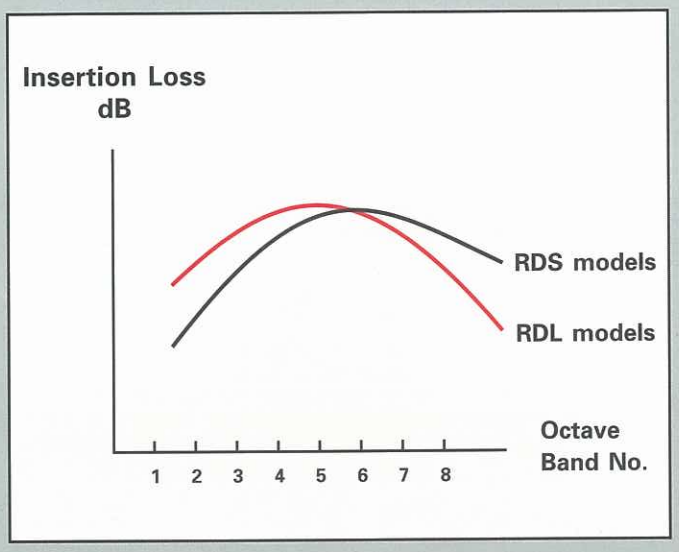


Fig. IV

UNIT SIZE

Standard silencer units are sized from widths of 250mm to 600mm in 25mm increment. Table one lists all the unit sizes and actual widths of silencer units.

Unit Size		Width of Silencer unit, mm	Relative Cost
RDS model	RDL model		
10	–	250	HIGHEST
11	–	275	
12	–	300	
13	–	325	
14	–	350	
15	–	375	
16	16	400	
17	17	425	
18	18	450	
19	19	475	
20	20	500	
21	21	525	
22	22	550	
23	23	575	
24	24	600	LOWEST

Table One

The availability of different unit sizes enables a silencer to be built up of different configurations. For example a silencer dimension 'M' of 600mm can be made from three different configurations shown as Fig. V.

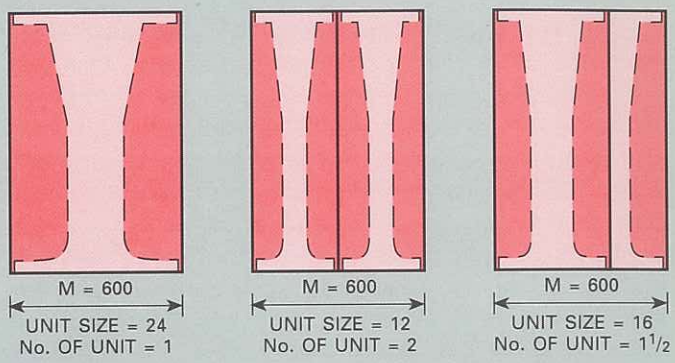


Fig. V

Each of the three configurations bears unique insertion loss and pressure drop performance. The final choice will rely on the actual noise control requirement and system layout.

TYPE NO.

The width of the central air passage always occupies certain purposely-selected percentage of the unit size. Different percentages are denoted the type number of the silencer. It determines principally the silencer pressure drop.

Type No.	Relative % of Air Passage	Relative Pressure Drop
1 1.5 2 2.5 3 3.5 4 4.5 5	LOWEST HIGHEST	HIGHEST LOWEST

Table Two

Increment in length 'L' is available at 300mm. Standard lengths with certified performance data are as listed in Table Three.

Length	Insertion Loss	Pressure Drop	Cost/metre
600	LOWEST	LOWEST	HIGHEST
900			
1200			
1500			
1800			
2100			
2400			
2700	HIGHEST	HIGHEST	HIGHEST

Table Three

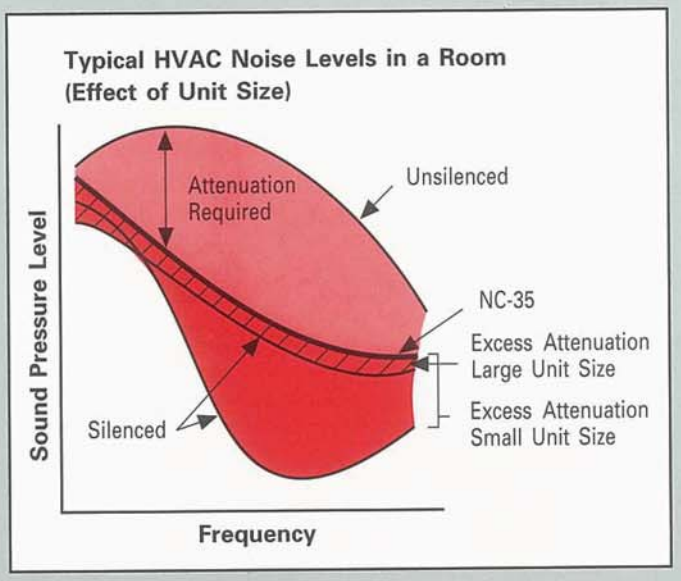
A proper designation of the silencer requires i) unit size, ii) model, iii) type no., iv) length; which means one can choose among numerous combination of these parameters to suit the noise control requirement.

Suggested Silencer Specification

1. Contractor must submit full calculation and selection of silencers to match equipment selected, system requirements, and to achieve final noise criterion in designated areas.
2. All silencers must be factory fabricated with a galvanised steel outer skin not less than 0.8mm. The acoustic filler must be non-combustible and odourless, covered with minimum 0.5mm galvanised perforated metal. The acoustic filler must be packed at 10% compression.
3. Where used for kitchen extract and clean flow application, the acoustic filler must be protected and covered with a noise transparant mylar wrapping underneath the perforated metal, the acoustic baffles shall comply to BS476, Part 7, Class 1.
4. All silencers shall have a 40mm slip flange at each end.
5. The air inlet side must have a solid, smooth and round radius nose. A cropped nose shall be rejected.
6. The air outlet or tail end must have an evase exit to enable a smooth expansion.
7. The air passage must be kept to the exact open area percentage and the two side walls in exact paralled by the use of double spacer/ retainer.
8. The G.I. casing shall be locked formed. For systems having an excess of 1250 Pascals static, the seams shall be filled with mastic.
9. All metal to metal joints shall be spot welded, no rivets allowed.
10. All silencers selected shall match exactly the system duct dimensions. Silencers selected cannot be compromised by tailoring side wall or splitter widths to suit duct size as deviations from published catalog data will be rejected.
11. Silencer performance data shall be in accordance to ASTM E-477 testing standards.
12. Upon architect or engineer's request, independent laboratory test data to ASTM E-477 standards shall be submitted.
13. Silencers of very large sizes are allowed to be made up of smaller modules to form a large bank modules.
14. Silencers shall be manufactured by VIBRON or approved equal.

How Vibron Silencers Optimise The HVAC Noise Control Scheme

Due to characteristic noise spectrum of air handlers, insertion loss required to achieve specified Noise Criteria is usually critical in the second and third octave bands. Typical characteristics are shown in the figure below.



1. Vibron developed the large unit size RDL series of silencers which gives adequate insertion loss at the lower octave bands. This will eliminate over-attenuation at higher octaves while at the same time significantly lower the pressure drop across the silencer, saving energy consumption of the air handler and reduce regenerated noise.
2. If in case required insertion loss at middle and/or higher octaves are significant, the smaller unit size RDS series of silencers will do the job.
3. The RDL series of silencers are tuned to give extra attenuation at 2nd and 3rd octave bands at the expense of insertion loss at higher octaves. This range of silencers are also low in pressure drop and is ideal for air-borne noise control in HVAC ductwork.
4. Varying the actual unit width and the size of the central air passage affects the insertion loss of a silencer. VIRBON tested and tabulated the performance of silencers with 25mm increment in unit width to ensure accuracy and reliabilities of the selection.
5. The ability of VIBRON to match the silencer cross section with the HVAC ductwork will eliminate the pressure loss at inlet and outlet transition pieces and save the system from excess regenerated noise at such transition pieces.
6. Published data is mean average laboratory data −2dB from which selections can be made with confidence in regards to actual installed performance.

Rectangular Duct Silencer Selection Procedure

Selecting a Vibron Silencer

The information required to select the correct Vibron silencer consists of:

1. Minimum Insertion Loss (IL) at various octave bands to achieve the noise control target. If not known, please consult our acoustical engineers.
2. Maximum Pressure Drop (PD) allowable across the silencer. Silencer PD will depend on by dividing the air flow through the silencer by the cross section area of the silencer.
3. Duct size and available lengths to accommodate the silencer. With this information, simply follow the steps below to select the most economical silencer which will meet the required performance.

Preliminaries

I) Let the cross section of the silencer be the same as that of the ductwork (or wall opening) to which the silencer will be mounted.

II) Look up Table Three and decide on a standard silencer length that is close to but not exceeding the allowable length specified for the silencer; if length is not specified, go for 900mm silencer length.

III) Calculate the face velocity of the silencer and look up the recommendation from Table Four. First go to the section of the table that correspond to the silencer length. Then from the lower portion of the section, which represents the larger end of unit sizes, find out the range of velocities containing the face velocity of the silencer determined earlier, and note the 'type no' that corresponds to the velocity range. The same procedure may be repeated by going to the upper portion of the body of Table Four to locate alternative 'type no' matching with the smaller end of the unit sizes.

IV) Evaluate the I.L. requirement. If higher IL is needed at mid and high octave bands while low octave bands are not of material importance, try series RDS silencers.

If in case high IL is expected of the low octave bands while that of the high octave bands is not of material importance, try series RDL silencers.

STEP 1 — Unit Size

The unit size is determined from the cross sectional dimensions "M" and "N". Let the smaller duct dimension be "M". Find the unit size(s) in the body of Table One that represents actual unit widths which, when multiplied by integers, will make up exactly the dimension M. Note the unit size, or several unit sizes in certain occasions, obtained through this method. The same can be repeated for dimension N to obtain an optional choice or in case no unit size matches dimension M. As explained earlier, half unit sizes are possible. Unit size having one-half of their actual unit width that gives integral portion of either dimensions M or N are also acceptable.

STEP 2 — Insertion Loss (IL)

Silencer insertion loss are tabulated in VIBRON data book.

i) START with the table for silencer length determined earlier and locate the block whose unit size corresponds to that determined in Step 1. Always try the largest unit size if there are a few possibilites.

ii) From the block, find the particular row with silencer 'type no'. Matching with the type no. determined earlier. Compare the insertion loss.

iii) If the tabulated IL is close to but not less than the specified IL, the silencer may suit the requirement. The appropriateness has yet to be decided upon checking the Pressure Drop.

iv) In case the IL for the silencer located in iii) far exceeds the required IL, go to the next shorter standard silencer length(s) and repeat ii) and iii) until the length with IL just meet or above the requirement is obtained.

STEP 3 — Pressure Drop

i) Go to the Pressure drop factor table in the VIBRON data book that correspond to the length of the silencer finalised from step 2.

ii) Look up the factor from the body of the table matches the unit size and type no. of the silencer finalised from step 2.

iii) Work out the face velocity in Feet Per Minute FPM (1 mps equals 196.85 FPM).

iv) Work out the square of the FPM obtained in iii) and divide it by the factor located in ii) to get the pressure drop in Pascal.

v) Compare the pressure drop in iv) with the specified. If it is smaller than the specified value, the silencer is acceptable. If not, do either one of the following:

a) keep the same unit silencer, go for next larger type no., and next larger silencer length, repeat the exercise in step 2,

b) take next smaller unit size among the choices obtained earlier, but with next larger type no., and next longer silencer, repeat step 2.

STEP 4 — Specify the Silencer

Typical silencer model designation	12 Unit Size	RDS/2 – Silencer Type	L Length in. (mm)	x	M Cross Section in. (mm)	x	N

Note: Performance specification is obtained by eliminating the cross section dimensions, eg. 12 RDS/2-900.

Example:
A 600mm x 900mm duct is handling 3.0m³/s air flow, select a silencer to meet the following specification.

IL in Octave Bands								Pressure Drop	Length
1	2	3	4	5	6	7	8	(Pa)	mm
7	13	17	24	30	20	15	9	55	1500

Calculation of Face velocity

Face Velocity = 3.0/(0.6 x 0.9) = 5.56m/s

From Table Four (i), recommended selection are:

Unit Size	Type no.
10 – 15	3
16 – 24	2

	Face Velocity for Silencer Length below 1500mm (m/s)				
Unit Size	1	2	3	4	5
10 THRU **15**	2.0 | 3.9	3.5 | 5.8	5.5 | 8.1	7.5 | 11.4	
16 THRU **24**	2.0 | 4.5	4.0 | 6.6	6.5 | 9.3	8.5 | 13.2	12.0 | 16.5

Table Four (i)

Step 1

Choose 600mm as dimension "M", from table 1, unit size is 24, other alternative unit sizes are 12 and 16.

Step 2

From VIBRON RDS data book, the following insertion loss can be located by the three parameter,
ie. Length = 1500mm, unit size = 24 and type no. = 2.

Octave Band	1	2	3	4	5	6	7	8
Insertion Loss	8	14	17	26	31	23	16	11

The insertion loss selected meet the specification.

Step 3

From the data book, the pressure drop factor of the silencer finalised from step 2 is 23123.

Face velocity of silencer = 5.56m/s x 196.85 = 1094FPM.

Pressure Drop = 1094 x 1094 / 23123 = 52Pa.

The pressure drop is small than the specified value, the silencer is acceptable.

Step 4

Silencer model designation is:

24RDS/2 - 1500 x 600 x 900

	Face Velocity for Silencer Length above 1500mm (m/s)				
Unit Size	1	2	3	4	5
10 THRU **15**	2.0 | 3.0	3.0 | 4.0	4.0 | 6.5	6.5 | 9.0	
16 THRU **24**	2.0 | 3.5	3.5 | 5.5	5.5 | 7.5	7.5 | 10.5	10.5 | 15.0

Table Four (ii)

VIBRON LIMITED

1720 MEYERSIDE DRIVE, MISSISSAUGA, ONTARIO, CANADA L5T 1A3 (416) 677-4922 TELEX: 06-968834

Annex O

Audio Control System

Configure complex systems elegantly with the power of HiQnet™ London Architect

HiQnet London Architect is the configuration, control and monitoring application for the Soundweb London family. Representations of Soundweb London devices can be positioned and organized logically to represent connectivity, rack locations and the racks themselves.

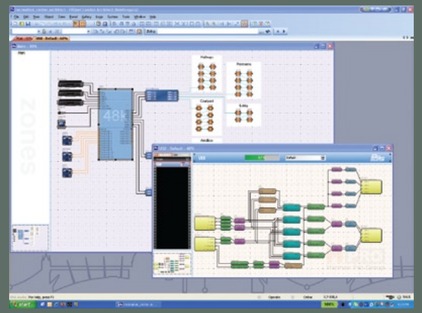
DRAG-AND-DROP CONFIGURATION

The open architecture of Soundweb London is configured using a simple drag-and-drop approach. Scalable audio 'Processing Objects' representing processors such as compressors, mixers, gains and crossovers can be positioned and connected as required within each DSP capable device. Since the configuration process does not require hardware, even the largest system can be designed from the comfort of a sofa.

With over 25 years of experience in audio signal processing, BSS Audio modeled the DSP algorithms of Soundweb London on its highly acclaimed analog signal processors.

SIMPLIFY THE COMPLEX

To assist in navigation through Soundweb London designs, 'Signal Name Following' allows the name of the signal to be displayed at any point within a design. The names of signals are maintained across networked audio connections so keeping track of signals as designs scale up is as simple as hovering a mouse pointer.



SCALABLE AUDIO PROCESSING

Each Processing Object has a 'Default Control Panel' which contains all of the controls one would expect to find for the given processor. These controls offer real-time control of parameters when online to a configured system.

Dedicated Processing Objects for common functions eliminate the complexity of providing solutions for those applications. One such example is the scalable Room Combine Processing Object which provides a comprehensively featured Default Control Panel and automates the linking and routing associated with the combining of rooms.

USER-SPECIFIC CONTROL

'Custom Control Panels' allow user-specific control interfaces to be designed. With complete control over navigation, functionality, look and feel; well-designed Custom Control Panels represent significant added value to technical and non-technical users alike.

SCALABLE LOGIC PROCESSING

In addition to audio processing, Soundweb London is also able to process logic. Scalable logic 'Processing Objects' representing functions such as AND, OR and Truth Tables can be positioned and connected as required within each device. Used in conjunction with external control and input from the audio domain, logic processing opens the door to comprehensive automation and system integration.

ONE INTERFACE

HiQnet London Architect offers an 'Export to Clipboard' feature which allows individual parameters to be exported from HiQnet London Architect and imported into HiQnet System Architect.™ This facilitates control and monitoring for Harman HiQnet systems from a single application, HiQnet System Architect.

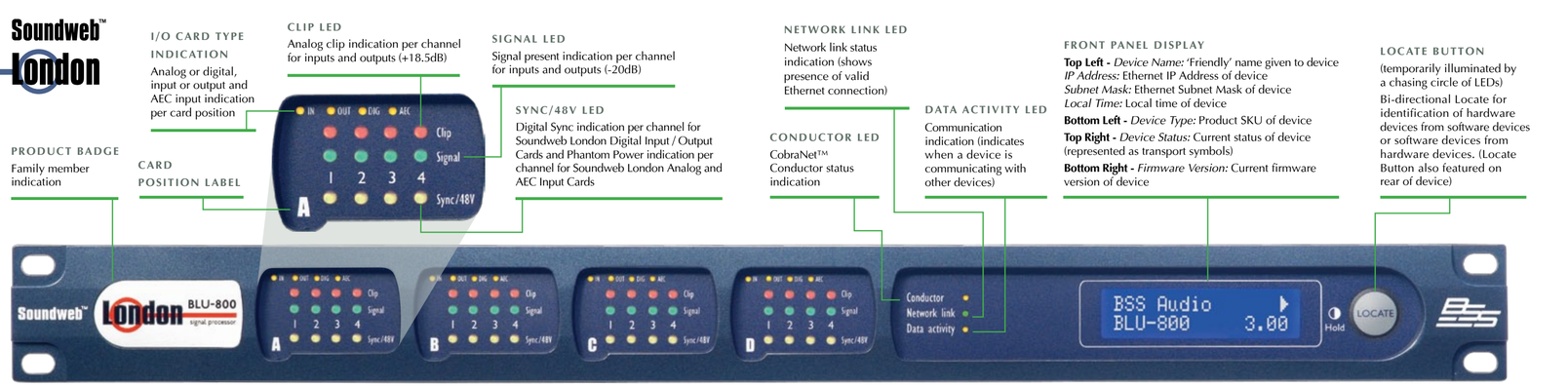
BSS Audio
8760 South Sandy Parkway
Sandy, Utah 84070
801.566.8800
bssaudio.com

PN: ZL10096-F

NETWORKED
PROGRAMMABLE
DSP SYSTEMS

Soundweb™
London

Whether a solo or a full ensemble, Soundweb London delivers the perfect performance.



The power, flexibility and reliability for any scale of installed sound system.

With a choice of eight configurable processors within the Soundweb London family and input / output card flexibility within each device, Soundweb London represents a truly flexible and scalable system. Whether you require the high bandwidth audio networking of a digital audio bus, CobraNet compatibility, DSP capability, input / output expansion or a specific mix of functionality, Soundweb London offers the building blocks of a tailor-made system.

	CHASSIS	CONFIG. I/O	INPUTS	OUTPUTS	CONFIG.	LCD DISPLAY	LOGIC	RS-232	GPIO	SIGNAL PROCESSING	COBRANET	DIGITAL AUDIO BUS	AEC COMPATIBLE
BLU-800	19"	✓	C	C	S	✓	✓	✓	✓	4X	✓	256	✓
BLU-80	19"	✓	C	C	S	✓	✓	✓	✓	1X	✓		
BLU-320	19"	✓	C	C	S	✓	✓	✓	✓		✓	256	✓
BLU-32	19"	✓	C	C	S	✓	✓	✓	✓		✓		
BLU-160	19"	✓	C	C	S	✓	✓	✓	✓	4X		256	✓
BLU-16	19"	✓	C	C	S	✓	✓	✓	✓	1X			
BLU-120	19"	✓	C	C	S	✓	✓	✓	✓			256	✓
BLU-100	19"		12	8	S		✓	✓	✓	2X		48	
BLU-BIB	HALF-RACK		8		M							256	
BLU-BOB1	HALF-RACK			8	M							256	
BLU-BOB2	19"			8	M							256	

C= Configurable; S= Software; M= Manual

Wall Controllers

BLU-10 (available in white, black and blue) [E]

BLU-8 (available in white and black) [E]

BLU-6 [CI]

BLU-3 [CI]

sw9015US [CI]

sw9012US [CI]

Input / Output Expanders

Rack Mount Kit available to accommodate up to two BLU-BIB or BLU-BOB1 devices (1U).

BLU-BIB

BLU-BOB1

Also available in 19" chassis (BLU-BOB2)

Accessories

BLU-HIF
Telephone Headset Interface

BLU-MC1
Fiber Optic Media Converter

[E] = Ethernet Controller [CI] = Control Input Controller

Annex P

Calibration Certificates

Hong Kong Calibration Ltd.
香 港 校 正 有限公司

Calibration Certificate

Certificate No. 404229 Page 1 of 2 Pages

Customer : Environmental Resources Management

Address : 16/F DCH Commercial Centre 25 Westlands Road Quarry Bay Hong Kong

Order No. : Q41594 **Date of receipt :** 20-Jun-14

Item Tested

Description : Sound Level Calibrator

Manufacturer : Svantek

Model : SV30A **Serial No. :** 7971

Test Conditions

Date of Test : 23-Jun-14 **Supply Voltage :** --

Ambient Temperature : (23 ± 3)°C **Relative Humidity :** (50 ± 25) %

Test Specifications

Calibration check.

Ref. Document/Procedure : F21, Z02.

Test Results

All results were within the IEC 942 Class 1 specification.

The results are shown in the attached page(s).

Main Test equipment used:

Equipment No.	Description	Cert. No.	Traceable to
S014	Spectrum Analyzer	35730	NIM-PRC & SCL-HKSAR
S205	Ref. Sound Level Calibrator	PHCO40002	SCL-HKSAR
S041	Universal Counter	34621	SCL-HKSAR
S206	Sound Level Meter	36203	SCL-HKSAR

The values given in this Calibration Certificate only relate to the values measured at the time of the test and any uncertainties quoted will not include allowance for the equipment long term drift, variations with environmental changes, vibration and shock during transportation, overloading, mis-handling, or the capability of any other laboratory to repeat the measurement. Hong Kong Calibration Ltd. shall not be liable for any loss or damage resulting from the use of the equipment.

The test equipment used for calibration are traceable to International System of Units (SI).
The test results apply to the above Unit-Under-Test only

Calibrated by : Dorothy Cheuk

Approved by : Steve Kwan

Date: 23-Jun-14

This Certificate is issued by:
Hong Kong Calibration Ltd
Unit 8B, 24/F., Well Fung Industrial Centre, No. 58-76, Ta Chuen Ping Street,Kwai Chung, NT,Hong Kong.
Tel: 2425 8801 Fax: 2425 8646

Calibration Certificate

Results :

1. Level Accuracy

UUT Nominal Value (dB)	Measured Value (dB)	IEC 942 Class 1 Spec.
94	94.15	± 0.3 dB
114	114.17	

Uncertainty : ± 0.2 dB

2. Frequency

UUT Nominal Value	Measured Value	IEC 942 Class 1 Spec.
1 kHz	1.000 kHz	± 2 %

Uncertainty : $\pm 3.6 \times 10^{-6}$

3. Level Stability : 0.0 dB
IEC 942 Class 1 Spec. : ± 0.1 dB
Uncertainty : ± 0.01 dB

4. Total Harmonic Distortion : < 0.8 %
IEC 942 Class 1 Spec. : < 3 %
Uncertainty : ± 2.3 % of reading

Remark : 1. UUT : Unit-Under-Test
2. The above measured values are the mean of 3 measurements.
3. The uncertainty claimed is for a confidence probability of not less than 95%.
4. Atmospheric Pressure : 991 hPa.

---------- END ----------

Hong Kong Calibration Ltd.
香港校正有限公司

Calibration Certificate

Certificate No. 404228

Customer : Environmental Resources Management

Address : 16/F DCH Commercial Centre 25 Westlands Road Quarry Bay Hong Kong

Order No. : Q41594 **Date of receipt :** 20-Jun-14

Item Tested

Description : Sound Level Calibrator
Manufacturer : 01dB-Stell
Model : CAL21 **Serial No. :** 34113609(2011)

Test Conditions

Date of Test : 23-Jun-14 **Supply Voltage :** --
Ambient Temperature : (23 ± 3)°C **Relative Humidity :** (50 ± 25) %

Test Specifications

Calibration check.
Calibration procedure : Z02, IEC 942.

Test Results

All results were within the IEC 942 Class 2 specification.
The results are shown in the attached page(s).

Main Test equipment used:

Equipment No.	Description	Cert. No.	Traceable to
S205	Ref. Sound Level Calibrator	PHCO40002	SCL-HKSAR
S041	Universal Counter	34621	SCL-HKSAR
S206	Sound Level Meter	36203	SCL-HKSAR

The values given in this Calibration Certificate only relate to the values measured at the time of the test and any uncertainties quoted will not include allowance for the equipment long term drift, variations with environmental changes, vibration and shock during transportation, overloading, mis-handling, or the capability of any other laboratory to repeat the measurement. Hong Kong Calibration Ltd. shall not be liable for any loss or damage resulting from the use of the equipment.

The test equipment used for calibration are traceable to International System of Units (SI).
The test results apply to the above Unit-Under-Test only

Calibrated by : Dorothy Cheuk

Approved by : Steve Kwan

Date: 23-Jun-14

This Certificate is issued by:
Hong Kong Calibration Ltd.
Unit 8B, 24/F., Well Fung Industrial Centre, No. 58-76, Ta Chuen Ping Street,Kwai Chung, NT,Hong Kong.
Tel: 2425 8801 Fax: 2425 8646

Calibration Certificate

Results :

1. Level Accuracy

UUT Nominal Value (dB)	Measured Value (dB)	IEC 942 Class 1 Spec.
94	93.98	± 0.3 dB

Uncertainty : ± 0.2 dB

2. Frequency

UUT Nominal Value	Measured Value	IEC 942 Class 1 Spec.
1 kHz	1.008 kHz	± 2 %

Uncertainty : $\pm 3.6 \times 10^{-6}$

3. Level Stability : 0.0 dB
IEC 942 Class 1 Spec. : ± 0.1 dB
Uncertainty : ± 0.1 dB

4. Total Harmonic Distortion : < 1.6 %
IEC 942 Class 1 Spec. : < 3 %
Uncertainty : ± 2.3 % of reading

Remark : 1. UUT : Unit-Under-Test
2. The above measured values are the mean of 3 measurement.
3. The uncertainty claimed is for a confidence probability of not less than 95%.
4. Atmospheric Pressure : 991 hPa.

---------- END ----------

Hong Kong Calibration Ltd.
香 港 校 正 有限公司

Calibration Certificate

Certificate No. **32987** Page 1 of 3 Pages

Customer : Environmental Resources Management

Address : 21/F, Lincoln House, 979 King's Road, Taikoo Place, Island East, Hong Kong.

Order No. : Q31162 **Date of receipt :** 3-May-13

Item Tested

Description : Sound Level Meter

Manufacturer : Solo

Model : 01dB **Serial No. :** 65226

Test Conditions

Date of Test : 21-May-13 **Supply Voltage :** --

Ambient Temperature : (23 ± 3)°C **Relative Humidity :** (50 ± 25) %

Test Specifications

Calibration check.

Calibration procedure : Z01.

Test Results

All results were within the IEC 651 Type1, IEC 804 Type1 and IEC 1260 Class1 specification.

The results are shown in the attached page(s).

Test equipment used:

Equipment No.	Description	Cert. No.	Traceable to
S017	Multi-Function Generator	C127181	SCL-HKSAR
S024	Sound Level Calibrator	30620	NIM-PRC & SCL-HKSAR

The values given in this Calibration Certificate only relate to the values measured at the time of the test and any uncertainties quoted will not include allowance for the equipment long term drift, variations with environmental changes, vibration and shock during transportation, overloading, mis-handling, or the capability of any other laboratory to repeat the measurement. Hong Kong Calibration Ltd. shall not be liable for any loss or damage resulting from the use of the equipment.

The test equipment used for calibration are traceable to International System of Units (SI).
The test results apply to the above Unit-Under-Test only

Calibrated by : Liam Wong

Approved by : Dorothy Cheuk

Date: 21-May-13

This Certificate is issued by:
Hong Kong Calibration Ltd.
Unit 8B, 24/F., Well Fung Industrial Centre, No. 58-76, Ta Chuen Ping Street,Kwai Chung, NT,Hong Kong.
Tel: 2425 8801 Fax: 2425 8646

E

Calibration Certificate

Results :

1. Accuracy Check

UUT Setting			Applied Value (dB)	UUT Reading (dB)
Range (dB)	Response	Weighting		
20 - 140	Fast	L_A	94.0	93.8
	Slow			93.8
	Fast	L_C		93.9
	Slow			93.9
	Fast	L_A	114.0	113.9
	Slow			113.9
	Fast	L_C		113.9
	Slow			113.9

IEC 651 Type 1 Spec. : ± 0.7 dB
Uncertainty : ± 0.1 dB

2. Level Stability : 0.0 dB

IEC 651 Type 1 Spec. : ± 0.3 dB
Uncertainty : ± 0.1 dB

3. Linearity

Differential level linearity

UUT Range	Applied Value (dB)	UUT Reading (dB)	Variation (dB)	IEC 651 Type 1 Spec.
140	84.0	83.8	0.0	± 0.4 dB
	94.0	93.8 (Ref.)	- -	
	95.0	94.8	0.0	± 0.2 dB

Uncertainty : ± 0.1 dB

Calibration Certificate

4. Frequency Weighting

A weighting

Frequency	Attenuation (dB)	IEC 651 Type 1 Spec.
31.5 Hz	-39.5	- 39.4 dB, ± 1.5 dB
63 Hz	-26.1	- 26.2 dB, ± 1.5 dB
125 Hz	-16.1	- 16.1 dB, ± 1 dB
250 Hz	-8.6	- 8.6 dB, ± 1 dB
500 Hz	-3.3	- 3.2 dB, ± 1 dB
1 kHz	0.0 (Ref.)	0 dB, ± 1 dB
2 kHz	+1.2	+ 1.2 dB, ± 1 dB
4 kHz	+0.8	+ 1.0 dB ,± 1 dB
8 kHz	-1.8	- 1.1 dB, + 1.5 dB ~ - 3 dB
16 kHz	-12.1	- 6.6 dB, + 3 dB ~- ∞

Uncertainty : ± 0.1 dB

5. Time Averaging

Applied Burst duty Factor	Applied Leq Value (dB)	UUT Reading (dB)	IEC 804 Type 1 Spec.
continuous	40.0	- -	--
1/10	40.0	40.0	± 0.5 dB
$1/10^2$	40.0	39.9	
$1/10^3$	40.0	39.9	± 1.0 dB
$1/10^4$	40.0	39.9	

Uncertainty : ± 0.1 dB

Calibration Certificate

6. Filter Characteristics

6.1 1/1 – Octave Filter

Frequency	Attenuation (dB)	IEC 1260 Class 1 (dB)
125 Hz	-74.8	< - 61
250 Hz	-55.0	< - 42
500 Hz	-24.4	< - 17.5
707 Hz	-3.0	- 2 ~ - 5
1 kHz (Ref)	--	--
1.414 kHz	-2.8	- 2 ~ - 5
2 kHz	-48.3	< - 17.5
4 kHz	-88.6	< - 42
8 kHz	-89.0	< - 61

Uncertainty : ± 0.25 dB

6.2 1/3 – Octave Filter

Frequency	Attenuation (dB)	IEC 1260 Class 1 (dB)
326 Hz	-68.4	< - 61
530 Hz	-58.4	< - 42
772 Hz	-28.4	< - 17.5
891 Hz	-3.5	+ 0.3 ~ - 5.0
1 kHz (Ref)	--	--
1.122 kHz	-3.7	+ 0.3 ~ - 5.0
1.296 kHz	-31.5	< - 17.5
1.887 kHz	-66.5	< - 42
3.070 kHz	-90.0	< - 61

Uncertainty : ± 0.25 dB

Remarks : 1. UUT : Unit-Under-Test
2. The uncertainty claimed is for a confidence probability of not less than 95%.
3. Atmospheric Pressure : 996 hPa.

---------- END ----------

Hong Kong Calibration Ltd.
香港校正有限公司

Calibration Certificate

Certificate No. 34249 Page 1 of 3 Pages

Customer : Environmental Resources Management

Address : 21/F, Lincoln House, 979 King's Road, Taikoo Place, Island East, Hong Kong.

Order No. : Q31652 **Date of receipt :** 24-Jun-13

Item Tested

Description : Sound Level Meter

Manufacturer : Solo

Model : 01dB **Serial No. :** 65225

Test Conditions

Date of Test : 5-Jul-13 **Supply Voltage :** --

Ambient Temperature : (23 ± 3)°C **Relative Humidity :** (50 ± 25) %

Test Specifications

Calibration check.

Calibration procedure : Z01.

Test Results

All results were within the IEC 651 Type1, IEC 804 Type1 and IEC 1260 Class1 specification.

The results are shown in the attached page(s).

Test equipment used:

Equipment No.	Description	Cert. No.	Traceable to
S017	Multi-Function Generator	C127181	SCL-HKSAR
S024	Sound Level Calibrator	30620	NIM-PRC & SCL-HKSAR

The values given in this Calibration Certificate only relate to the values measured at the time of the test and any uncertainties quoted will not include allowance for the equipment long term drift, variations with environmental changes, vibration and shock during transportation, overloading, mis-handling, or the capability of any other laboratory to repeat the measurement. Hong Kong Calibration Ltd. shall not be liable for any loss or damage resulting from the use of the equipment.

The test equipment used for calibration are traceable to International System of Units (SI).
The test results apply to the above Unit-Under-Test only

Calibrated by : Liam Wong

Approved by : Dorothy Cheuk

Date: 5-Jul-13

This Certificate is issued by:
Hong Kong Calibration Ltd.
Unit 8B, 24/F., Well Fung Industrial Centre, No. 58-76, Ta Chuen Ping Street,Kwai Chung, NT,Hong Kong.
Tel: 2425 8801 Fax: 2425 8646

Calibration Certificate

Results :

1. SPL Accuracy

UUT Setting				Applied Value (dB)	UUT Reading (dB)
Level Range	Octave Filter	Weight	Time Const.		
20 – 140 dB	OFF	A	Fast	94.0	93.7
			Slow		93.7
		C	Fast		93.7
	ON (1/1)	--	Fast		93.7
	ON (1/3)	--	Fast		93.7
	OFF	A	Fast	114.0	113.7
			Slow		113.7
		C	Fast		113.7
	ON (1/1)	--	Fast		113.7
	ON (1/3)	--	Fast		113.7

IEC 651 Type 1 Spec. : ± 0.7 dB
Uncertainty : ± 0.2 dB

2. Level Stability : 0.0 dB

IEC 651 Type 1 Spec. : ± 0.3 dB
Uncertainty : ± 0.1 dB

3. Linearity

UUT Range (dB)	Applied Value (dB)	UUT Reading (dB)	Variation (dB)	IEC 651 Type 1 Spec.
20 – 140 dB	84.0	83.8	+0.1	± 0.4 dB
	94.0	93.7 (Ref.)	--	
	95.0	94.7	0.0	± 0.2 dB

Calibration Certificate

4. Frequency Weighting

A weighting

Frequency	Attenuation (dB)	IEC 651 Type 1 Spec.
31.5 Hz	-39.2	- 39.4 dB, ± 1.5 dB
63 Hz	-25.9	- 26.2 dB, ± 1.5 dB
125 Hz	-16.0	- 16.1 dB, ± 1 dB
250 Hz	-8.5	- 8.6 dB, ± 1 dB
500 Hz	-3.1	- 3.2 dB, ± 1 dB
1 kHz	0.0 (Ref.)	0 dB, ± 1 dB
2 kHz	+1.2	+ 1.2 dB, ± 1 dB
4 kHz	+0.9	+ 1.0 dB ,± 1 dB
8 kHz	-1.7	- 1.1 dB, + 1.5 dB ~ - 3 dB
16 kHz	-12.1	- 6.6 dB, + 3 dB ~- ∞

Uncertainty : ± 0.1 dB

5. Time Averaging

Applied Burst duty Factor	Applied Leq Value (dB)	UUT Reading (dB)	IEC 804 Type 1 Spec.
continuous	40.0	40.0	--
1/10	40.0	40.0	± 0.5 dB
$1/10^2$	40.0	40.0	
$1/10^3$	40.0	40.0	± 1.0 dB
$1/10^4$	40.0	40.0	

Uncertainty : ± 0.1 dB

Calibration Certificate

6. Filter Characteristics

6.1 1/1 – Octave Filter

Frequency	Attenuation (dB)	IEC 1260 Class 1 (dB)
125 Hz	-74.4	< - 61
250 Hz	-55.0	< - 42
500 Hz	-24.4	< - 17.5
707 Hz	-3.0	- 2 ~ - 5
1 kHz (Ref)	--	--
1.414 kHz	-2.8	- 2 ~ - 5
2 kHz	-18.3	< - 17.5
4 kHz	-83.6	< - 42
8 kHz	-84.5	< - 61

Uncertainty : ± 0.25 dB

6.2 1/3 – Octave Filter

Frequency	Attenuation (dB)	IEC 1260 Class 1 (dB)
326 Hz	-69.1	< - 61
530 Hz	-59.8	< - 42
772 Hz	-28.4	< - 17.5
891 Hz	-3.4	+ 0.3 ~ - 5.0
1 kHz (Ref)	--	--
1.122 kHz	-3.7	+ 0.3 ~ - 5.0
1.296 kHz	-31.5	< - 17.5
1.887 kHz	-66.8	< - 42
3.070 kHz	-80.7	< - 61

Uncertainty : ± 0.25 dB

Remark : 1. UUT : Unit-Under-Test
2. The uncertainty claimed is for a confidence probability of not less than 95%.
3. Atmospheric Pressure : 1001 hPa.

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