

SHARPS REDMORE

ACOUSTIC CONSULTANTS ▪ Established 1990



Report

Proposed Aldi store, Abbey Road, Neath

Fixed plant noise assessment

Prepared by

K J Metcalfe BSc (Hons). MIOA

Date 3rd June 2021

Project No: 1918927

Head Office

Sharps Redmore

The White House, London Road,
Copdock, Ipswich, IP8 3JH

T 01473 730073

E contact@sharpsredmore.co.uk

W sharpsredmore.co.uk

Regional Locations

South England (Head Office),
South West England,
North England, Wales, Scotland

Sharps Redmore Partnership Limited

Registered in England No. 2593855

Directors

RD Sullivan BA(Hons), PhD, CEng, MIOA, MAAS, MASA;

KJ Metcalfe BSc(Hons), MIOA;

N Durup BSc(Hons), MSc, PhD, CEng, FIOA, MInstP, MASA, MAES;

GJ King MIOA, MCIEH

Company Consultant

TL Redmore BEng, MSc, PhD, MIOA



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- A. Sketch showing plant scheme changes
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DISCLAIMER

This report has been prepared with all reasonable skill, care and diligence commensurate with an acoustic consultancy practice under the terms and brief agreed with our client at that time. Sharps Redmore provides no duty or responsibility whatsoever to any third party who relies upon its content, recommendations or conclusions.

1.0 Introduction

- 1.1 Sharps Redmore (SR) has been instructed to undertake a noise assessment of fixed plant equipment associated with the consented Aldi store at Abbey Road, Neath (planning permission P2019/5304). The fixed plant scheme has been amended from that originally proposed, with a new configuration and plant locations.
- 1.2 There are a number of planning conditions imposed of the consent that relate to the control of noise from fixed plant. These are conditions 21, 21, 22, 23, 24, 25 and 34.
- 1.3 These planning conditions state:

“21. Noise assessment

Within 3 months of the store becoming fully operational, a noise assessment shall be undertaken to evaluate the actual noise impact of the development (which shall include all aspects of the development) in accordance with a methodology which shall first have been agreed in writing by the Local Planning Authority. The purpose of the assessment will be to evaluate whether or not the predictions made during the application phase are representative of operational real life noise level. Findings of the assessment shall be documented within a report, which shall be submitted to the Local Planning Authority within 4 months of the store becoming fully operational, and which shall include any necessary mitigation or modifications necessary to ensure that the development is in compliance with the noise parameters set out in condition 34.

22 Enclosure around the CO2 refrigeration packs

Notwithstanding the submitted plan and prior to the first beneficial use of the development, a scheme shall be submitted to and approved in writing by the Local Planning Authority detailing the enclosure around the CO2 refrigeration packs. The scheme shall provide a more suitable less intrusive alternative to palisade fencing. The fencing as agreed shall be erected prior to the first beneficial use of the development and retained as such thereafter.

23 Erection of means of enclosure and acoustic fence

All mean of enclosures including the acoustic fencing as shown on drawing 190487-1400 P21 (with the exception of the enclosure situated around the CO2 refrigeration packs which is covered under condition 22) shall be erected on site prior to the first beneficial use of the development and retained as such thereafter.

24 Acoustic fencing

Notwithstanding the submitted plans and prior to the first beneficial use of the development, full details of the 2.5m and 2m high sections of Acoustic fencing including specifications) shall be submitted to and approved in writing by the Local Planning Authority. The acoustic barrier shall be constructed in accordance with the agreed design and erected prior to the first beneficial use of the development and retained as such thereafter.

25 Ultra-low noise 30dB gas cooler

The Ultra-low noise 30dB gas coolers shall be installed prior to the first beneficial use of the development and retained and maintained as such thereafter. Should any of the approved plant need to be repaired or replaced then any repaired or replacement plant shall as a minimum perform to the same noise specification.

34 Plant noise

Between the hours of 07:00 and 19:00 the noise rating level of plant/machinery at the development shall not exceed 10 dB below the existing background noise level and Between the hours of 19:00 and 07:00 the noise rating level of plant/machinery at the development shall not exceed 35 dB (A) . The noise levels shall be determined at the nearest noise- sensitive premises or at another location that is deemed suitable by the Authority. Measurements and assessments shall be made in accordance with "BS 4142:2014 Methods for rating and assessing industrial and commercial sound".

- 1.4 The extent of the changes to the plant scheme at this site are illustrated on the sketch plan at Appendix A. The purpose of this assessment is to demonstrate whether the new proposed plant scheme can comply with the requirements of planning condition 34, which sets plant noise limits.
- 1.5 The refrigeration and ventilation plant schemes are shown in the technical drawings reproduced at Appendix B.
- 1.6 An assessment of plant noise is presented at section 2 with the assessment conclusions in section 3.

2.0 Fixed plant noise assessment

- 2.1 The objective assessment of plant sound sources in commercial premises is typically undertaken in accordance with British Standard 4142:2014. This Standard enables the resultant sound levels from new plant equipment to be compared against the existing typical background sound level (L_{A90}) of an area to establish the significance of the sound impact.
- 2.2 The typical background noise levels measured at the site boundary with 7 Llys-y-coed to the east were 53 dB L_{A90} during the daytime and 38 dB L_{A90} at night.
- 2.3 Planning condition 34 requires that the rating level of noise from plant equipment shall not exceed a noise level 10 dB below the daytime background noise climate, and 35 dB at all other times. Hence based on the measured background noise levels the daytime plant rating noise level limit is 43 dBA.
- 2.4 The following table summarises the mechanical services plant equipment source noise levels.

TABLE 1: Plant schedule source noise levels

Description	Octave band (Hz) sound power levels dB L_W							
	63	125	250	500	1K	2K	4K	8K
New generation refrigeration pack	33 dBA at 10 metres							
Gas cooler	35 dBA at 10 metres							
Air source heat pump 1	59 dB L_{WA}							
Air source heat pump 2	59 dB L_{WA}							
Air source heat pump 3	59 dB L_{WA}							
LT condenser	33 dBA at 10 metres							
HT condenser	32 dBA at 10 metres							
AHU extract	69	66	76	72	69	70	68	67
AHU fresh air intake	76	71	79	78	81	81	78	75
EF1 meeting room extract	76	74	74	67	63	60	52	46
EF2 toilet extract	84	76	73	72	68	65	58	52
EF3 managers office extract	84	76	73	72	68	65	58	52
Managers office AC	50 dBA at 1 metre							

- 2.5 It is assumed that all of the plant equipment would operate all of the time.

Noise modelling

- 2.6 SR uses an environmental noise modelling software package called 'NoysPlot'. This software enables coordinates to be entered for the relative positions of noise sources, receivers and barriers to calculate a resultant noise level at a given noise receptor. The software carries out 'text book' atmospheric side calculations with regard to distance and screening attenuation by referencing relative source and receiver positions.
- 2.7 The schedule of source noise data produced by the noise model is presented in Appendix C1.1.
- 2.8 The height coordinates ('z') used in the 'NoysPlot' model have been taken from the LBF Architects drawings and from site observations. The horizontal coordinates are referenced from an arbitrary 'x', 'y' position on a grid system.
- 2.9 NoysPlot uses operating time information to calculate noise levels for daytime and night time operation. The time period that the equipment is assumed to be operating is denoted by 'D' to indicate daytime only operation; 'N' to denote night time usage and 'A' to indicate that the equipment runs all the time. As explained, all of the plant equipment would operate all of the time. None of the ventilation or refrigeration equipment is considered to attract a BS 4142 rating level correction for noticeable acoustic characteristic at the receptor location.
- 2.10 NoysPlot has the capability to accept input noise data in a number of formats. Where available, the ventilation plant manufacturer's sound power level data (designated by the letter W in the L_p/L_w column of the input schedule) is used. Where the sound power level data is not available the manufacturer's un-weighted octave band sound pressure levels at a stated distance are used (designated P but with an N in the dBA column of the schedule to indicate un-weighted). Alternatively, measured or manufacturer's A-weighted, single figure, averaged level at the stated distance is used (designated 'P' with 'Y' in the dBA column of the schedule). For this assessment, single figure A-weighted noise level data and octave band sound power levels have been used.
- 2.11 The surface directivity is also assessed for all cases – this depends on the number of adjacent reflective surfaces – the number can be seen in the column headed Q in the input schedule.
- 2.12 Summaries of the atmospheric noise calculations for daytime and night time are displayed in Appendices C3 and C4. Calculations for each source to receiver can be made available upon request. These calculations take into account the attenuation afforded by distance, outlet reflection, angular and surface directivity and acoustic screening. The software maintains a logarithmic summation for each receiver position and ranks the individual noise sources in order of contribution to the overall noise level (highest at the top of the list). This assists with the identification of those noise sources requiring additional noise control.
- 2.13 The input data defining the locations of the noise sources, the receivers and screening are shown in Appendix C2. The NoysPlot noise model principally considers two noise barrier types; the barrier descriptor 'R' is used in the schedule to denote a ring type whereby only noise transmitted over the top of the barrier is considered; whilst noise barriers denoted 'F' for finite consider noise transmitted over the top and around the ends of the barrier.

This assessment models the store building and screening mitigation as ring and finite barriers.

- 2.14 The NoysPlot calculations (see Appendices C3 and C4) show the following resultant plant noise levels at the closest residential receptors to the east of the site.

TABLE 2: Summary of predicted plant rating noise levels

Noise sensitive receptor	Predicted plant rating noise level dB(A)	
	Daytime	Night time
7 Llys-y-coed	29	33
Glyn Hir	25	29

- 2.15 The above predicted noise levels are achieved by applying attenuation to the ventilation fan systems. Atmospheric side attenuators with the following minimum insertion loss performance are required.

TABLE 3 Minimum insertion loss performance

Equipment name/reference	Insertion loss – Mid frequency octave bands (Hz)							
	63	125	250	500	1K	2K	4K	8K
AHU extract	0	0	10	15	18	19	18	15
AHU fresh air intake	2	5	20	24	28	30	28	20
EF1 meeting room extract	0	0	5	8	10	10	4	0
EF2 toilet extract	0	0	5	8	10	10	4	0
EF3 managers office extract	0	0	5	8	10	10	4	0

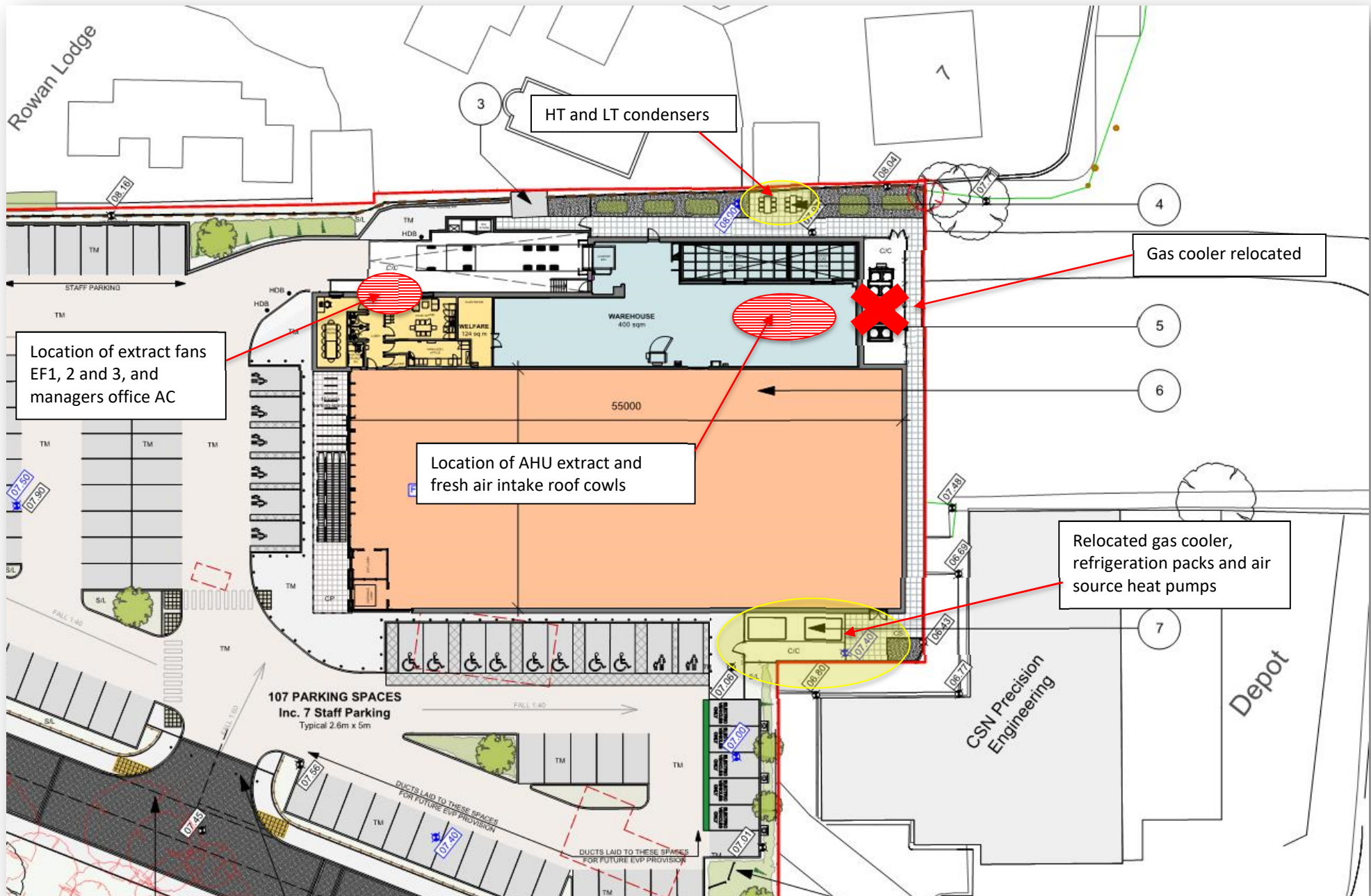
- 2.16 The predicted rating noise levels demonstrate compliance with the requirements of planning condition 34.
- 2.17 In terms of an assessment in accordance with BS 4142, the predicted rating noise levels are at least 24 dB below the daytime background noise level, and at least 6 dB below the night time background noise level. This situation, where plant rating noise levels are below the background sound level, is indicative of low impact, depending upon context.
- 2.18 It can be seen from the schedule of plant equipment source noise levels at Table 1 that the plant scheme no longer uses the ultra low noise 30 dB (at 10 metres) gas coolers. Therefore, planning condition 25 requires amendment or removal to reflect the current proposed gas coolers. It is contended that planning condition 25 is not relevant to the current scheme, and in any event is not necessary in the context of planning condition 34, since condition 34 is the overriding planning condition to control plant noise levels at adjacent receptors.

3.0 Assessment conclusions

- 3.1 This assessment considers fixed plant noise associated with the consented Aldi store development at Abbey Road, Neath.
- 3.2 The plant noise assessment, undertaken in accordance with the methodology in BS 4142:2014+A1:2019, demonstrates that the predicted noise levels from the operation of the Aldi fixed plant equipment (at the closest existing residential properties) would comply with the requirements of planning condition 34 of planning permission P2019/5304.
- 3.3 The principal noise reduction measures at this site would be the use of atmospheric side attenuators to the extract and supply fan systems, and the selection of intrinsically quiet refrigeration plant equipment.

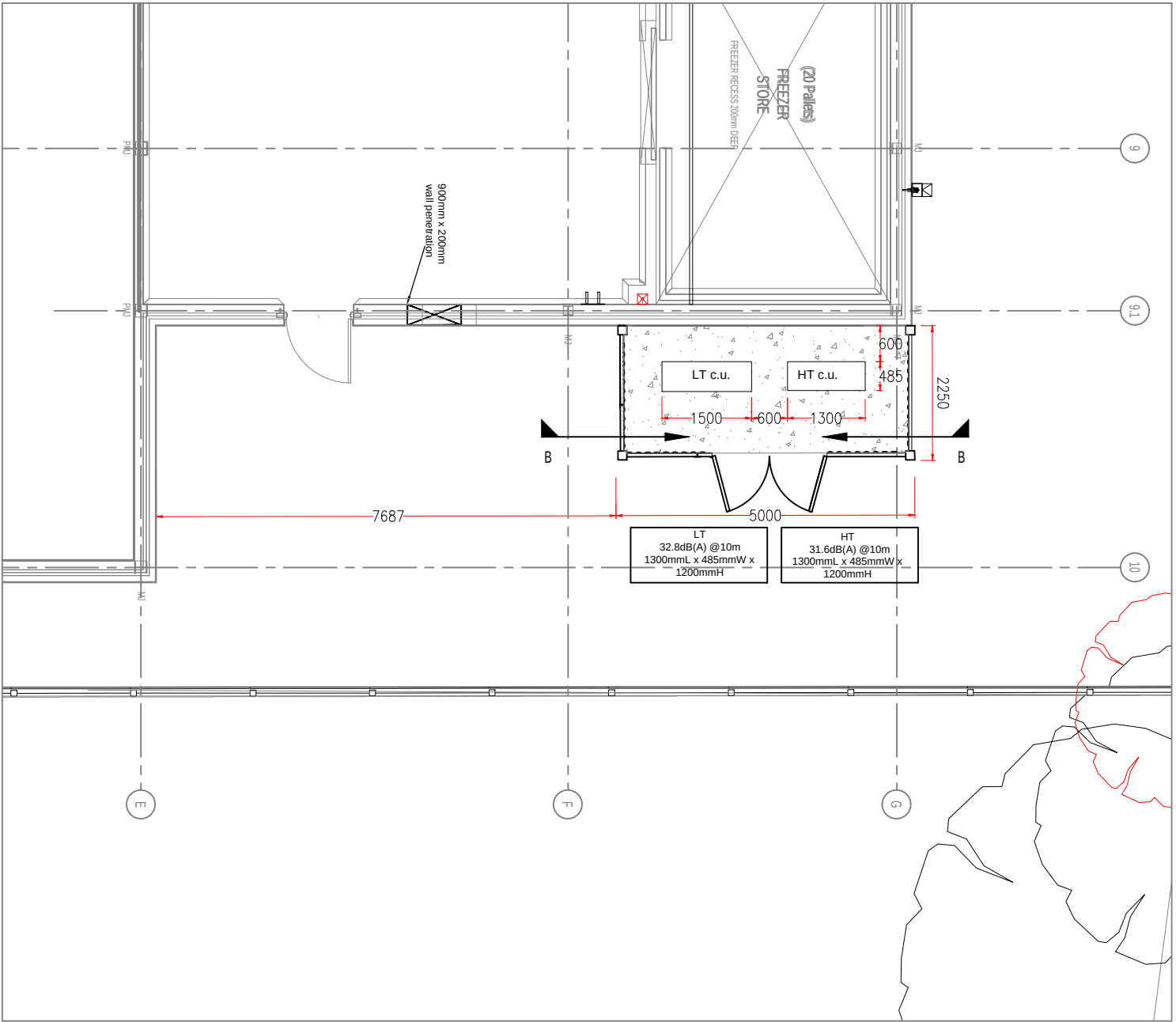
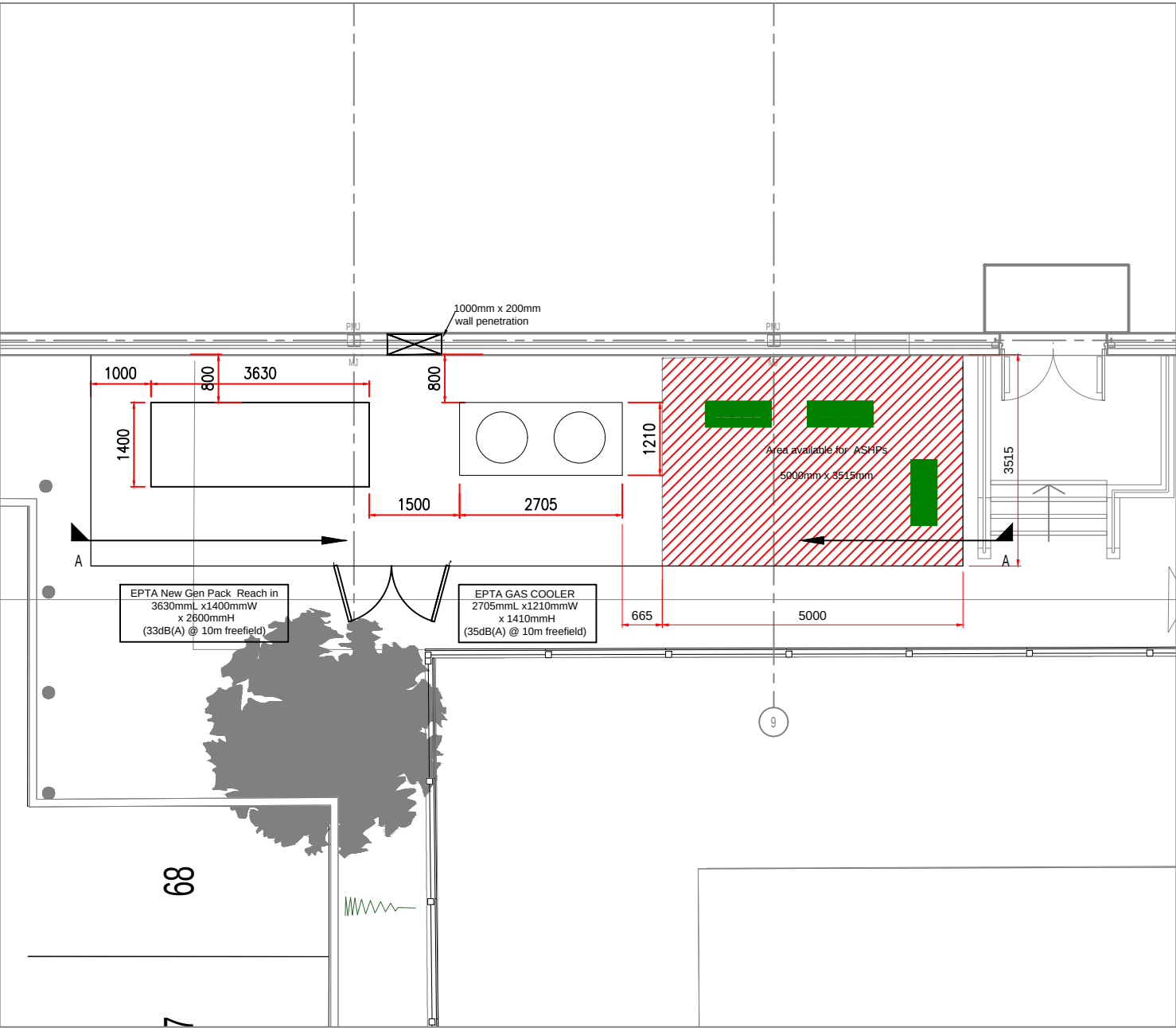
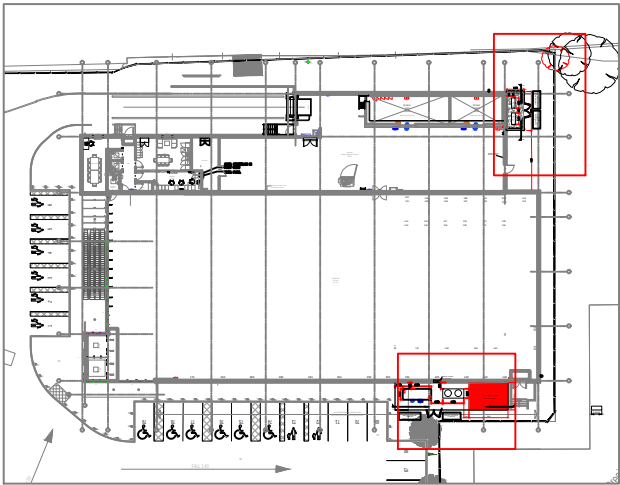
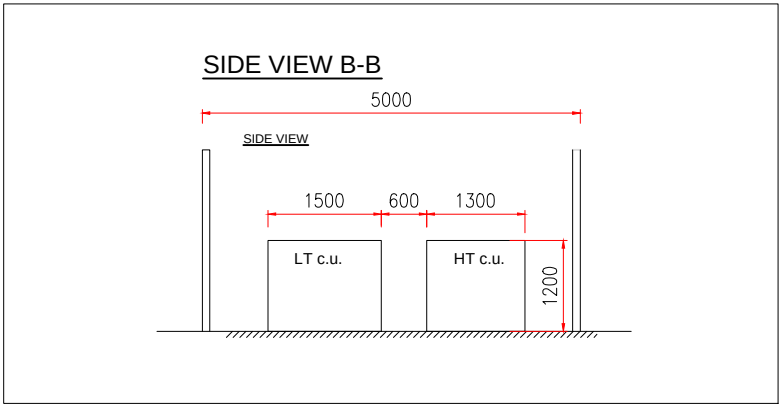
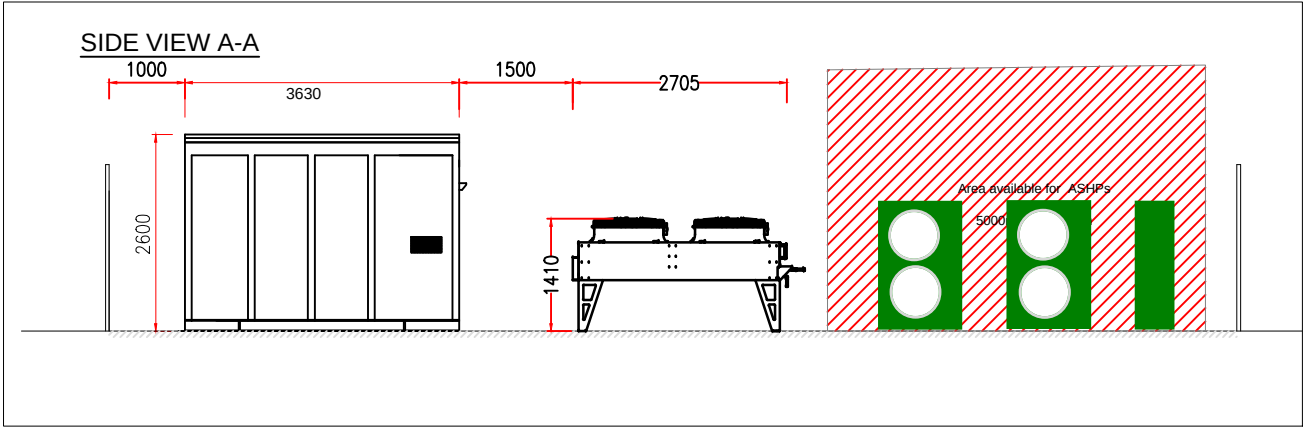
APPENDIX A

SKETCH SHOWING PLANT SCHEME CHANGES



APPENDIX B

TECHNICAL DRAWINGS



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CLIENT

ALDI Stores Ltd



REVISIONS

REV.	DESCRIPTION	DRAWN	APPD.	DATE
-	Original issue.	S.W.	R.P.	17-05-2019
A	Two refrigeration packs added. Internal plant room added.	S.W.	R.P.	17-05-2019
B	Internal plant room removed.	S.W.	R.P.	17-05-2019
C	Plant layout enlarged and updated.	K.R.	R.P.	18-01-2021
D	Plant area and layout revised.	K.R.	R.P.	12-05-2021

PROJECT

Aldi Neath

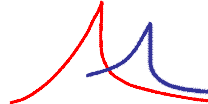
DRAWING TITLE

Plant Compound

DRAWING NUMBER	Rev	SCALE	SHEET SIZE
1463-R6	D	1:100	A3

STATUS

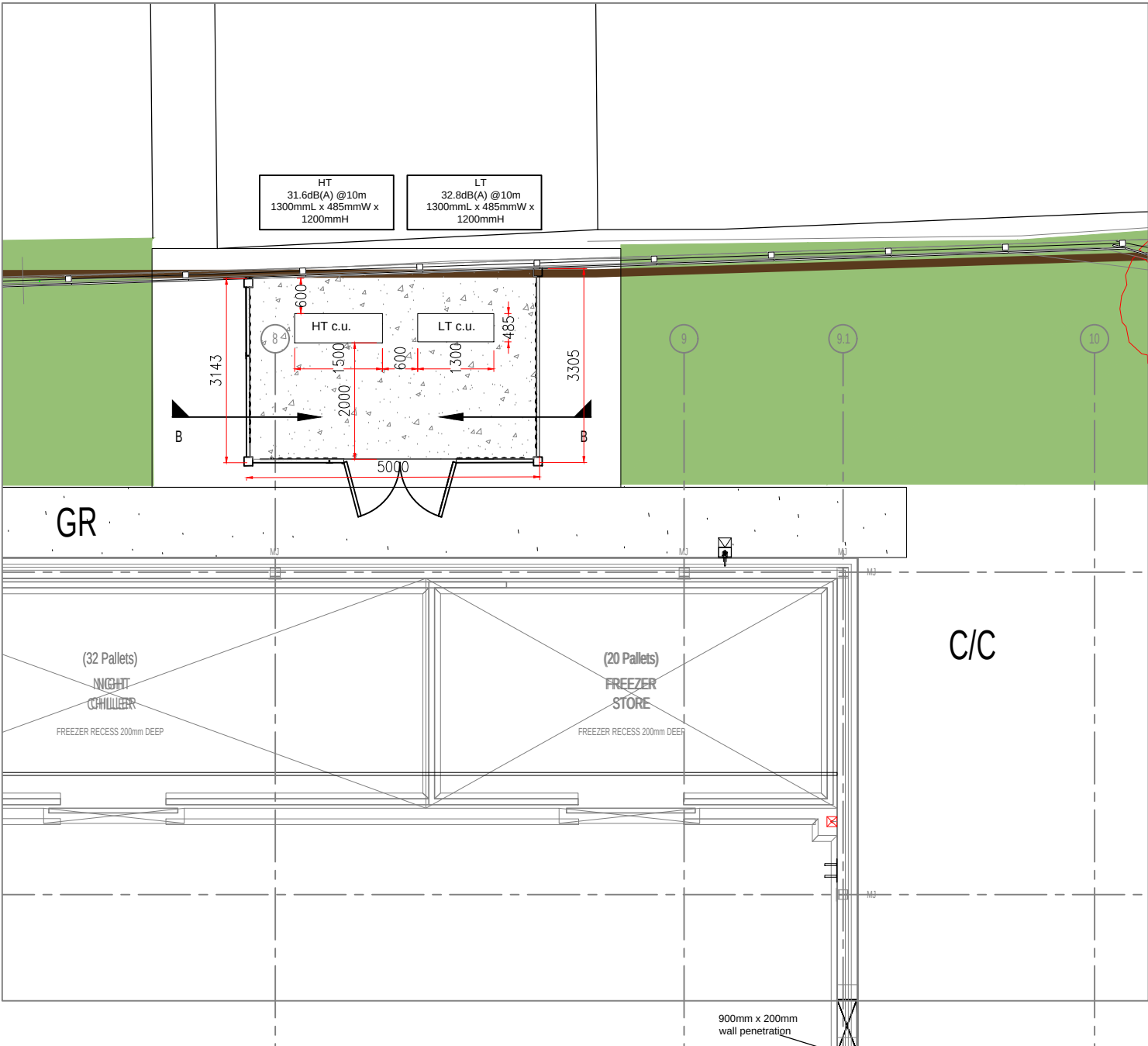
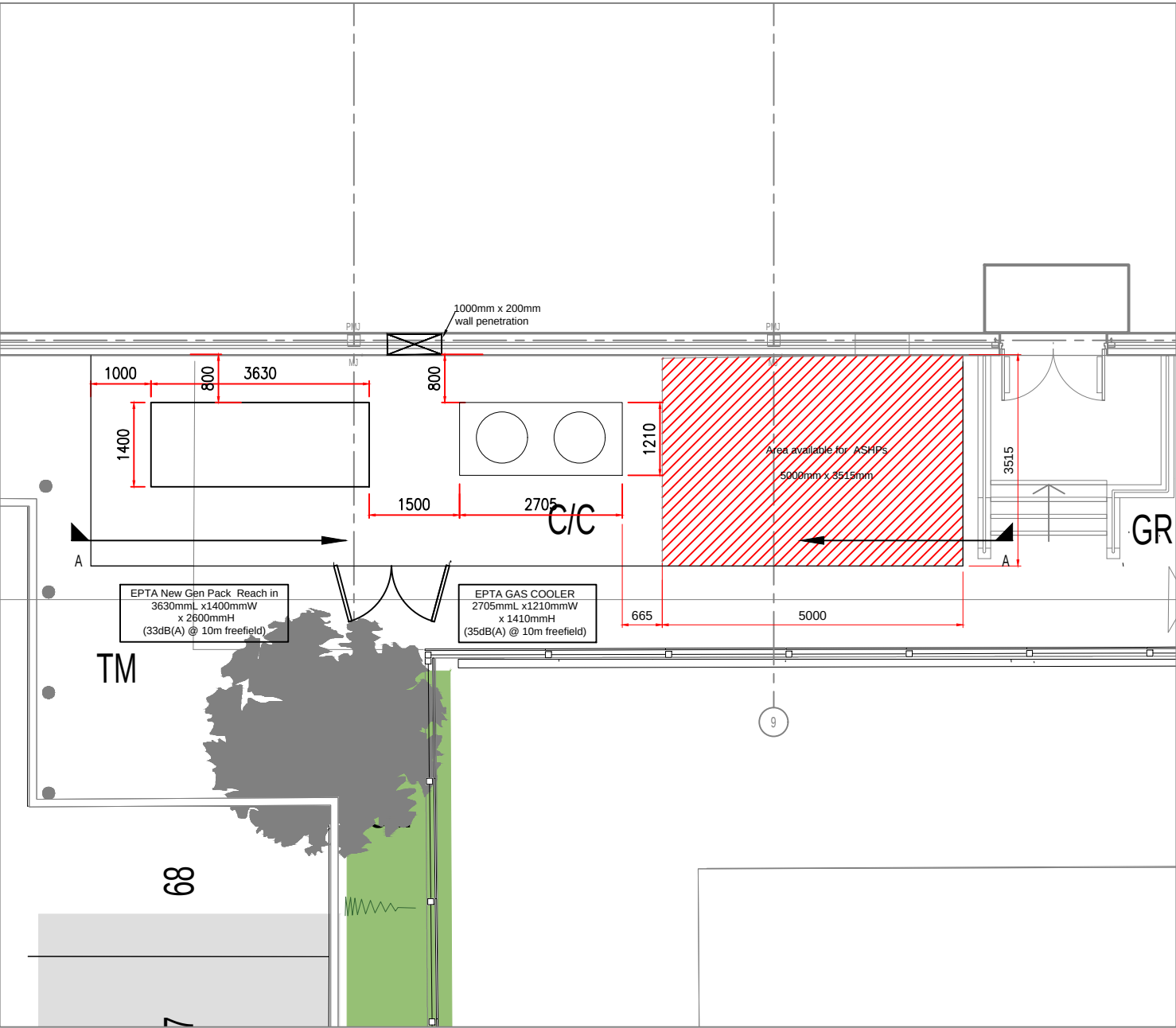
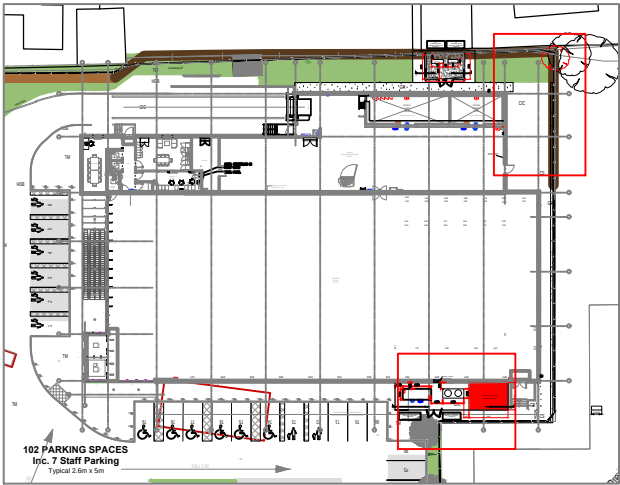
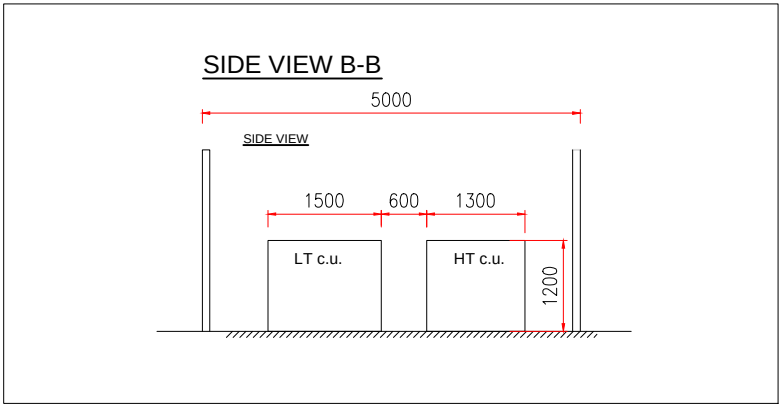
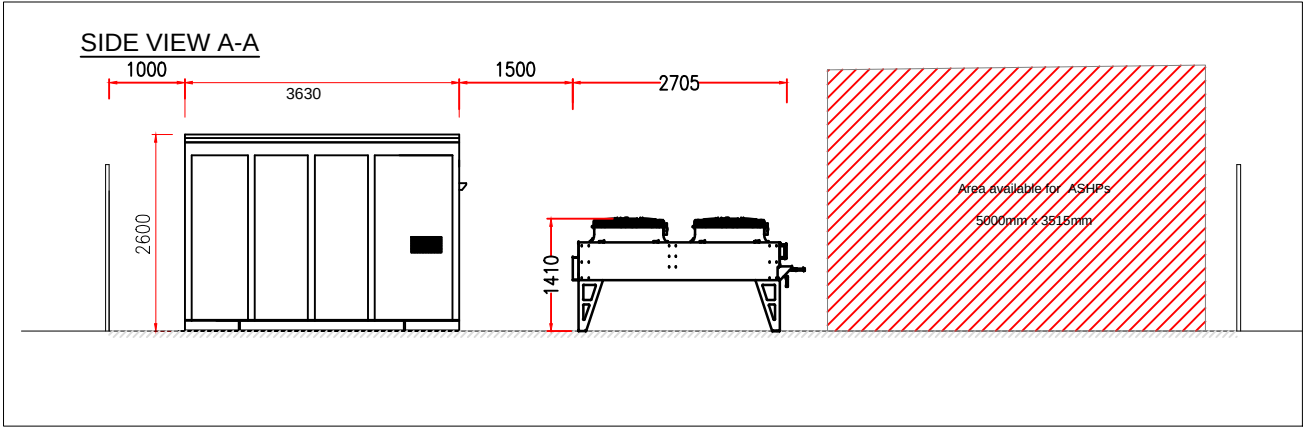
INFORMATION



K2 Engineering (Cooling) Ltd
Specialists in Refrigeration and
Air Conditioning

K2 Engineering (Cooling) Ltd
2 The Parade
Brighton Road
Burgh Heath, Surrey
KT20 6AT

Tel: +44 (0) 20 8394 0900
Email: david@k2cooling.com



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C	Plant layout enlarged and updated.	K.R.	R.P.	18-01-2021
D	Plant area and layout revised.	K.R.	R.P.	12-05-2021
D	HT and LT area relocated. .	K.R.	R.P.	21-05-2021

PROJECT

Aldi Neath

DRAWING TITLE

Plant Compound

DRAWING NUMBER

1463-R6

Rev

E

SCALE

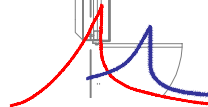
1:100

SHEET SIZE

A3

STATUS

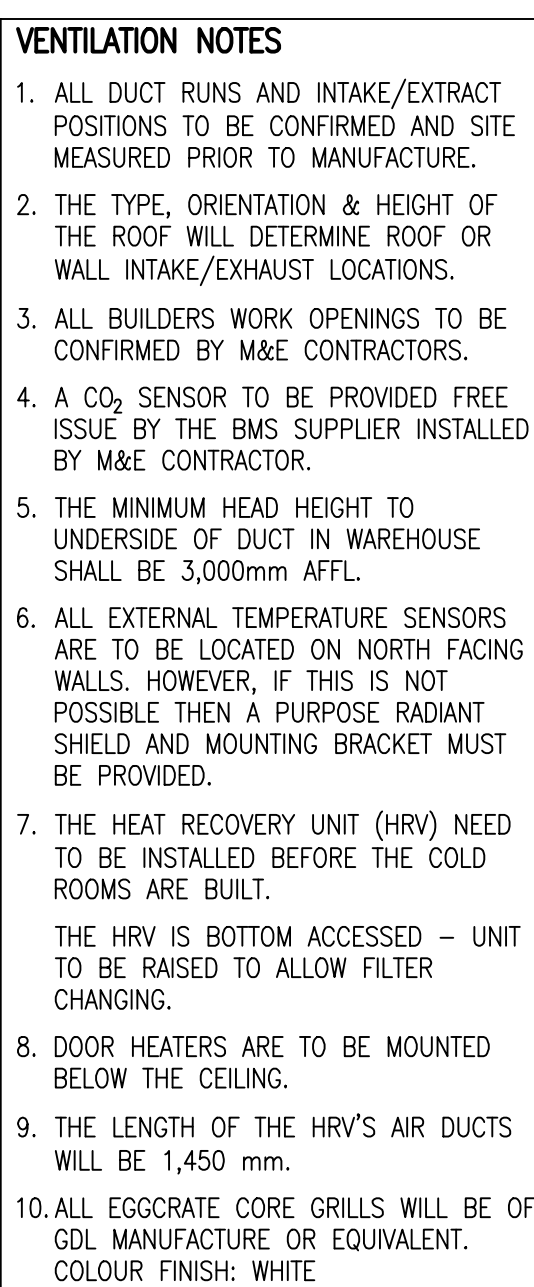
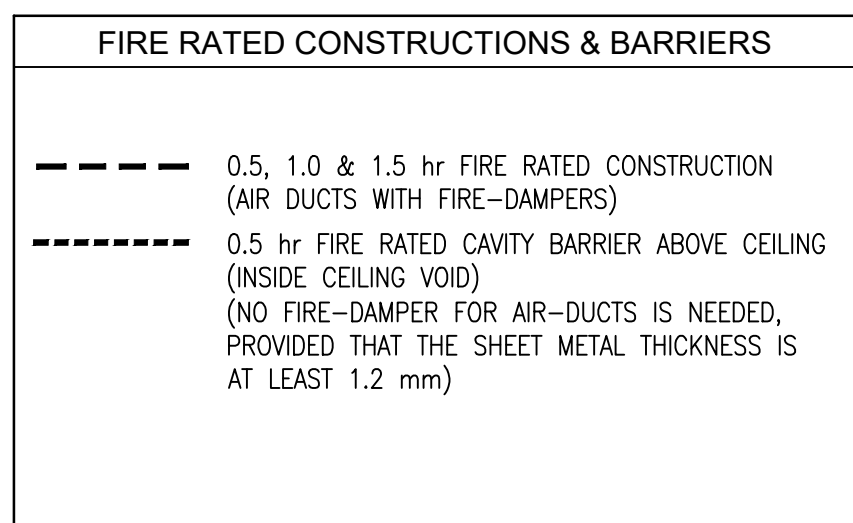
INFORMATION



K2 Engineering (Cooling) Ltd
2 The Parade
Brighton Road
Burgh Heath, Surrey
KT20 6AT

K2 Engineering (Cooling) Ltd
Specialists in Refrigeration and
Air Conditioning

Tel: +44 (0) 20 8394 0900
Email: david@k2cooling.com



ODH-1 & ODH-2
OVERDOOR HEATERS (AIR CURTAINS)
 MANUFACTURER: BIDDLE
 MODEL: DF L-150-W4-F
 EXPOSED UNIT WITH HIGH OUTPUT COIL
 MAXIMUM MOUNTING HEIGHT: 3.5 m
 AIR FLOW RATE (L-M-H): 439-570-731 L/s
 WATER FLOW RATE: 0.15 L/s (540 L/h)
 WATER PRESSURE DROP: 0.19 mWg
 HEATING CAPACITY (L-M-H): 9-10.6-12.3 kW
 (20°C ENTERING AIR & 60/40°C LTHW F&R)
 DIMENSIONS (WxDxH): 1,500x570x270 mm
 RATED POWER INPUT: 0.77 kW/230 V
 NOISE LEVEL: 48 dB(A) @ MEDIUM SPEED
 WEIGHT: 50 kg

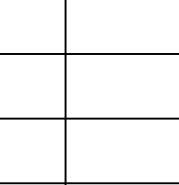
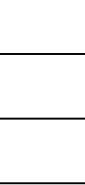
HRV-1
BIDDLE HEAT RECOVERY (HRV) UNIT, TYPE HR3500.
 • FLAT PLANTROOM, INSPECTION/MAINTENANCE
 THROUGH BOTTOM ACCESS
 • EC FAN MOTORS (DC CONTROLLED 5-10V)
 • CAPACITY: 972 L/s (3,500 m³/h)
 • HEAT EFFICIENCY= ~76.5%

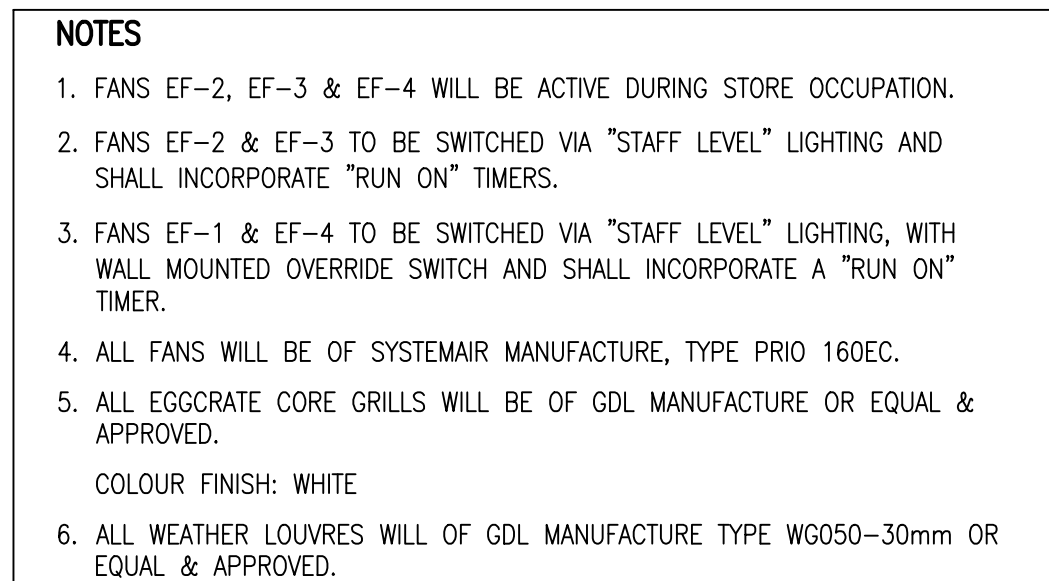
SUPPLY AIR FAN
 max 3,500 m³/h @ 300 Pa-SPEED 100% (10 VDC)
 POWER INPUT 1.35 kW/230 V/5.6 A, SFP= ~1.37,
EXTRACT AIR FAN
 max 3,500 m³/h @ 150 Pa-SPEED 100% (10 VDC)
 POWER INPUT 1.29 kW/230 V/5.14 A, SFP= ~1.32,

EDH
ELECTRIC DUCT HEATER
MANUFACTURER: AAH LTD
DIAMETER: Ø450 mm
MODEL C450E9 CIRCULAR HEATER (AAH/8)
CAPACITY: 9 kW/400 V
C/W TEMPERATURE CONTROLLER, EQUIPPED WITH:

- SOLID STATE RELAY (SSR)
- AIR FLOW SWITCH
- OVERHEAT CUT-OUT
- SUPPLY FAN1 (TEMPERATURE CONTROLLED)
- SUPPLY FAN2 (CONSTANT RUN)
- 2 DIGIT LED DISPLAY
- PUSH BUTTONS (PCB MOUNTED)
- LEDS (POWER ON, HEATER ON, ERROR)
- 0-10 VOLT SIGNAL FOR SET POINT TEMPERATURE
- OPTIONAL REMOTE FAULT RELAY FOR FAULT SIGNAL FOR BMS

ROOF COWLS
MANUFACTURER: SYSTEMAIR (FANS & SPARES)
MODEL: RA-630
CASING: GLASS REINFORCED PLASTIC WITH
ULTRA-VIOLET STABILISER
HORIZONTAL DISCHARGE WITH BIRD GUARD
CONNECTION OPENING: 790x790 mm
EXTERNAL DIMENSIONS: 1,115x1,115 mm
HEIGHT: 650 mm
WEIGHT: 70 kg
COLOURED TO RAL OR BS
STANDARD COLOUR: RAL 7035 GOOSEWING GREY

A	03.02.20	MG	FIRST ISSUE		
Issue	Date	By	Description		
	BUILDING MANAGEMENT TECHNOLOGY				
Unit 2 Forest Business Park, Oswin Road Leicester LE3 1HR					
Tel: (0116) 244 0331 E-Mail: <firstname.surname>bmt-ltd.co.uk					
Client:					
ALDI STORES LTD					
Architect:					
KENDALL KINGSCOTT LTD					
Drawing Title:					
ALDI CARDIFF NEATH ABBEY RD, NEATH MECHANICAL SERVICES RETAIL AREA VENTILATION GA					
Drawing No.				ISSUE	
B3590/M1				A	
Scale:			First Issue Date:		
1:100 @ A1			MAR 2020		



	ø100 ø150 ø200 AIR EXTRACT/SUPPLY VALVE ø100, ø150 & ø200 mm
	ø250 SOUND ATTENUATOR (CROSSTALK) FITTED ON ø250 mm AIR DUCT
	ø125/(32) ROUND AIR DUCT ø125 mm, CARRYING 32 L/S OF AIR
	VCD VOLUME CONTROL DAMPER FITTED ON CIRCULAR AIR DUCT
	FD FIRE DAMPER INSTALLED IN CIRCULAR AIR-DUCT, FIRE RATED $\frac{1}{2}$-1-$\frac{1}{2}$ HOUR, AS PER ARCHITECTS FIRE STRATEGY PLANS
	250x250 EGGCRATE CORE GRILLE 250x250 mm
	ø200 EGGCRATE CORE GRILLE ø200 mm
	MD MOTION DETECTION SENSOR (PIR DETECTOR)

----- 0.5, 1.0 & 1.5 hr FIRE RATED CONSTRUCTION
(AIR DUCTS WITH FIRE-DAMPERS)

----- 0.5 hr FIRE RATED CAVITY BARRIER ABOVE CEILING
(INSIDE CEILING VOID)
(NO FIRE-DAMPER FOR AIR-DUCTS IS NEEDED, PROVIDED
THAT THE SHEET METAL THICKNESS IS AT LEAST 1.2 mm)

AC-1
FUJITSU ASYG12LMCA
HIGH EFFICIENCY WALL MOUNTED
AIR CONDITIONING SYSTEM R410A
COOLING (UK) TONN 3.5 kW
COOLING (UK) SENSIBLE: 2.14 kW
HEATING (NOMINAL): 4.0 kW
COP=3.92 (NOMINAL)
EER=3.50 (NOMINAL)
OPERATING RANGE: COOLING: -10°C + +43°C
HEATING: -15°C + +24°C
POWER SUPPLY: 220-240V/50Hz
MODBUS INTERFACE
REMOTE CONTROLLER: HARD WIRED
GRAVITY CONDENSATE DRAINAGE: ONLY
REFRIGERANT LINES: 3/8" (G)-1/4" (L)
INTERNAL UNIT
AIRFLOW: 208 L/s (HIGH)
SOUND PRESSURE LEVEL: 21-43 dB(A)
DIMENSIONS (HxWxD): 268x840x203 mm
WEIGHT: 9 kg
EXTERNAL UNIT
SOUND PRESSURE LEVEL: 50 dB(A)
DIMENSIONS (HxWxD): 535x663x293 mm
WEIGHT: 26 kg



APPENDIX C

NOYSLOT PLANT NOISE PREDICTIONS

Client: Aldi Stores	Appendix C1.1	Page: 1 of 1
Project: Aldi Neath	Project no: 1918927	
Consultant: K J Metcalfe	Date: 02 June 2021	

Sound power levels (Lw) & sound pressure levels (Lp) for fans & other equipment											
Equipment name/reference	Lw/	Dist.	On time	Mid-frequency Octave Bands (Hz)							
	Lp	(m)	D/N/A	63	125	250	500	1k	2k	4k	8k
New Gen Refrigeration Pack	Lp	10	A	33	dBA						
Gas Cooler	Lp	10	A	35	dBA						
Air Source Heat Pump 1	Lw		A	59	dBA						
Air Source Heat Pump 2	Lw		A	59	dBA						
Air Source Heat Pump 3	Lw		A	59	dBA						
LT Condenser	Lp	10	A	33	dBA						
HT Condenser	Lp	10	A	32	dBA						
AHU Extract	Lw		A	69	66	76	72	69	70	68	67
AHU Fresh Air Intake	Lw		A	76	71	79	78	81	81	78	75
EF1 Meeting Room Extract	Lw		A	76	74	74	67	63	60	52	46
EF2 Toilet Extract	Lw		A	84	76	73	72	68	65	58	52
EF3 Staff Room Exhaust	Lw		A	84	76	73	72	68	65	58	52
Managers Office AC Unit	Lp	1	A	50	dBA						

Notes:

- Lw/Lp
Lw means sound power level (dB)
Lp means sound pressure level at the stated distance (dB@m)
- On times (On.time D/N/A):
D (Day) means that the fan/equipment could operate at any time between 0700 and 2300 hours
N (Night) means that the fan/equipment could operate at any time between 2300 and 0700 hours
A (All) means that the fan/equipment could operate at any time during the day and night

Appendix C2: NoysPlot input data, source, receptor and barrier data

Sharps Redmore Partnership
The White House, London Road, Copdock, Ipswich, IP8 3JH

Filename: p:\19 - Projects\1918927 Aldi Neath-KJM\NoysPlot\Aldi Neath
Date: 02 June 2021
Entries by: K J Metcalfe
Project no: 1918927
Project title: Aldi Neath
Client's name: Aldi Stores

Map/plot details: Length: 3200
Width: 3200
Height: 250

Source data - description, co-ordinates, outlet size, percentage to atmosphere, directivity, sound levels and running period

Source description	Co-ordinates			Outlet details			%	Q	Run d/n/a	Lp/ Lw	dBA Y/N	Dist (m)	Noise level - Octave band centre frequency Hz							
	X m	Y m	Z m	Amm	Bmm	Ang.							63	125	250	500	1k	2k	4k	8k
New Gen Refrigeration Pack	242.0	198.5	10.1	0	0	0	100	2	A	P	Y	10.0	33							
Gas Cooler	245.0	198.5	8.9	0	0	0	100	2	A	P	Y	10.0	35							
Air Source Heat Pump 1	247.0	198.0	9.0	0	0	0	100	1	A	W	Y	0.0	59							
Air Source Heat Pump 2	248.5	198.0	9.0	0	0	0	100	1	A	W	Y	0.0	59							
Air Source Heat Pump 3	249.0	198.0	9.0	0	0	0	100	1	A	W	Y	0.0	59							
LT Condenser	242.0	241.0	8.7	0	0	180	100	2	A	P	Y	10.0	33							
HT Condenser	245.0	241.5	8.7	0	0	180	100	2	A	P	Y	10.0	32							
AHU Extract	240.4	234.4	13.5	0	0	360	100	1	A	W	N	0.0	69	66	76	72	69	70	68	67
AHU Fresh Air Intake	250.3	234.4	13.5	0	0	360	100	1	A	W	N	0.0	76	71	79	78	81	81	78	75
EF1 Meeting Room Extract	202.0	232.2	10.5	380	300	180	100	1	A	W	N	0.0	76	74	74	67	63	60	52	46
EF2 Toilet Extract	202.3	232.2	10.5	240	300	180	100	1	A	W	N	0.0	84	76	73	72	68	65	58	52
EF3 Staff Room Exhaust	202.6	232.2	10.5	380	300	180	100	1	A	W	N	0.0	84	76	73	72	68	65	58	52
Managers Office AC Unit	208.8	232.5	8.5	0	0	180	100	2	A	P	Y	1.0	50							

Receptor data - description and co-ordinates

Receptor description	Co-ordinates			DNA
	X m	Y m	Z m	
7 Llys Y-Coed ground floor	251.0	249.0	10.5	D
7 Llys Y-Coed first floor	251.0	249.0	13.5	N
Glyn Hir ground floor	213.0	255.0	9.5	D
Glyn Hir first floor	213.0	255.0	12.5	N

Barrier data - description and co-ordinates

Barrier description	Co-ordinates					
	Start			End		
	X m	Y m	Z m	X m	Y m	Z m
Ring Barrier	200.0	200.0	12.9	200.0	224.0	12.9
Ring Barrier	200.0	224.0	12.9	196.0	224.0	12.9
Ring Barrier	196.0	224.0	12.9	196.0	232.0	12.9
Ring Barrier	196.0	232.0	12.9	224.0	232.0	12.9
Ring Barrier	224.0	232.0	12.9	224.0	237.5	12.9
Ring Barrier	224.0	237.5	12.9	251.5	237.5	12.9
Ring Barrier	251.5	237.5	12.9	251.5	224.5	12.9
Ring Barrier	251.5	224.5	12.9	255.5	224.0	12.9
Ring Barrier	255.5	224.0	12.9	255.5	200.0	12.9
Ring Barrier	255.5	200.0	12.9	200.0	200.0	12.9
Ring Barrier	240.0	242.5	11.2	240.0	249.0	11.2
Ring Barrier	240.0	249.0	11.2	247.0	249.0	11.2
Ring Barrier	247.0	249.0	11.2	247.0	243.0	11.2
Ring Barrier	247.0	243.0	11.2	240.0	242.5	11.2
Ring Barrier	252.0	246.5	12.5	251.0	259.0	12.5
Ring Barrier	251.0	259.0	12.5	262.0	260.0	12.5
Ring Barrier	262.0	260.0	12.5	263.0	247.0	12.5
Ring Barrier	263.0	247.0	12.5	252.0	246.5	12.5
Finite Barrier	154.0	239.0	10.5	200.0	239.0	10.5
Finite Barrier	200.0	239.0	10.5	204.0	240.0	10.5
Finite Barrier	204.0	240.0	10.5	256.0	242.0	10.5

Appendix C3: Predicted daytime noise levels

Overall receptor listings

Period: Day time

Overall daytime plant noise levels (dB)	Mid frequency octave bands (Hz)								
	63	125	250	500	1k	2k	4k	8k	dBA
Number 7 Llys Y-Coed ground floor	46	36	30	23	19	18	17	21	29
Glyn Hir ground floor	43	35	28	21	15	11	8	12	25

Source noise levels at receiver: Number 7 Llys Y Coed ground floor

Period: Day time

Plant Item	Mid frequency octave bands (Hz)								
	63	125	250	500	1k	2k	4k	8k	dBA
AHU Fresh Air Intake	38	30	23	18	17	15	14	19	25
AHU Extract	31	28	28	19	13	13	12	14	24
LT Condenser	41	28	19	10	5	4	4	6	19
HT Condenser	40	28	18	9	6	5	5	7	18
EF3 Staff Room Exhaust	33	25	14	9	0	0	0	0	13
EF2 Toilet Extract	32	24	15	8	0	0	0	0	13
Managers Office AC Unit	33	22	13	5	0	0	0	0	11
EF1 Meeting Room Extract	25	23	15	4	0	0	0	0	11
Gas Cooler	29	16	6	0	0	0	0	0	5
New Gen Refrigeration Pack	28	15	5	0	0	0	0	0	4
Air Source Heat Pump 1	22	10	0	0	0	0	0	0	0
Air Source Heat Pump 3	23	10	0	0	0	0	0	0	0
Air Source Heat Pump 2	23	10	0	0	0	0	0	0	0
Total Free field Lp and dBA	46	36	30	23	19	18	17	21	29

Source noise levels at receiver: Glyn Hir ground floor

Period: Day time

Plant Item	Mid frequency octave bands (Hz)								
	63	125	250	500	1k	2k	4k	8k	dBA
EF3 Staff Room Exhaust	37	30	21	16	7	3	0	0	19
EF2 Toilet Extract	36	29	22	15	10	3	0	0	19
AHU Extract	25	22	22	13	7	7	6	8	18
EF1 Meeting Room Extract	29	28	22	11	2	0	0	0	17
AHU Fresh Air Intake	28	20	13	8	7	5	4	9	15
Managers Office AC Unit	36	25	16	7	2	0	0	0	14
LT Condenser	33	20	11	2	0	0	0	0	10
HT Condenser	29	17	7	0	0	0	0	0	6
Gas Cooler	26	14	4	0	0	0	0	0	0
New Gen Refrigeration Pack	26	13	3	0	0	0	0	0	0
Air Source Heat Pump 1	20	7	0	0	0	0	0	0	0
Air Source Heat Pump 3	19	6	0	0	0	0	0	0	0
Air Source Heat Pump 2	19	6	0	0	0	0	0	0	0
Total Free field Lp and dBA	43	35	28	21	15	11	8	12	25

Appendix C4: Predicted nighttime noise levels

Overall receptor listings

Period: Night-time

Overall nighttime plant noise levels (dB)	Mid frequency octave bands (Hz)								dBA
	63	125	250	500	1k	2k	4k	8k	
Number 7 Llys Y-Coed first floor	47	38	34	28	24	23	22	25	33
Glyn Hir first floor	44	36	31	26	20	17	15	17	29

Source noise levels at receiver: Number 7 Llys Y-Coed first floor

Period: Night-time

Plant item	Mid frequency octave bands (Hz)								dBA
	63	125	250	500	1k	2k	4k	8k	
AHU Fresh Air Intake	39	32	28	23	22	20	19	24	29
AHU Extract	32	30	32	24	18	18	17	19	28
LT Condenser	42	30	20	12	6	4	4	6	20
HT Condenser	41	28	19	10	5	4	4	6	19
Managers Office AC Unit	32	23	16	11	10	10	10	12	18
EF2 Toilet Extract	31	26	21	15	10	4	3	0	18
EF3 Staff Room Exhaust	32	27	20	16	7	4	0	0	18
EF1 Meeting Room Extract	24	25	21	11	2	0	0	0	15
Gas Cooler	29	16	6	0	0	0	0	0	5
New Gen Refrigeration Pack	28	16	6	0	0	0	0	0	4
Air Source Heat Pump 1	23	10	0	0	0	0	0	0	0
Air Source Heat Pump 2	23	10	0	0	0	0	0	0	0
Air Source Heat Pump 3	23	10	0	0	0	0	0	0	0
Total Free field Lp and dBA	47	38	34	28	24	23	22	25	33

Source noise levels at receiver: Glyn Hir first floor

Period: Night-time

Plant item	Mid frequency octave bands (Hz)								dBA
	63	125	250	500	1k	2k	4k	8k	
EF2 Toilet Extract	37	30	25	21	16	10	9	4	23
EF3 Staff Room Exhaust	38	31	24	22	13	10	6	4	23
AHU Extract	25	23	23	16	12	12	11	13	21
EF1 Meeting Room Extract	30	29	25	17	8	5	0	0	20
AHU Fresh Air Intake	28	21	14	10	12	10	9	14	19
Managers Office AC Unit	38	28	20	13	8	5	3	2	18
LT Condenser	33	21	11	2	0	0	0	0	10
HT Condenser	30	17	7	0	0	0	0	0	7
Gas Cooler	27	14	4	0	0	0	0	0	4
New Gen Refrigeration Pack	26	13	4	0	0	0	0	0	0
Air Source Heat Pump 1	20	7	0	0	0	0	0	0	0
Air Source Heat Pump 2	19	6	0	0	0	0	0	0	0
Air Source Heat Pump 3	19	7	0	0	0	0	0	0	0
Total Free field Lp and dBA	44	36	31	26	20	17	15	17	29

APPENDIX D

ACOUSTIC TERMINOLOGY

Acoustic Terminology

- D1 Noise, defined as unwanted sound, is measured in units of decibels, dB. The range of audible sounds is from 0 dB to 140 dB. Two equal sources of sound, if added together will result in an increase in level of 3 dB, i.e. $50\text{ dB} + 50\text{ dB} = 53\text{ dB}$. Increases in continuous sound are perceived in the following manner:
- 1 dB increase - barely perceptible.
 - 3 dB increase - just noticeable.
 - 10 dB increase - perceived as twice as loud.
- D2 Frequency (or pitch) of sound is measured in units of Hertz. 1 Hertz (Hz) = 1 cycle/second. The range of frequencies audible to the human ear is around 20Hz to 18000Hz (or 18kHz). The capability of a person to hear higher frequencies will reduce with age. The ear is more sensitive to medium frequency than high or low frequencies.
- D3 To take account of the varying sensitivity of people to different frequencies a weighting scale has been universally adopted called "A-weighting". The measuring equipment has the ability automatically to weight (or filter) a sound to this A scale so that the sound level it measures best correlates to the subjective response of a person. The unit of measurement thus becomes dBA (decibel, A-weighted).
- D4 The second important characteristic of sound is amplitude or level. Two units are used to express level, a) sound power level - L_w and b) sound pressure level - L_p . Sound power level is an inherent property of a source whilst sound pressure level is dependent on surroundings/distance/directivity, etc. The sound level that is measured on a meter is the sound pressure level, L_p .
- D5 External sound levels are rarely steady but rise or fall in response to the activity in the area - cars, voices, planes, birdsong, etc. A person's subjective response to different noises has been found to vary dependent on the type and temporal distribution of a particular type of noise. A set of statistical indices have been developed for the subjective response to these different noise sources.
- D6 The main noise indices in use in the UK are:
- L_{A90} : The sound level (in dBA) exceeded for 90% of the time. This level gives an indication of the sound level during the quieter periods of time in any given sample. It is used to describe the "background sound level" of an area.
 - L_{Aeq} : The equivalent continuous sound level in dBA. This unit may be described as "the notional steady noise level that would provide, over a period, the same energy as the intermittent noise". In other words, the energy average level. This unit is now used to measure a wide variety of different types of noise of an industrial or commercial nature, as well as aircraft and trains.
 - L_{A10} : The sound level (in dBA) exceeded for 10% of the time. This level gives an indication of the sound level during the noisier periods of time in any given sample. It has been used over many years to measure and assess road traffic noise.

L_{AMAX} : The maximum level of sound measured in any given period. This unit is used to measure and assess transient noises, i.e. gun shots, individual vehicles, etc.

- D7 The sound energy of a transient event may be described by a term SEL - Sound Exposure Level. This is the L_{Aeq} level normalised to one second. That is the constant level in dBA which lasting for one second has the same amount of acoustic energy as a given A weighted noise event lasting for a period of time. The use of this unit allows the prediction of the L_{Aeq} level over any period and for any number of events using the equation;

$$L_{AeqT} = SEL + 10 \log n - 10 \log T \text{ dB.}$$

Where

n = Number of events in time period T.

T = Total sample period in seconds.

- D8 In the open, known as free field, sound attenuates at a rate of 6 dB per each doubling of distance. This is known as geometric spreading or sometimes referred to as the Inverse Square Law. As noise is measured on a Logarithmic scale, this attenuation in distance = $20 \log$ (ratio of distances), e.g. for a noise level of 60 dB at ten metres, the corresponding level at 160 metres is:

$$60 - 20 \log \frac{160}{10} = 60 - 24 = 36 \text{ dB.}$$