

SHARPS REDMORE

ACOUSTIC CONSULTANTS ▪ Established 1990



Report

Plant noise assessment

Noise assessment to seek the discharge of planning condition 11 (F/21/91821) relating to fixed plant noise at the proposed Aldi store at Hedge End Retail Park, Hedge End.

Prepared by

K J Metcalfe BSc (Hons). MIOA

Date 28th September 2022

Project No 2120326

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),
North England, Wales, Scotland

Sharps Redmore Partnership Limited

Registered in England No. 2593855

Directors

TL Redmore BEng(Hons), MSc, PhD, MIOA;
RD Sullivan BA(Hons), PhD, CEng, MIOA, MAAS, MASA;
DE Barke MSc, MIOA;
KJ Metcalfe BSc(Hons), MIOA



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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 the proposed fixed plant equipment at the proposed Aldi development at Hedge End Retail Park, Hedge End, Southampton. A site location plan is attached at Appendix A.

1.2 This assessment is submitted to seek the discharge of planning condition 11 of F/21/91821 which states:

“No fixed plant or machinery shall be installed or operated outside of the building unless first approved in writing by the local planning authority. Details of any proposed plant or equipment submitted so as to obtain approval shall include evidence that the impact of noise from such plant or machinery will be satisfactory and will not impact unduly upon the amenity of neighbouring residents and the development shall then accord with the approved details. For the avoidance of doubt, the rating level of the sound emitted from the site shall not exceed 50 dBA between the hours of 0700 and 2300 and 38 dBA at all other times. The sound levels shall be determined by measurement or calculation at the nearest noise sensitive premises. The measurements and assessment shall be made according to BS4142:2014+A1:2019.

Reason: In the interests of protecting the amenity of the occupiers of neighbouring residential properties.”

1.3 This assessment is based on the following technical drawings:

- K2 Engineering plant compound drawing 2156-R6
- BMT retail area ventilation drawing 1101
- BMT welfare area ventilation drawing 1107
- BMT external services layout drawing 2303

2.0 Proposed fixed plant and ventilation equipment

- 2.1 The following table summarises the mechanical services plant and ventilation associated with the proposed Aldi store. The source noise information has been obtained from K2 Engineering (Cooling) Ltd and BMT. The plant area configuration/layout is shown at Appendix B.

TABLE 1: Plant equipment schedule – source noise levels

Plant Item	L_{pA}/L_{wA}	Mid frequency octave bands (Hz)							
		63	125	250	500	1k	2k	4k	8k
5x Air Source Heat Pumps	L_{wA}	74	62	57	53	48	45	46	42
Compressor Pack	L_{pA}	33 dBA at 10 metres							
Gas Cooler	L_{pA}	30 dBA at 10 metres							
LT Condenser	L_{pA}	43 dBA at 10 metres							
MT Condenser	L_{pA}	43 dBA at 10 metres							
EF1 Meeting Room Extract	L_{wA}	67	69	68	67	65	63	60	53
EF2 WC Extract	L_{wA}	67	69	68	67	65	63	60	53
EF3 Staff Room Extract	L_{wA}	67	69	68	67	65	63	60	53
AHU Fresh Air Intake	L_{wA}	76	71	79	78	81	81	78	75
AHU Exhaust	L_{wA}	69	66	76	72	69	70	68	67

- 2.2 In our experience the equipment in the table above does not exhibit any characteristic that would attract a rating level correction, as detailed in BS 4142:2014. The noise from these units is bland in nature and would not draw attention when operating correctly.

3.0 Fixed plant noise assessment

- 3.1 The technical drawings provided by K2 Engineering and BMT show that the refrigeration plant equipment is to be located at ground floor level adjacent to the side of the service yard area on the eastern elevation of the store. The welfare area ventilation is to be located on the north-eastern façade of the store and the retail area air handling unit fresh air intake and exhaust is to be located on the roof of the store.
- 3.2 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.
- 3.3 The schedule of source noise data produced by the noise model is presented in Appendix C1. The horizontal coordinates are referenced from an arbitrary 'x', 'y' position on a grid system.
- 3.4 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; an 'N' to denote night time usage and 'A' to indicate that the equipment runs all the time.
- 3.5 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, the 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 both single figure A-weighted sound pressure level data and octave band sound power level data from the manufacturer is used.
- 3.6 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.

- 3.7 A summary of the atmospheric noise calculations for daytime and night time are displayed in Appendices C3 and C4. Calculations for each individual noise 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.
- 3.8 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 retail store building as a ring barrier.
- 3.9 The NoysPlot calculations (see Appendices C3 and C4) show the following resultant plant rating noise levels at the closest residential receptor:

TABLE 2: Predicted plant (rating) noise levels

Noise sensitive receptor	Predicted rating noise level dB(A)	
	Daytime	Night time
51 Goodlands Vale	38	33
61 Goodlands Vale	38	32

- 3.10 The predicted noise levels in Table 2 above demonstrate that the proposed plant scheme would comply with the requirements of planning condition 11 of consent F/21/91821 (which sets rating noise level limits of 50 dBA daytime and 38 dBA at night).

4.0 Assessment conclusions

- 4.1 The assessment considers noise from the proposed fixed plant equipment for the proposed Aldi store at Hedge End Retail Park, Hedge End, Southampton.
- 4.2 This assessment and report objectively demonstrates that predicted plant (rating) noise levels will be 38 dB daytime and 33 dB at night. This complies with the requirement of condition 11 for the noise rating level not to exceed 50 dB daytime and 38 dB at night.
- 4.3 The predicted plant rating noise levels would comply with the requirement of the National Planning Policy Framework (NPPF) to avoid “significant adverse impact”.

APPENDIX A

SITE LOCATION PLAN

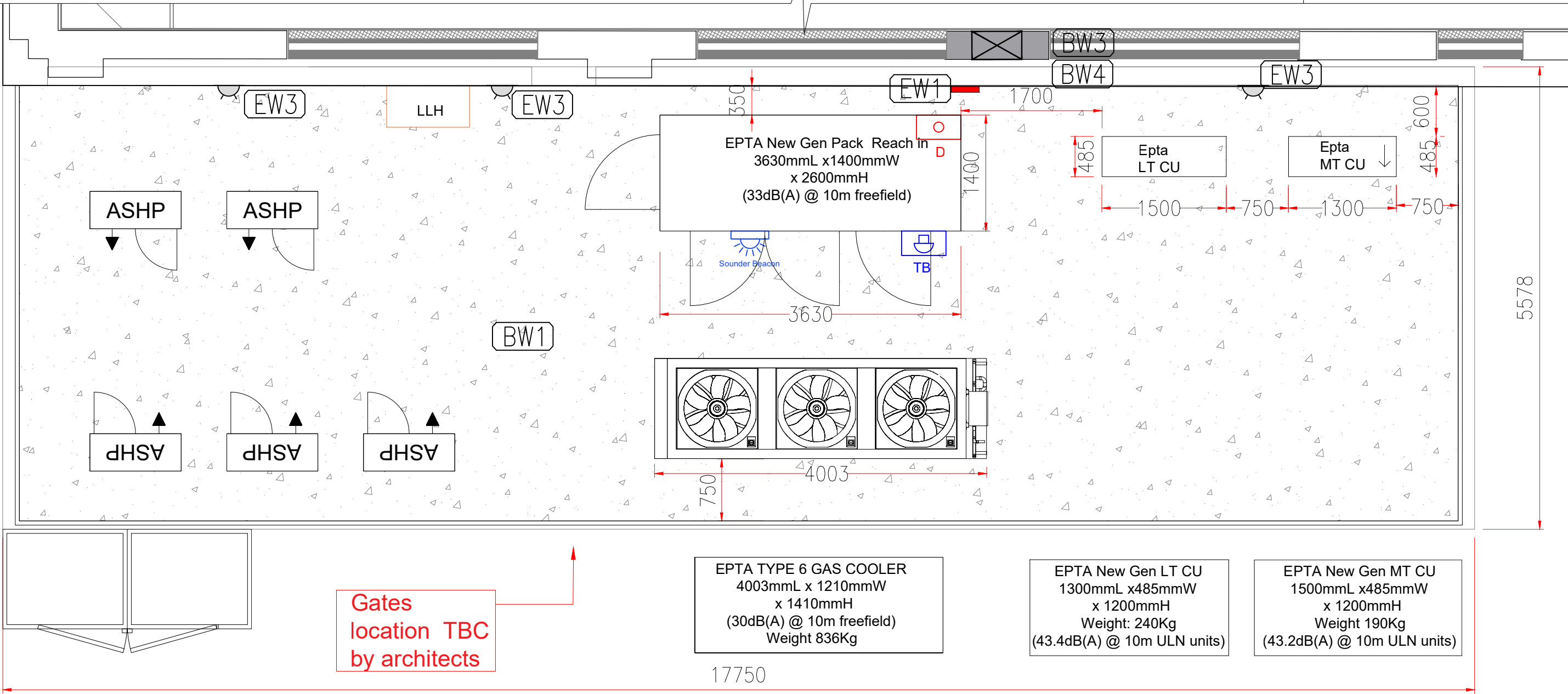
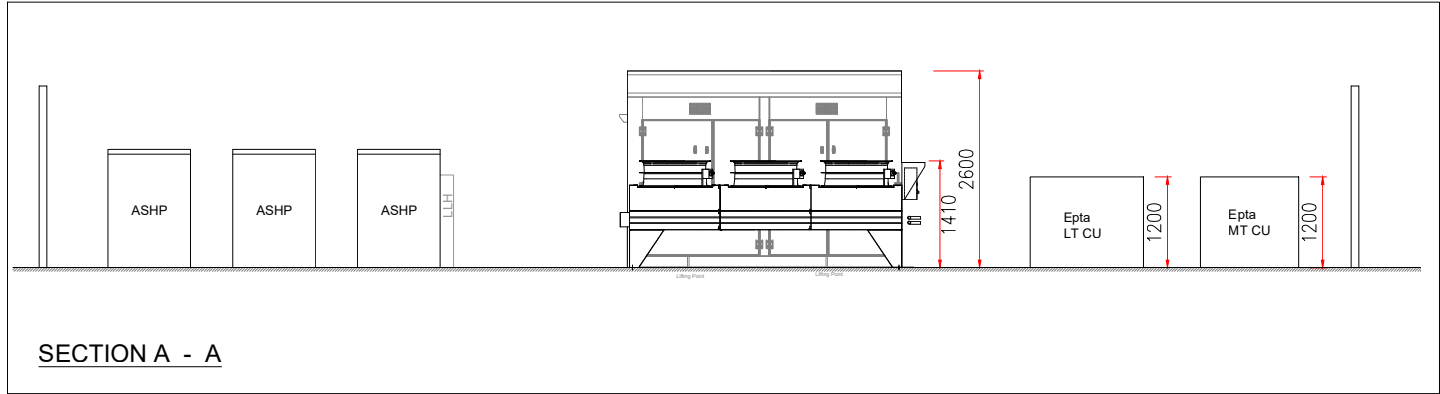
Appendix A: Site location plan



APPENDIX B

ALDI PLANT LAYOUT DRAWING

- NOTES.
1. THE SYSTEM REFRIGERANT CHARGE MUST BE WEIGHED IN, AND ANY CHARGE ABOVE 6.5 KG MUST BE FLAGGED IMMEDIATELY.
 2. ANY CONDENSING UNIT PIPE RUN GREATER THAN 30 METRES MUST BE FLAGGED IMMEDIATELY.
 3. THE SYSTEM COMES PRE CHARGED WITH OIL FOR A 4 KG REFRIGERANT CHARGE, BUT WILL LIKELY NEED ADDITIONAL OIL AS THE REFRIGERANT CHARGE IS LIKELY TO BE 5-6.5 KG.
 4. IN ORDER TO PRESSURE TEST THE FINAL CONNECTIONS, AN ADDITIONAL SERVICE VALVE IS REQUIRED ON THE STORE PIPEWORK SIDE.
 5. THE SUCTION SIDE WILL NEED OVERPRESSURE PROTECTION, AS THE SYSTEM DOES NOT COME WITH A 60 BAR PRV.
 6. THE RIVACOLD HECU VACUUM MODE WILL NEED ADDITIONAL SET UP AS THE DEFAULT VALUES HAVE THE HPV AND RPRV CLOSED. NOT DOING SO RUNS THE RISK OF THE GAS COOLER AND DOWNSTREAM TO THE HPV WILL RETAIN IT'S CHARGE OF OFN, UNLESS THE VALVES ARE MANUALLY OPENED.
 7. THE CONDENSING UNITS ARE TO BE NETWORKED, AND FLOATING SUCTION AND SMOOTH LINES ENABLED AS STANDARD.



Copyright of K2 Engineering (Cooling) Ltd. Drawings are not to be reproduced in whole or in part without the prior written permission of K2 Engineering (Cooling) Ltd. Do not scale, figured dimensions to be taken from this drawing only. All dimensions are in millimeters unless otherwise stated and to be verified on site before proceeding with work. Any discrepancies to be notified in writing to K2 Engineering (Cooling) Ltd immediately.

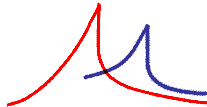
CLIENT

ALDI Stores Ltd



REVISIONS				
REV.	DESCRIPTION	DRAWN	APPD.	DATE
-	Original issue.	K.R.	B.C.	07-04-2022

PROJECT			
Aldi Southampton, Hedge End			
DRAWING TITLE			
Plant Compound			
DRAWING NUMBER	Rev	SCALE	SHEET SIZE
2156-R6	-	1:50/100	A3
STATUS			
INFORMATION			

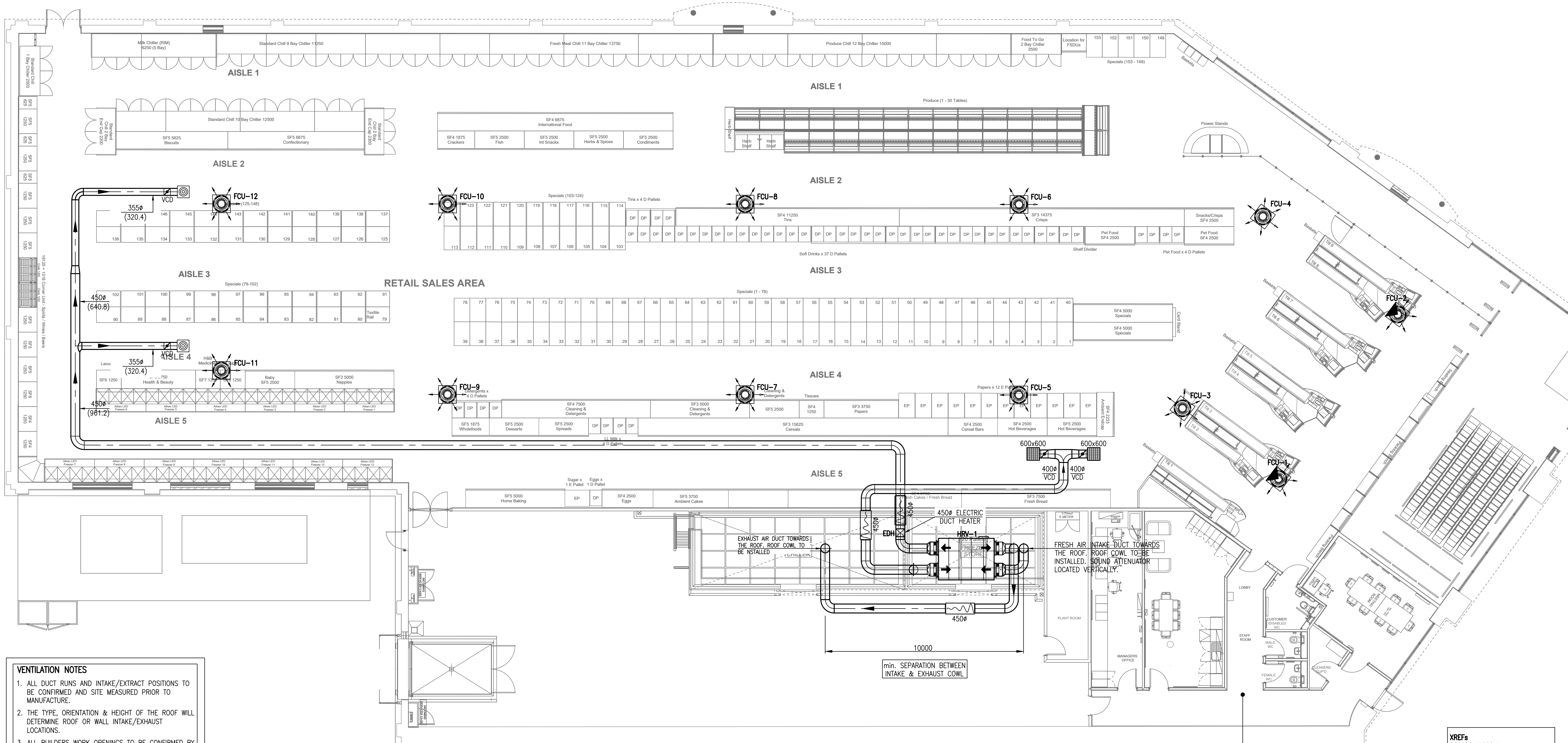


K2 Engineering (Cooling) Ltd
Specialists in Refrigeration and Air Conditioning

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

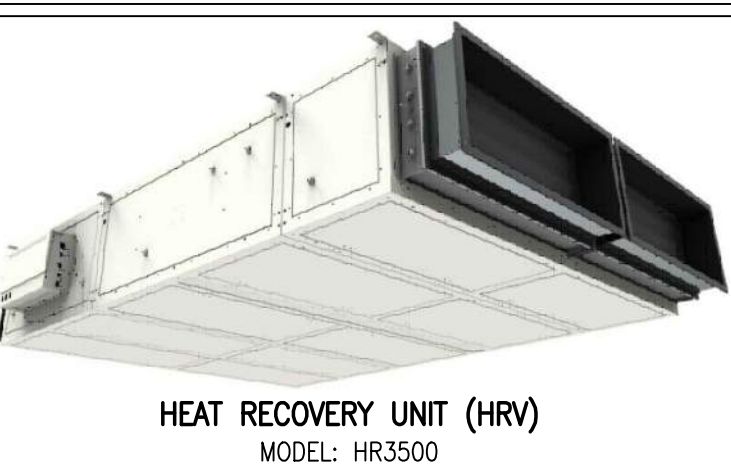
Tel: +44 (0) 20 8394 0900
Email: david@k2cooling.com

REV	DATE	DESCRIPTION	DRW	Eng
C01	14.02.22	FIRST ISSUE	AW	CT



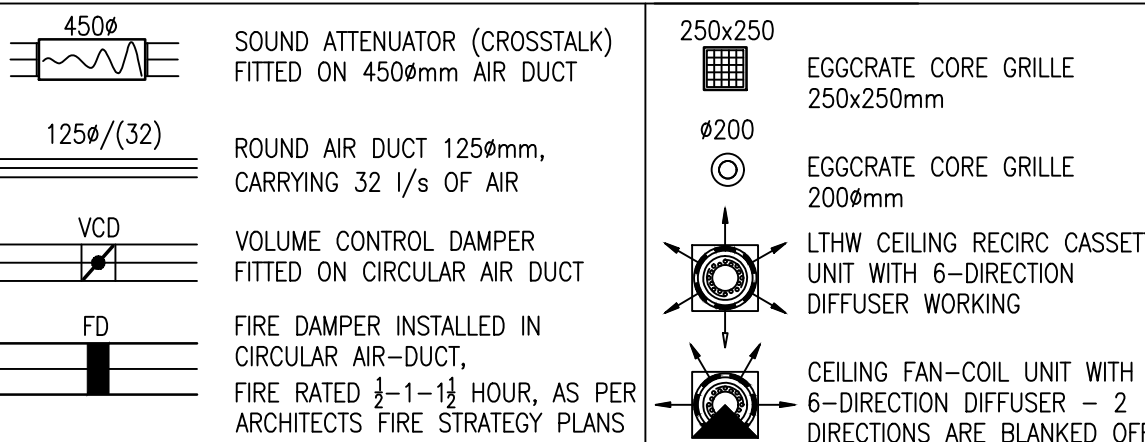
- VENTILATION NOTES**
1. ALL DUCT RUNS AND INTAKE/EXTRACT POSITIONS TO BE CONFIRMED AND SITE MEASURED PRIOR TO MANUFACTURE.
 2. THE TYPE, ORIENTATION & HEIGHT OF THE ROOF WILL DETERMINE ROOF OR WALL INTAKE/EXHAUST LOCATIONS.
 3. ALL BUILDERS WORK OPENINGS TO BE CONFIRMED BY M&E CONTRACTORS.
 4. A CO₂ SENSOR TO BE PROVIDED FREE ISSUE BY THE BMS SUPPLIER INSTALLED BY MECHANICAL CONTRACTOR.
 5. THE MINIMUM HEAD HEIGHT TO UNDERSIDE OF DUCT IN WAREHOUSE SHALL BE 3,000mm AFFL.
 6. ALL EXTERNAL TEMPERATURE SENSORS ARE TO BE LOCATED ON NORTH FACING WALLS. HOWEVER, IF THIS IS NOT POSSIBLE THEN A PURPOSE RADIANT SHIELD AND MOUNTING BRACKET MUST BE PROVIDED.
 7. THE HEAT RECOVERY UNIT (HRV) NEED TO BE INSTALLED BEFORE THE COLD ROOMS ARE BUILT. THE HRV IS BOTTOM ACCESSED - UNIT TO BE RASSED TO ALLOW FILTER CHANGING.
 8. DOOR HEATERS ARE TO BE MOUNTED BELOW THE CEILING.
 9. ALL EGGRATE CORE GRILLS WILL BE OF GDL MANUFACTURE OR EQUAL & APPROVED. COLOUR FINISH: WHITE

ROOF COWLS
MANUFACTURER: SYSTEMAIR (FANS & SPARES)
MODEL: RA-630
CASING: GLASS REINFORCED PLASTIC WITH ULTRA-VIOLET STABILISER
HORIZONTAL DISCHARGE WITH BIRD GUARD
CONNECTION OPENING: 790x790mm
EXTERNAL DIMENSIONS: 1,115x1,115mm
HEIGHT: 650mm
WEIGHT: 70kg
COLOURED TO RAL OR BS
STANDARD COLOUR: RAL 7035 GOOSEWING GREY



HEAT RECOVERY UNIT (HRV)
MODEL: HR3500

SYMBOLS LEGEND



- 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 1.35kW/230 V/5.56 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,

- NOISE LEVEL**
- 66 db(A) @ 1m FROM UNDERSIDE OF UNIT
 - SUPPLY AIR TO STORE: 86.6 db(A)
 - EXTRACT AIR FROM STORE: 76.7 db(A)

- FEATURES**
- CONDENSATE BY GRAVITY THROUGH CONDENSATE TRAP
 - DIRTY FILTER INDICATION

PROJECT AIR FLOW RATE: 961.2 l/s (3,460 m³/h)
DIMENSIONS: (WxLxH)=2,160x2,910x544mm
WEIGHT=580kg
CONNECTIONS=500x380mm

EDH
ELECTRIC DUCT HEATER
MANUFACTURER: AAH LTD
DIAMETER: 450mm
MODEL C450E9 CIRCULAR HEATER (AAH/8)

- CAPACITY: 9kW/400V
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

NOTE
FOR DATA OF THE CEILING FAN-COIL UNITS PLEASE REFER TO DRAWING W624.

NOTES ON CEILING FAN-COIL UNITS

1. ALL FAN-COIL UNITS WILL BE FULLY COORDINATED WITH THE REQUIRED LIGHTING SCHEME.
1. ENSURE EACH UNIT COVERS AN APPROXIMATE FLOOR AREA OF 200m²
2. CASSETTES ADJACENT TO THE CHILLERS / FRESH PRODUCE WILL HAVE TWO (2) WAYS BLANKED OFF.

XREFs
200698-W200.dwg

Client
ALDI STORES LTD.
BMT Project No. / Project Title
B3725 ALDI - SWINDON
Project Address
HEDGE END - SOUTHAMPTON



Drawing Title
**ELECTRICAL INSTALLATION
RETAIL AREA VENTILATION**

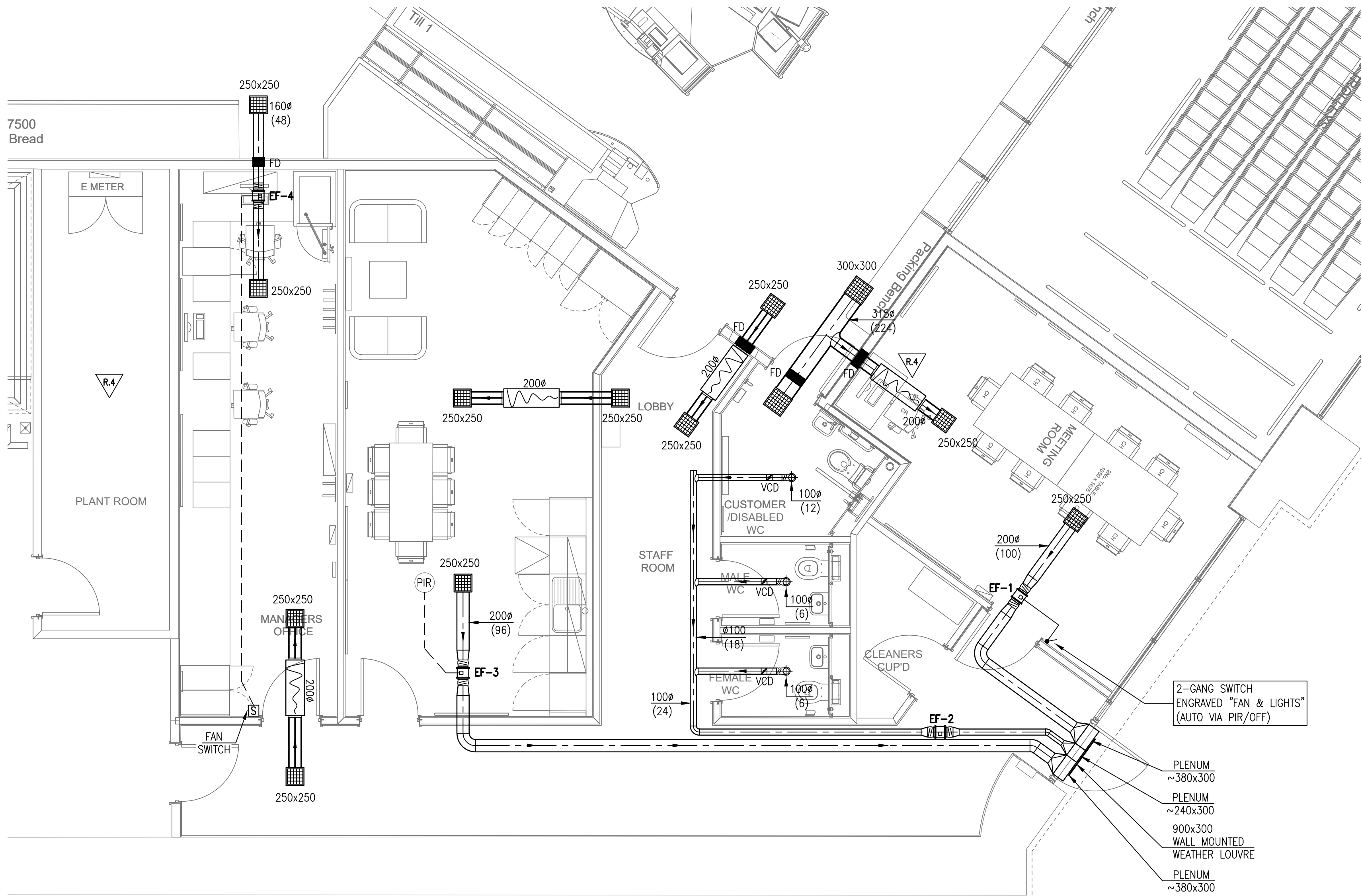
Job No. Originator Zone Level Type Role
B3725 BMT ZZ ZZ DR M
System Classification Drawing No. Suitability Revision
Ss_65_40_00.00-1101 A5 C01

Drawn Engineer Date Scale Size
AW CT 2022/02/14 1:50 A1



920B MELTON ROAD
THURMASTON
LEICS.
LE14 6GR
TEL: (0153) 2414 0331
E-MAIL: <firstname.surname@bmt-td.co.uk>

REV	DATE	DESCRIPTION	DRW	Eng
CO1	14.02.22	FIRST ISSUE	AW	CT



SYMBOLS LEGEND	
	AIR EXTRACT/SUPPLY VALVE 100mm, 150mm & 200mm
	SOUND ATTENUATOR (CROSSTALK) FITTED ON 250mm AIR DUCT
	ROUND AIR DUCT 125mm, CARRYING 32 l/s OF AIR
	VOLUME CONTROL DAMPER FITTED ON CIRCULAR AIR DUCT
	FIRE DAMPER INSTALLED IN CIRCULAR AIR-DUCT, FIRE RATED 1-1 1/2 HOUR, AS PER ARCHITECTS FIRE STRATEGY PLANS
	EGGCRATE CORE GRILLE
	MOTION DETECTION SENSOR (PIR DETECTOR)

EXTRACT FANS SCHEDULE	
EF-1 OPERATION 104 l/s (374m³/h) @ 100Pa, SFP~0.25, 2,874 RPM. 1Ph 230V/50Hz, ~26W, ~0.25A	Attention! Do not use with heated air in excess of 55°C (131°F) CEILING VOID MOUNTED, SYSTEMAIR PRIO 160EC CIRCULAR DUCT EXTRACT FAN, 160mmx220mm. CHARACTERISTICS • EC MOTOR WITH SPEED CONTROL • INTEGRATED MOTOR PROTECTION • ENCLOSURE CLASS IP44 • CAN BE INSTALLED IN ANY POSITION • WEIGHT: 1.6kg • SOUND PRESSURE: 47 db(A) @ 3m.
EF-2 OPERATION 24 l/s (~86m³/h) @ 100Pa, SFP~0.70, 2,874 RPM. 1Ph 230V/50Hz, ~17W, ~0.18A	
EF-3 OPERATION 96 l/s (346m³/h) @ 100Pa, SFP~0.24, 2,794 RPM. 1Ph 230V/50Hz, ~23W, ~0.23A	
EF-4 OPERATION 48 l/s (173m³/h) @ 100Pa, SFP~0.35, 2,530 RPM. 1Ph 230V/50Hz, ~17W, ~0.18A	

- NOTES**
- FANS EF-2, EF-3 & EF-4 WILL BE ACTIVE DURING STORE OCCUPATION.
 - FANS EF-2 & EF-3 TO BE SWITCHED VIA "STAFF LEVEL" LIGHTING AND SHALL INCORPORATE "RUN ON" TIMERS.
 - FANS EF-1 & EF-4 TO BE SWITCHED VIA "STAFF LEVEL" LIGHTING, WITH WALL MOUNTED OVERRIDE SWITCH AND SHALL INCORPORATE A "RUN ON" TIMER.
 - ALL FANS WILL BE OF SYSTEMAIR MANUFACTURE, TYPE PRIO 160EC.
 - ALL EGGCRATE CORE GRILLES WILL BE OF GDL MANUFACTURE OR EQUAL & APPROVED. COLOUR FINISH: WHITE
 - ALL WEATHER LOUVRES WILL OF GDL MANUFACTURE TYPE WG050-30mm OR EQUAL & APPROVED.

XREF
200698-W200.dwg

Client	ALDI STORES LTD.	
BMT Project No. / Project Title	B3725 ALDI - SWINDON	
Project Address	HEDGE END - SOUTHAMPTON	

Drawing Title					
ELECTRICAL INSTALLATION WELFARE AREA VENTILATION					
Job No.	Originator	Zone	Level	Type	Role
B3725	BMT	A1	ZZ	DR	M
System Classification		Drawing No.	Subtality	Revision	
Ss_65_40_00_00-1107		A5	C01		
Drawn	Engineer	Date	Scale		Size
AW	CT	2022/02/14	1:50		A1



920B MELTON ROAD
THURMASTON
LEICS.
LE4 8GR
TEL: (0116) 244 0331
E-MAIL: <firstname.surname@bmt-ttd.co.uk>

APPENDIX C

NOYSPLOT NOISE MODEL CALCULATIONS

Client: Aldi				Appendix C1.1 Page: 1 of 1							
Project: Aldi Hedge End Retail Park				Project no: 2120326							
Consultant: K J Metcalfe				Date: 12 September 2022							
Sound power levels (Lw) & sound pressure levels (Lp) for fans & other equipment											
Equipment name/reference	Lw/ Lp	Dist. (m)	On time D/N/A	Mid-frequency Octave Bands (Hz)							
				63	125	250	500	1k	2k	4k	8k
ASHP 1	Lw		A	74	62	57	53	48	45	46	42
ASHP 2	Lw		A	74	62	57	53	48	45	46	42
ASHP 3	Lw		A	74	62	57	53	48	45	46	42
ASHP 4	Lw		A	74	62	57	53	48	45	46	42
ASHP 5	Lw		A	74	62	57	53	48	45	46	42
Compressor Pack	Lp	10	A	33	dBA						
Gas Cooler	Lp	10	A	30	dBA						
LT Condenser	Lp	10	A	43	dBA						
MT Condenser	Lp	10	A	43	dBA						
EF1 Meeting Room Extract	Lw		D	67	69	68	67	65	63	60	53
EF2 WC Extract	Lw		D	67	69	68	67	65	63	60	53
EF3 Staff Room Extract	Lw		D	67	69	68	67	65	63	60	53
AHU FAI	Lw		D	76	71	79	78	81	81	78	75
AHU Exhaust	Lw		D	69	66	76	72	69	70	68	67

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:\21 - Projects\2120326 Aldi Hedge End Retail Park-KJM\NoysPlot\Aldi Hedge End Retail Park
Date: 12 September 2022
Entries by: K J Metcalfe
Project no: 2120326
Project title: Aldi Hedge End Retail Park
Client's name: Aldi

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	Lp/	dBA	Dist	Noise level - Octave band centre frequency Hz							
	X m	Y m	Z m	Amm	Bmm	Ang.			d/n/a	Lw	Y/N	(m)	63	125	250	500	1k	2k	4k	8k
ASHP 1	526.0	501.6	0.8	0	0	90	100	2	A	W	N	0.0	74	62	57	53	48	45	46	42
ASHP 2	526.0	503.2	0.8	0	0	90	100	2	A	W	N	0.0	74	62	57	53	48	45	46	42
ASHP 3	528.0	501.6	0.8	0	0	270	100	2	A	W	N	0.0	74	62	57	53	48	45	46	42
ASHP 4	528.0	503.2	0.8	0	0	270	100	2	A	W	N	0.0	74	62	57	53	48	45	46	42
ASHP 5	528.0	504.8	0.8	0	0	270	100	2	A	W	N	0.0	74	62	57	53	48	45	46	42
Compressor Pack	525.0	510.0	2.6	0	0	0	100	2	A	P	Y	10.0	33 dBA							
Gas Cooler	528.0	510.0	1.4	0	0	0	100	2	A	P	Y	10.0	30 dBA							
LT Condenser	525.0	514.0	1.2	0	0	0	100	2	A	P	Y	10.0	43 dBA							
MT Condenser	525.0	516.0	1.2	0	0	0	100	2	A	P	Y	10.0	43 dBA							
EF1 Meeting Room Extract	535.0	568.3	3.0	300	1000	135	100	1	D	W	N	0.0	67	69	68	67	65	63	60	53
EF2 WC Extract	535.0	568.3	3.0	300	1000	135	100	1	D	W	N	0.0	67	69	68	67	65	63	60	53
EF3 Staff Room Extract	535.0	568.3	3.0	300	1000	135	100	1	D	W	N	0.0	67	69	68	67	65	63	60	53
AHU FAI	528.0	551.0	6.0	0	0	0	100	1	D	W	N	0.0	76	71	79	78	81	81	78	75
AHU Exhaust	528.0	541.0	6.0	0	0	0	100	1	D	W	N	0.0	69	66	76	72	69	70	68	67

Receptor data - description and co-ordinates

Receptor description	Co-ordinates			DNA
	X m	Y m	Z m	
61 Goodlands Vale	606.0	498.0	4.5	A
51 Goodlands Vale	577.0	466.0	4.5	A

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	500.0	500.0	5.0	500.0	558.0	5.0
Ring barrier	500.0	558.0	5.0	516.0	580.0	5.0
Ring barrier	516.0	580.0	5.0	535.0	567.0	5.0
Ring barrier	535.0	567.0	5.0	576.0	567.0	5.0
Ring barrier	576.0	567.0	5.0	580.0	562.0	5.0
Ring barrier	580.0	562.0	5.0	580.0	532.0	5.0
Ring barrier	580.0	532.0	5.0	576.0	527.0	5.0
Ring barrier	576.0	527.0	5.0	556.0	527.0	5.0
Ring barrier	556.0	527.0	5.0	556.0	519.0	5.0
Ring barrier	556.0	519.0	5.0	524.0	519.0	5.0
Ring barrier	524.0	519.0	5.0	524.0	500.0	5.0
Ring barrier	524.0	500.0	5.0	500.0	500.0	5.0

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
51 Goodlands Vale	50	40	34	30	30	31	31	29	38
61 Goodlands Vale	49	39	34	30	31	31	30	30	38

Source noise levels at receiver: 61 Goodlands Vale

Period: Day time

Plant item	Mid frequency octave bands (Hz)								
	63	125	250	500	1k	2k	4k	8k	dBA
AHU FAI	24	19	27	26	30	30	28	28	36
LT Condenser	45	35	28	22	19	18	18	20	28
MT Condenser	45	35	28	22	19	18	18	20	28
AHU Exhaust	17	14	24	21	18	21	21	20	27
Compressor Pack	35	25	18	12	9	8	8	10	18
Gas Cooler	32	22	15	9	6	5	5	7	15
ASHP 5	31	19	14	10	5	2	3	0	13
ASHP 2	31	19	14	10	5	2	3	0	13
ASHP 1	31	19	14	10	5	2	3	0	13
ASHP 4	31	19	14	10	5	2	3	0	13
ASHP 3	31	19	14	10	5	2	3	0	13
EF3 Staff Room Extract	3	7	9	6	2	1	0	0	8
EF2 WC Extract	3	7	9	6	2	1	0	0	8
EF1 Meeting Room Extract	3	7	9	6	2	1	0	0	8
Total Free field Lp and dBA	49	39	34	30	31	31	30	30	38

Source noise levels at receiver: 51 Goodlands Vale

Period: Day time

Plant item	Mid frequency octave bands (Hz)								
	63	125	250	500	1k	2k	4k	8k	dBA
AHU FAI	23	18	26	26	29	30	30	27	36
LT Condenser	46	36	29	23	20	19	19	21	29
MT Condenser	46	36	29	23	20	19	19	21	29
AHU Exhaust	17	14	25	21	19	23	21	20	28
Compressor Pack	36	26	19	13	10	9	9	11	19
Gas Cooler	34	24	17	11	8	7	7	9	17
ASHP 5	33	21	16	12	7	4	5	1	15
ASHP 2	33	21	16	12	7	4	5	1	15
ASHP 1	33	21	16	12	7	4	5	1	15
ASHP 4	33	21	16	12	7	4	5	1	15
ASHP 3	33	21	16	12	7	4	5	1	15
EF3 Staff Room Extract	1	6	6	3	0	0	0	0	0
EF2 WC Extract	1	6	6	3	0	0	0	0	0
EF1 Meeting Room Extract	1	6	6	3	0	0	0	0	0
Total Free field Lp and dBA	50	40	34	30	30	31	31	29	38

Appendix C4: Predicted night time noise levels

Overall receptor listings
 Period: Night time

Overall daytime plant noise levels (dB)	Mid frequency octave bands (Hz)								
	63	125	250	500	1k	2k	4k	8k	dBA
51 Goodlands Vale	50	40	33	27	24	23	23	24	33
61 Goodlands Vale	49	39	32	26	23	22	22	23	32

Source noise levels at receiver: 61 Goodlands Vale

Period: Night time

Plant item	Mid frequency octave bands (Hz)								
	63	125	250	500	1k	2k	4k	8k	dBA
LT Condenser	45	35	28	22	19	18	18	20	28
MT Condenser	45	35	28	22	19	18	18	20	28
Compressor Pack	35	25	18	12	9	8	8	10	18
Gas Cooler	32	22	15	9	6	5	5	7	15
ASHP 5	31	19	14	10	5	2	3	0	13
ASHP 3	31	19	14	10	5	2	3	0	13
ASHP 1	31	19	14	10	5	2	3	0	13
ASHP 4	31	19	14	10	5	2	3	0	13
ASHP 2	31	19	14	10	5	2	3	0	13
Total Free field Lp and dBA	49	39	32	26	23	22	22	23	32

Source noise levels at receiver: 51 Goodlands Vale

Period: Night time

Plant item	Mid frequency octave bands (Hz)								
	63	125	250	500	1k	2k	4k	8k	dBA
LT Condenser	46	36	29	23	20	19	19	21	29
MT Condenser	46	36	29	23	20	19	19	21	29
Compressor Pack	36	26	19	13	10	9	9	11	19
Gas Cooler	34	24	17	11	8	7	7	9	17
ASHP 5	33	21	16	12	7	4	5	1	15
ASHP 3	33	21	16	12	7	4	5	1	15
ASHP 1	33	21	16	12	7	4	5	1	15
ASHP 4	33	21	16	12	7	4	5	1	15
ASHP 2	33	21	16	12	7	4	5	1	15
Total Free field Lp and dBA	50	40	33	27	24	23	23	24	33

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 dB + 50 dB = 53 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:

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