

**Coombe Farm,
Llanvair Discoed,
Chepstow,
Monmouthshire**

***Proposed Additional Poultry Units
& Heat Exchangers***

NOISE IMPACT ASSESSMENT

**Acoustics Report M1521/R03
11th April 2023**

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1. Introduction

This acoustic report documents a noise impact assessment for the proposed heat exchangers and two additional poultry units at Coombe Farm, Chepstow, Monmouthshire; Figures 1 - 3.

The report is divided into the following sections:

- Section 2: Overview of the Development
- Section 3: BS4142:2014+A1:2019
- Section 4: Noise survey
- Section 5: Noise Impact Assessment
- Section 6: Conclusion
- Appendix A: Noise monitor and weather station data
- Appendix B: Calculations
- Appendix C: Manufacturers noise data

2. Overview of the Development

The proposal is for two additional poultry units, which will be located to the south-east of the four existing poultry units (Sheds 1 – 4) at Coombe Farm, and 6 heat exchangers; Figures 1 and 2.

The closest dwellings, labelled A – D in Figure 1, are between approximately 445m and 620 from the proposed additional poultry units. As with the existing poultry units, the proposed sheds will be fully acoustically shielded (i.e., the line of sight is blocked by a solid barrier) from the development by topography; Dwellings A, C and D are located within a narrow valley 50m - 60m below Coombe Farm and there is an approximately 10m high hill between the development and Dwelling B.

For the assessment, the development noise emissions generated by plant and transport activities have been considered. These consist of:

- **Plant:**
 - *Ventilation fans:* The ventilation fans on the proposed additional poultry units will consist of:
 - Roof fans: 16 x Fancom 3680 fans per shed, arranged in two rows of 8 either side of the ridge
 - Gable end fans: 8 x Fancom 34130 units per shed, located on the north-east gable ends.
 - *Heat exchangers:* 6 x Big Dutchman Earny 2 heat exchangers, which will be positioned in pairs between sheds 1 & 2, 3 & 4 and 5 & 6; Figure 3
- **Transport:** Transport noise includes commercial vehicles manoeuvring and loading/unloading on the concrete apron to the south-west of the units; Figure 1. A forklift will be used for the loading/unloading of HGVs. Vehicles will access the site via the access road serving Coombe Farm and the existing poultry units.

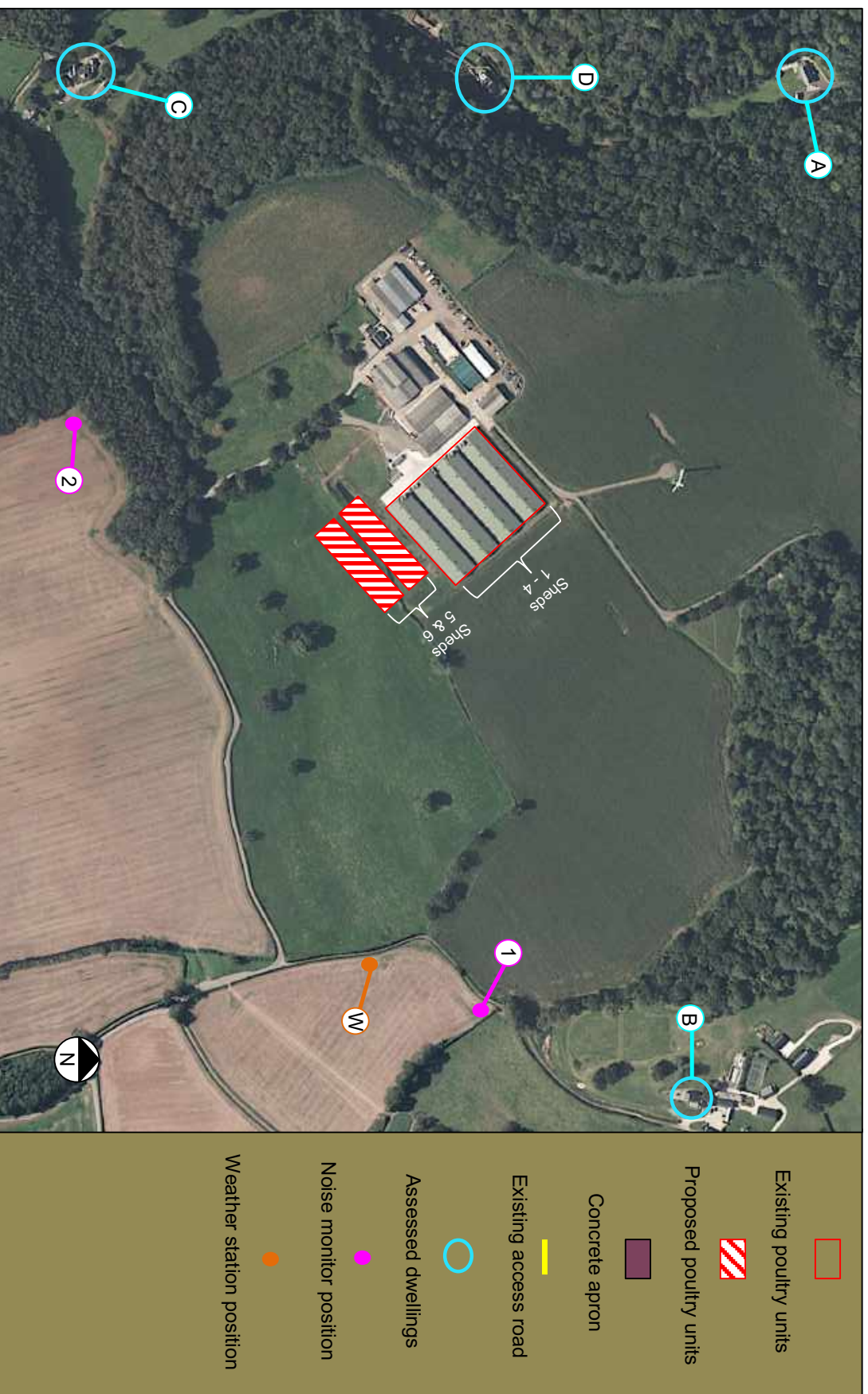


Figure 1. Aerial view (source: www.google.com) showing footprint of existing and proposed poultry units, assessed dwellings and noise monitor and weather station positions

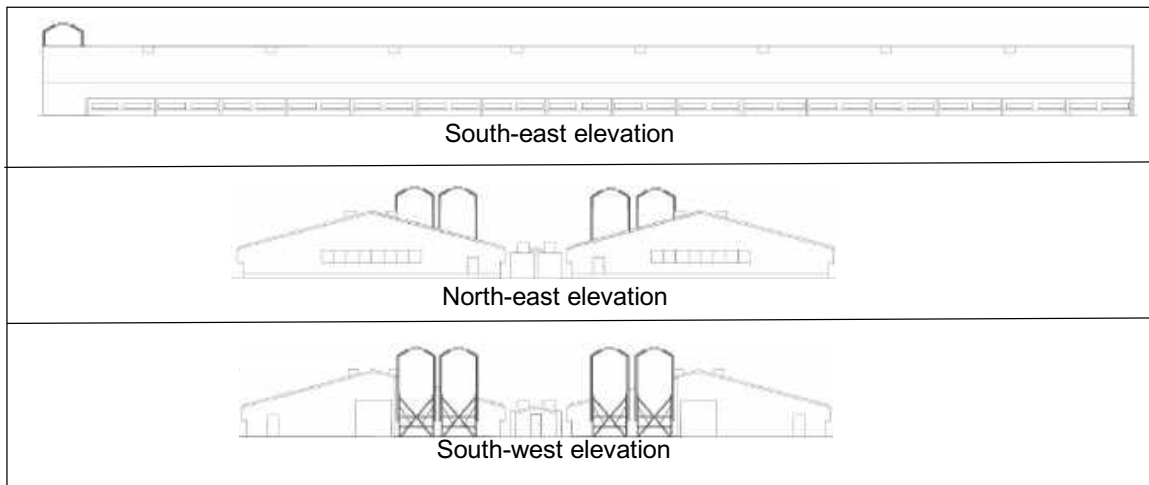


Figure 2. Elevations of proposed additional poultry units

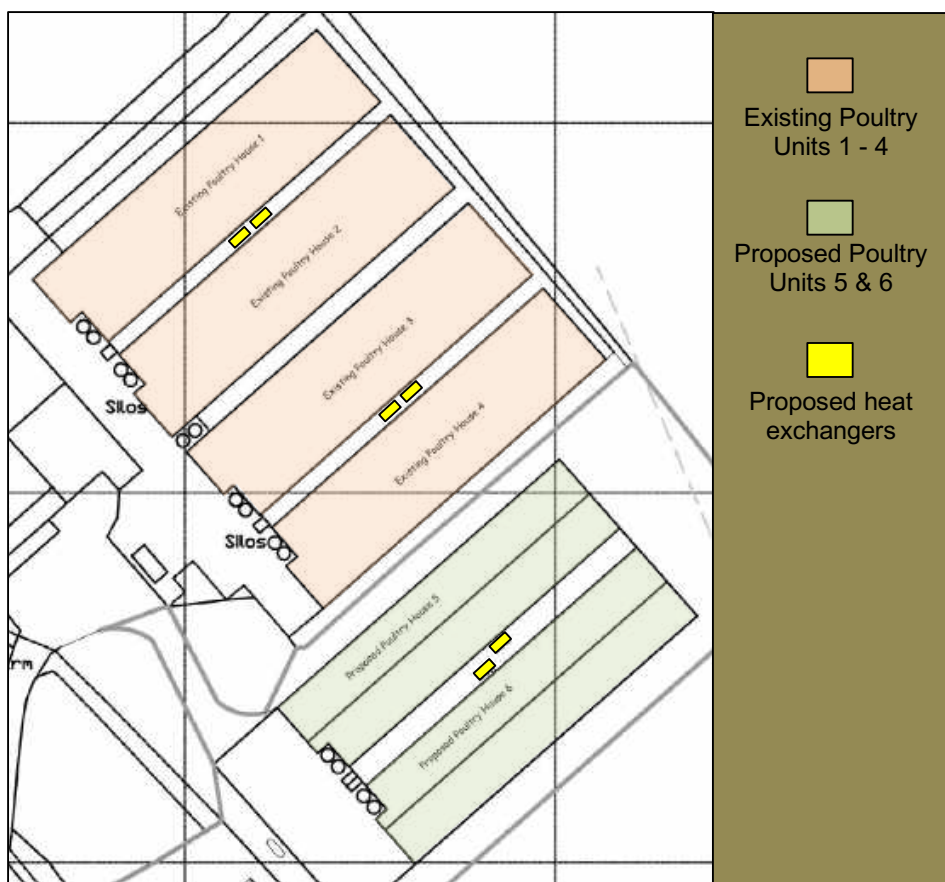


Figure 3. Plan showing location of proposed heat exchangers

3. BS4142:2014+A1:2019

The noise assessments detailed in this report of the ventilation fans and transport activities within the concrete aprons have been conducted in accordance of BS4142:2014+A1:2019 'Methods for Rating and Assessing Industrial and Commercial Sound'.

BS4142 provides a methodology to assess the impact of industrial and commercial noise affecting dwellings, whereby the 'typical' background noise level is deducted from the industrial noise Rating Level (industrial noise corrected to account for the 'on-time' and noise character of the noise source; see sections 3.1 and 3.2 below). The following guidance is given based on the established difference:

- A difference of around +10dB or more is likely to be an indication of significant adverse impact, depending on context
- A difference of +5dB is likely to be an indication of an adverse impact, depending on context
- The lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact. Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on context

Context, as defined in BS4142:2014+A1:2019, includes the consideration of the following factors:

- The absolute level of the noise emissions
- Character and level of the residual sound compared to the character and level of the Specific Level
- Sensitivity of the receptor and any acoustic design measures (e.g., façade sound insulation, use of mechanical ventilation and acoustic screening) incorporated at premises used for residential purposes

Where background noise and Rating Levels are low, BS4142:2014+A1:2019 states that '*absolute levels might be as, or more, relevant than the margin by which the rating level exceeds the background. This is especially true at night*'. Low background noise and rating levels are not defined. However, in BS4142:1997 it states that '*background noise levels below 30dB and rating levels below about 35dB are considered to be very low*'.

3.1 On-time correction

To take account of industrial/commercial noise sources that do not operate continually an 'on-time' correction is applied using:

$$- 10 \log (r/r_{ref})$$

Where:

r_{ref} = reference time (1hr between 07:00 – 23:00hrs and 15 minutes between 23:00 – 07:00hrs)

r = total 'on-time' during the reference period

Note that the shorter reference time interval between 23:00 – 07:00hrs is designed to penalise industrial/commercial noise events that occur during the night.

3.2 Noise character correction

BS4142 provides four noise character correction categories with associated penalties that must be applied when determining the Rating Level, namely:

- **Tonality:**
 - Not perceptible = 0dB
 - Just perceptible = +2dB
 - Clearly perceptible = +4dB
 - Highly perceptible = +6dB
- **Impulsivity:**
 - Not perceptible = 0dB
 - Just perceptible = +3dB
 - Clearly perceptible = +6dB
 - Highly perceptible = +9dB
- **Intermittency:** +3dB if the intermittency of operation is readily distinctive against the residual noise environment
- **Other:** +3dB applied if the specific sound is neither tonal or impulsive but features noise characteristics that are readily distinctive against the residual noise environment

4. Noise Survey

A noise survey has been undertaken in order to establish representative background noise levels at the nearest dwellings and to identify if there is any contribution to the noise environment from the operation of the existing poultry unit's ventilation fans (the existing poultry units were operational throughout the survey period).

It should be noted that a noise survey using the same measurement locations was previously conducted by Matrix Acoustics in 2015 (as documented in our report M1521/R01 dated 23/6/15) prior to the operation of Sheds 1 – 4.

- **Survey dates:** Monday 30th May – Wednesday 1st June 2022
- **Weather;** Table A1, Appendix A:
 - Precipitation: Dry
 - Wind Speed: Highest recorded wind speed 2.2m/s, with a median of 0m/s
 - Wind direction:
 - 19:00 – 05:00: W
 - 05:00 – 10:00: SW
 - 10:00 – 20:00: W
 - 20:00 – 23:00: NW
 - 23:00 – 17:00: W
- **Monitor locations:** Microphones/weather station mounted on tripods and located as indicated in Figure 1.
- **Equipment:**
 - Weather Station: Kestrel type 4500
 - Noise monitors: Brüel & Kjær Type 2238 (Positions 1 and 2)
- **Monitor configuration:**
 - Weather station: Configured to measure the average wind speed and temperature over consecutive 10-minute periods
 - Noise Monitors: configured to measure consecutive 15-minute samples of noise.

- **Calibration:** Noise monitors calibrated before and after the survey using a Brüel & Kjær Type 4231 calibrator with no deviations found

All noise measurements are free-field. Full tabulated results are given in Table A1, Appendix A.

The weather conditions will not have adversely affected the noise measurements.

3.1 Survey observations

The nearby roads are single track with very light traffic flow. Consequently, the impact of passing cars on the underlying noise environment is negligible.

Noise emissions from the ventilation fans on the existing poultry units were noted to be inaudible at both Positions 1 and 2; the general noise environment was very quiet.

3.2 Typical background noise level, L_{A90} , at nearest dwelling

Figures 3 and 4 show the variation in the measured maximum (L_{Amax}), ambient (L_{Aeq}) and background (L_{A90}) at Positions 1 and 2 respectively.

Figure 3. Position 1 noise monitor data (free-field)

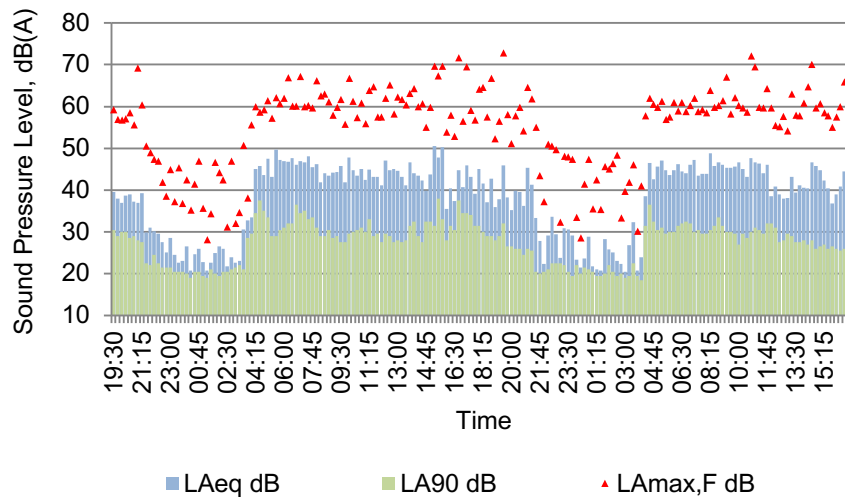
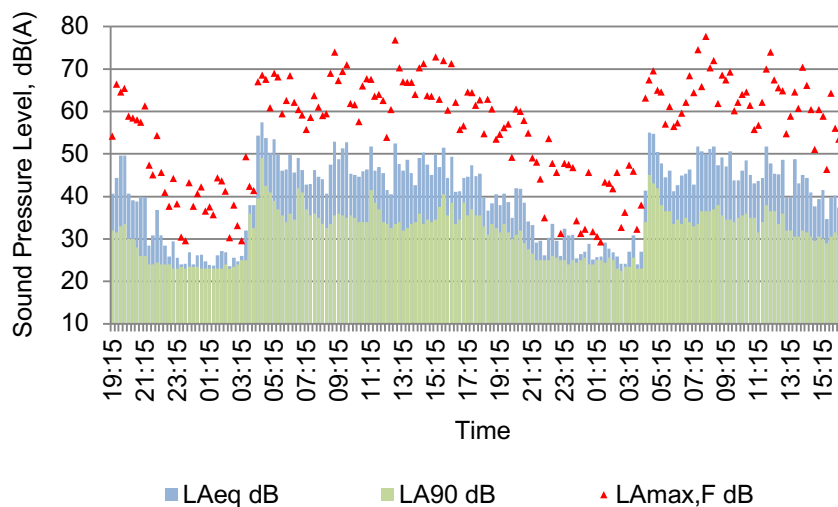


Figure 4. Position 2 noise monitor data (free-field)



As can be seen in Figure 3 and 4, the variation in the recorded noise levels at both measurement positions follow the same overall pattern. This indicates that they were exposed to the same general noise environment.

Background noise levels at Position 2 are typically slightly higher (by around 3dB) than those obtained at Position 1. This finding is consistent with the survey conducted in 2015 prior to the operation of Sheds 1 - 4, and consequently is not expected to be as a result of noise emissions from the existing poultry units.

At both measurement positions there are no periods of plateaus in the recorded background noise levels. This indicates that the noise monitors were not exposed to a continuous noise source such as the operation of the existing ventilation fans. This further provides evidence that at both measurements positions the contribution of the noise emissions from the existing ventilation fans was negligible.

Reviewing the survey data representative typical background noise levels have been established as

- Day (07:00 – 20:00hrs): L_{A90} 29dB
- Evening (20:00 – 23:00hrs): L_{A90} 27dB
- Night (23:00 – 07:00hrs): L_{A90} 22dB

These very low background noise levels, which are consistent with those obtained from our 2015 survey, are considered representative to those that will occur at Dwellings A – D; Figure 2.

It should be highlighted that our 2015 survey found that there was little to no variation between weekdays and the weekend in the environmental noise levels.

5. Noise Impact Assessment

5.1 Calculation of aggregate extract fan noise at nearest dwelling

The full calculations of the extract fan, heat exchanger and transport noise emissions are provided in Tables B1 – B6, Appendix B, with the resultant aggregate BS4142 Rating and Assessment Levels at Dwellings A – D given in Table 2.

5.2 Source noise data

- **Ventilation fans**
 - Ridge extract fan type:
 - Type: Fancom 3680
 - Sound pressure level: 70dB(A) at 2m, 45° lateral; see Appendix C for manufacturers data sheet
 - Total number of fans: 16 per shed, arranged in two rows of 8 either sided of the riegde
 - Duct terminations: roof mounted ducts, terminating 6.4m above local ground; Figure 2
 - Gable end extract fans:
 - Type: Fancom 34130
 - Sound pressure level: 75dB(A) at 2m, 45° lateral; see Appendix C for manufacturers data sheet
 - Total number of fans: 8 per shed
 - Grille locations: North-east gable end
- **Heat Exchangers**
 - Type: Big Dutcham Earny 2
 - Total number of units: 6
 - Location: located in pairs, position between Shed 1 & 2, 3 & 4 and 5 & 6; Figure 3

- Sound pressure level: Ranges between 65.4 – 76.3dB at 1m depending on location; see Appendix C for manufacturers data sheet. For the assessment the highest value has been used.
- **Transport noise:** Inhouse measured source noise levels
 - Stock delivery/collection (HGV arriving/departing, manoeuvring and loading/unloading using a diesel forklift): $L_{Aeq,1hr}$ 60dB, $L_{Aeq,15 mins}$ 62dB and $L_{Amax,F}$ 79 at 20m

5.3 Extract fan operation

The temperature within the sheds is determined by a combination of the heat generated by the birds themselves, the external temperature and the ventilation provided by the extract fans.

To provide sufficient ventilation of the bird generated heat, as required to maintain the ideal internal operating temperature of around 20°C, up to 25% of the roof extract fans will be required to operate (either intermittently or on variable speed).

With the influence of the external temperature additional extract fans may be required in order to maintain the ideal operating internal temperature. Here the fans are operated in Stages, triggered with each 1°C rise above the ideal internal temperature. The highest Stage will typically only be triggered when the internal temperature rises above 23°.

Normally the roof extract fans will provide sufficient extraction on their own; the gable end fans are only required during periods of extreme external temperatures or due to failure of the roof extract fans.

The operation of 100% of the roof extract fans, and additionally the gable end fans if required, are only expected to occur during the day period when the external temperatures have the potential to be higher.

During the evening and night, when the external temperature will fall, there will be a corresponding decrease in the number of roof extract fans needed above those for bird generated heat alone; the expected percentage of roof extract fans required to maintain the set temperature are 50% and 25% for the evening and night periods respectively.

For the assessment calculations conservative assumptions have been made on the number of ventilation fans required, namely:

- Day (07:00 – 20:00hrs): 100% roof and gable end extract fans operating (this is the worst-case scenario; typically, the gable end fans will not be required to operate)
- Evening (20:00 – 23:00hrs): 100% roof extract fans operating
- Night (23:00 – 07:00hrs): 50% roof extract fans operating

5.4 Heat Exchanger Operation

Typically heat exchangers are not required to operate at greater than 70% capacity, which would normally only be required during the day period. During the evening/night periods the heat exchangers would be expected to only be required to operate at 50% and 35% capacities respectively.

As manufacturers noise data is only available for the heat exchangers at 100% capacity, and as an absolute worst-case scenario, for the assessment it has been assumed that the heat exchangers are running at 100% capacity day, evening and night.

5.5 Transport vehicle operation

Table 1 provides the type and frequency of commercial vehicles per flock cycle for both the existing and proposed enlarged poultry development.

The commercial vehicles will use the existing access road serving the existing poultry units. Stock will be loaded/unloaded on the concrete aprons to the south-west of the sheds.

As can be seen in Table 1, the proposed additional poultry units will result in an additional 221 commercial vehicle visits (442 movements) per annum. There will however be no increase in the frequency of commercial vehicles in any BS4142 assessment periods (1hr during the day and 15-minutes during the night)

The majority of transport movements will only occur during the working day (07:00 – 20:00hrs). However, in order to avoid stressing the birds catching is typically undertaken during the night.

Table 1. Traffic Generation			
Activity	Vehicle Size	Existing Frequency 220,000 Birds.	Proposed Frequency 300,000 Birds.
Chick Delivery	16.5m Articulated HGV	3	4
Feed Delivery	16.5m Articulated HGV	22	33
Bird Removal	16.5m Articulated HGV	28	38
Manure Removal	Tractor and Trailer (retained on farm)	18	24
Dirty Water Removal	Tractor and Tanker (retained on farm)	2	3
Carcass Collection	7.5 tonne rigid lorry	5	5
Shavings Delivery	16.5m Articulated HGV	2	3
Gas Delivery	Tanker	2	3
Total per Flock		84	113
Total per Annum (7.6 flocks)		638 (1276 movements)	859 (1718 movements)

5.6 Derivation of aggregate Specific Level

The individual noise level of each noise source has been calculated at Dwellings A - D; Figure 1. The following corrections have been applied to the source noise data:

- **Directivity correction (extract fans only):**
 - Ridge fans: correction to convert the fan noise data from the manufacturers stated level at 45° lateral to 90° lateral (the propagation angle for the assessed dwellings), determined using the corrections given in Duct Directivity Index Applications (Day H. Hansen C & Bennett B, Acoustics Australia 96 Vol. 37 December (2009) No. 3). For the calculation a frequency spectra has been used
 - Gable end fans: correction to convert the fan noise data from the manufacturers stated level at 45° from the termination to the propagation angle for the assessed dwellings, determined using the corrections given in Figure 11.2, p322, Noise Control in Building Services, SRL Ltd. For the calculation a frequency spectra has been used
- **Reflections (extract fans & heat exchangers):** 3dB added to account for reflections off the poultry shed roof/façade
- **Distance correction:** $20 \times \log (d_1/d_0)$, where d_1 = distance between receptor and the noise source and d_0 = reference distance.
- **Shielding attenuation:** where the line of sight is blocked by a solid barrier between the extract fan and dwelling, e.g., by the local topography for all dwellings in this case, the shielding correction has been calculated in accordance with ISO 9613-2: Attenuation of sound during propagation outdoors, Formula 14:

$$D_z = 10 \times \text{Log} [3 + (C_2/\lambda) \times C_3 \times z \times K_{\text{met}}]$$

Where,

D_z = barrier attenuation, dB

$C_2 = 20$

$C_3 = 1$

λ = wavelength of sound at the nominal midband frequency of the octave band, m

z = path difference between direct and shielded noise paths

$K_{\text{met}} = 1$

For the calculation the receiver height has been taken to be 4.5m above local ground

- **Ground absorption correction:** ISO 9613-2: Attenuation of sound during propagation outdoors, Formula 10:

$$A_{\text{gr}} = 4.8 - (2h_m/d)[17 + (300/d)]$$

Where,

h_m = mean height of the propagation path above ground

d = distance from source to receptor

In accordance with ISO 9613-2 the ground absorption correction is assumed to be zero when the line of sight of the noise source is partially or fully blocked by a solid body (i.e., when a shielding correction is applicable)

- **Atmospheric attenuation:** ISO 9613-2: Attenuation of sound during propagation outdoors, Formula 8:

$$A_{\text{atm}} = \alpha d/100$$

Where,

α = is the atmosphere attenuation coefficient for a temperature of 10°C and 70% relative humidity

d = distance from source to receptor

Note that for the assessment it has been assumed that the fans are operating continuously and consequently no 'on-time' correction has been applied.

Tables B1 – B6, Appendix B provide the full calculations.

5.7 Rating Level

To establish the Rating Levels the following BS4142 character corrections have been applied to the established Specific Levels.

- **Extract fans:**
 - **Tonality:** 0dB; measurements of in-situ Fancom fans at other poultry sites confirm that they are not tonal according to BS412's objective assessment methodology
 - **Impulsivity:** 0dB; The proposed extract fans will not contain an impulsive noise element such as bangs or a very sudden jump in sound output due to quick start-up/change in fan speed.
 - **Intermittency:** 0dB; the starting/stopping of individual fans will not be readily distinctive against the residual noise environment and consequently an intermittency penalty is not applicable
 - **Other:** 0dB; no 'other' noise characteristics of the fans are expected
- **Heat Exchangers:** 0dB; measurements of operating heat exchangers at other poultry developments have found that they are not tonal or contain impulsive elements; this is expected to be the case for the proposed units. The heat exchangers will not operate intermittently.
- **Stock collection/delivery**
 - **Tonality:** 0dB; measurements confirm that the stock collections/deliveries are not tonal.
 - **Impulsivity:** 6dB; the use of a forklift has the potential to generate 'highly perceptible' impulsive noise. Note that we have observed that with careful operation of the forklift (i.e., slowing loading crates) impulsive noise can be minimised.
 - **Intermittency:** 3dB; stock collections and HGV movements will be intermittent.
 - **Other:** 0dB; no 'other' noise characteristics are expected/have been identified

As is standard practice, the total character corrections have been capped at 6dB

5.8 Assessment Level

We define Assessment Level = $RL - \min L_{A90}$ dB, where:

RL = aggregate Rating Level, dB(A)

L_{A90} dB = the typical background noise level, L_{A90} , derived from the noise survey data

Note that the aggregate Rating Level includes the cumulative of the Rating Levels of the existing ventilation fans (as documented in our report M1521/R01 dated 23/6/15) on Sheds 1 – 4 and those on the proposed additional Sheds 5 and 6.

Table 2 provides the resultant Assessment Levels at Dwellings A - D.

Table 2. Typical background and calculated Rating and Assessment Levels at Dwellings A - D

Noise Source		Dwelling	Day: 07:00 - 20:00hrs				Evening : 20:00 - 23:00hrs				Night : 23:00 - 07:00hrs						
			100% gable end & roof fans operating				100% roof fans operating				50% roof fans operating						
			Typical L _{A90} dB		Rating Level, dB		Typical L _{A90} dB		Rating Level, dB		Typical L _{A90} dB		Rating Level, dB				
			Sheds 1 - 4	Sheds 5 & 6	Aggregate	Assessment Level, dB	Sheds 1 - 4	Sheds 5 & 6	Aggregate	Assessment Level, dB	Sheds 1 - 4	Sheds 5 & 6	Aggregate	Assessment Level, dB			
Plant	[A] Extract fans	A	29	24	6	24	-5	27	16	4	16	-11	22	13	1	13	-9
		B	29	29	22	30	1	27	22	8	22	-5	22	19	5	19	-3
		C	29	20	8	20	-9	27	13	6	14	-13	22	10	3	11	-11
		D	29	23	9	23	-6	27	16	7	17	-11	22	13	4	14	-9
	[B] Heat exchangers	A	29	5	2	7	-22	27	5	2	7	-20	22	5	2	7	-15
		B	29	11	8	13	-16	27	11	8	13	-14	22	11	8	13	-9
		C	29	5	4	8	-21	27	5	4	8	-19	22	5	4	8	-14
		D	29	7	4	9	-20	27	7	4	9	-18	22	7	4	9	-13
Transport	[C] Stock collection/delivery	A	29	17	12	17	-12	27	N/A			22	19	14	19	-3	
		B	29	20	17	20	-9	27	N/A			22	21	19	21	-1	
		C	29	18	15	18	-11	27	N/A			22	19	17	19	-3	
		D	29	21	14	21	-8	27	N/A			22	22	10	22	0	
Aggregate	[A] + [B] + [C]	A	29			25	-4	27			17	-10	22			20	-2
		B	29			30	1	27			23	-4	22			24	2
		C	29			23	-7	27			15	-12	22			20	-2
		D	29			25	-4	27			17	-10	22			23	1

Where the Rating Level is at parity with the typical background noise level (Assessment Level = 0dB) BS4142 states that the Specific Level will have a low impact; an adverse impact is indicated where the Rating Level is ≥ 5dB and <10dB above the typical background noise level.

The highest calculated aggregate Assessment Levels at the assessed dwellings during the day and evening are 1dB and -5dB respectively.

Taking into account that a 1dB change in noise level is imperceptible (i.e., an Assessment Level of 1dB would be perceived as the same as 0dB), we conclude that during the day and evening the aggregate Rating levels of the ventilation fans, heat exchangers and transport activities results in a BS4142 low noise impact.

It should also be highlight that the 1dB Assessment Level occurs for the worst-case scenario of 100% of the roof and gable ventilation fans and heat exchangers operating on all the existing and proposed sheds combined with a stock/collection delivery; in reality this scenario is unlikely to occur and as a consequence the aggregate Rating Level will be lower.

During the night period (23:00 – 07:00hrs) both the typical background noise levels and aggregate Rating Levels are very low at all four assessed dwellings. We therefore consider, in accordance with BS4142, that the absolute noise levels at Dwellings A - D during the night are of more relevance in determining the noise impact than the Assessment Levels in this case.

We consider it is reasonable to assume that the occupiers of the nearest dwellings will be within their houses during the night period. A room with an open window will provide 10 – 15dB sound reduction. Using the lower 10dB reduction the highest ventilation fan and transport activity noise

ingress at any of the assessed dwellings would be L_{Aeq} 8dB and $L_{Amax,F}$ 20dB (the maximum noise level will be generated by transport activities).

This ambient noise ingress level is extremely low, being significantly below both the typical background noise level and BS8233 L_{Aeq} 30dB noise ingress limits for bedrooms (noise limit applicable to road traffic noise and continuous operating plant).

ProPG: Planning & Noise (2017) provides guidance with regard to maximum noise events and sleep quality. Where individual noise events do not normally exceed 45dB more than 10 times a night within a bedroom ProPG states that this represents a reasonable threshold below which the effects of individual noise events on sleep can be regarded as negligible; the maximum noise ingress levels generated by the transport activities fall significantly below this threshold.

We therefore conclude that during the night the noise emissions from the development will result in a negligible noise impact.

5.9 Calculation uncertainty

With all calculations there is a level of uncertainty, which in this case we do not expect to be greater than +/-3dB (3dB is a just perceptible change in noise level). This small level of uncertainty is not considered to have any significance to the outcome of the assessment.

The established typical background noise levels are in line with the observed noise environment. No significant variation in the underlying noise environment that will alter the assessment findings is expected.

The difference between halving or doubling the number of fans operating (e.g., 50% to 100%) is 3dB. With smaller changes in the number of fans operating, for example, 50% to 70%, the change in aggregate noise emissions will be less than 2dB; this represents an imperceptible change in noise.

We therefore consider the used percentage of fans as suitably robust for the purpose of the assessment; it reflects the percentage of fans used in poultry units as advised by both operators and experts and would not result in a perceptible change in noise emissions with a 20 – 25% increase/decrease in the number of fans operating.

6. Conclusion

A BS4142 assessment has been undertaken of the operational noise sources of the proposed enlarged poultry development at Coombe Farm, Chepstow, Monmouthshire; Figures 1 - 3. The assessment included:

- A noise survey to establish representative background noise levels at the nearest dwellings to the development
- Calculation of the BS4142 Rating Levels generated by the ventilation fans, heat exchangers and transport activities

Via analysis of the survey data and calculation (Appendix B), it has been demonstrated that the aggregate BS4142 noise impact of the operating noise sources during the day and evening for the proposed poultry development will range between low to negligible.

Due to the very low Rating Levels and typical background noise levels during the night, the absolute noise emissions have been assessed to review acceptability; this is in accordance with guidance given in BS4142.

At the nearest dwellings the aggregate noise ingress via an open window during the night for the extract fans and transport activities will be low, being significantly below the typical background noise level and the BS8233 L_{Aeq} 30dB noise ingress limits for bedrooms (noise limit applicable to road traffic noise and continuous operating plant). The transport activity generated maximum noise levels will be below the WHO/PROPG sleep disturbance threshold. We therefore conclude

that during the night the poultry development noise emissions will result in a negligible noise impact.

On the basis that the proposed enlarged poultry development will not result in an adverse noise impact at the nearest dwellings, we conclude that on noise grounds the proposed scheme is acceptable

Table A1. Noise monitor data (free-field)													
Start Time	Position 1			Position 2			Start Time	Position 1			Position 2		
	L _{max,F} dB	L _{eq} dB	L ₉₀ dB	L _{max,F} dB	L _{eq} dB	L ₉₀ dB		L _{max,F} dB	L _{eq} dB	L ₉₀ dB	L _{max,F} dB	L _{eq} dB	L ₉₀ dB
19:15	89.6	59.4	29.0	54.2	40.6	32.0	06:45	60.1	46.0	36.5	60.4	49.0	42.0
19:30	59.2	39.6	30.5	66.4	44.3	31.5	07:00	67.2	46.9	34.5	59.2	46.2	41.0
19:45	56.9	37.9	29.0	64.6	49.6	33.0	07:15	59.9	46.6	35.0	55.7	42.8	37.0
20:00	56.7	37.0	30.0	65.4	49.6	33.5	07:30	60.2	48.1	33.0	58.6	42.9	35.5
20:15	57.1	38.7	30.0	65.8	49.6	30.0	07:45	59.6	45.5	33.5	63.7	46.2	36.0
20:30	58.5	39.0	28.5	65.5	49.1	30.0	08:00	66.1	46.2	31.0	61.0	44.6	35.0
20:45	55.6	37.3	29.0	63.0	38.8	28.0	08:15	62.5	41.9	29.0	59.0	44.1	33.5
21:00	69.2	36.9	28.0	57.5	39.9	26.0	08:30	63.0	44.1	29.0	59.4	40.7	32.5
21:15	60.4	39.2	27.5	61.3	39.8	26.0	08:45	61.1	43.5	30.5	69.0	47.5	33.5
21:30	50.5	29.9	22.5	47.3	28.4	24.0	09:00	57.9	44.2	28.5	73.9	52.9	35.5
21:45	48.9	31.0	22.0	45.0	30.9	24.0	09:15	59.8	44.3	29.0	67.2	48.8	36.0
22:00	47.3	30.2	24.5	54.3	36.8	24.5	09:30	61.7	45.8	27.5	69.4	51.3	35.0
22:15	46.9	29.6	22.5	45.7	30.8	24.0	09:45	55.7	41.8	27.5	70.9	52.8	35.0
22:30	41.8	27.6	21.5	40.9	28.4	24.0	10:00	66.7	47.8	29.5	61.9	45.3	35.5
22:45	38.5	25.1	21.5	37.6	25.9	24.0	10:15	61.2	44.8	30.0	61.5	45.0	35.0
23:00	44.9	28.5	21.5	44.2	29.4	23.0	10:30	57.4	43.5	30.5	57.6	44.6	34.0
23:15	37.3	24.5	20.5	38.3	25.5	23.0	10:45	60.8	45.1	31.0	66.0	45.9	34.0
23:30	45.3	22.7	20.5	30.4	24.0	23.5	11:00	55.9	42.4	30.0	67.7	46.3	34.0
23:45	36.8	23.0	20.5	29.5	24.1	23.0	11:15	63.9	44.9	33.0	67.6	51.8	41.5
23:00	42.5	28.5	20.0	43.2	26.9	23.5	11:30	64.7	43.1	29.0	63.6	46.1	38.5
00:15	36.2	20.8	19.0	37.6	24.0	23.5	11:45	57.5	43.1	29.5	64.0	46.9	37.0
00:30	41.5	24.6	20.5	40.7	26.2	23.5	12:00	61.9	47.1	29.5	62.5	45.5	34.0
00:45	46.9	26.0	20.5	42.2	26.3	23.0	12:15	61.9	47.1	29.5	53.9	41.5	33.5
01:00	35.7	22.8	19.5	36.5	24.7	23.0	12:30	65.1	44.7	29.0	60.5	40.5	32.5
01:15	28.1	20.7	19.0	37.5	23.8	23.0	12:45	58.2	45.0	27.5	76.8	52.4	33.5
01:30	34.4	22.6	21.0	35.6	23.7	23.0	13:00	62.3	44.6	28.0	70.2	47.6	34.0
01:45	46.6	25.0	20.0	44.4	26.1	23.0	13:15	61.7	43.2	27.5	67.0	46.0	32.0
02:00	44.2	26.5	19.5	43.7	27.2	23.0	13:30	60.4	41.1	28.0	66.9	48.6	32.5
02:15	42.4	26.0	20.5	41.2	26.8	24.0	13:45	63.1	46.7	31.5	66.9	45.5	33.5
02:30	31.2	21.8	20.5	30.2	23.6	23.0	14:00	64.3	44.0	32.5	64.0	42.7	34.0
02:45	46.9	24.0	21.0	37.9	25.5	23.5	14:15	59.9	43.4	29.0	70.2	49.1	36.0
03:00	32.0	22.6	21.5	33.1	24.7	24.0	14:30	60.7	42.3	27.5	71.2	50.3	33.5
03:15	34.7	23.0	22.0	29.6	26.0	25.0	14:45	55.0	39.8	32.5	63.7	47.5	34.5
03:30	50.7	30.6	21.0	49.4	32.0	25.0	15:00	59.8	43.7	32.5	63.6	45.1	34.0
03:45	38.1	32.7	28.5	42.3	38.0	36.0	15:15	69.7	50.6	31.5	72.8	49.9	34.5
04:00	56.6	33.5	29.5	41.4	37.9	32.0	15:30	67.3	47.8	33.0	62.8	46.9	37.5
04:15	59.9	45.1	34.5	47.0	54.3	39.5	15:45	69.6	50.2	38.0	72.0	51.4	40.5
04:30	58.7	45.7	37.5	68.6	57.4	49.0	16:00	53.9	35.5	28.0	60.3	44.3	35.5
04:45	61.4	47.5	33.5	60.8	53.2	41.0	16:15	57.9	37.4	31.5	71.2	49.4	38.5
05:00	64.2	43.6	35.0	67.6	50.8	42.5	16:30	52.8	40.4	30.5	62.1	41.1	33.5
05:15	57.2	43.2	29.0	69.0	53.4	39.0	16:45	71.7	44.8	37.5	55.7	41.2	34.5
05:30	62.1	49.7	29.0	68.1	49.9	37.0	17:00	56.5	40.7	34.5	56.6	44.4	38.5
05:45	60.6	47.2	30.5	69.5	46.1	36.5	17:15	69.5	45.9	34.5	64.5	44.6	35.5
06:00	61.9	46.9	31.0	62.5	46.3	34.0	17:30	59.0	43.2	34.0	64.4	47.3	37.0
06:15	66.9	46.8	32.0	65.4	49.8	36.0	17:45	56.7	39.1	31.5	61.4	44.8	35.5
06:30	60.1	47.6	32.0	62.2	45.6	34.5	18:00	64.1	45.0	31.5	62.7	45.3	35.5

Table A2: Weather station data																							
Start Time	Wind Speed, m/s	Temp, °C	Start Time	Wind Speed, m/s	Temp, °C	Start Time	Wind Speed, m/s	Temp, °C	Start Time	Wind Speed, m/s	Temp, °C	Start Time	Wind Speed, m/s	Temp, °C	Start Time	Wind Speed, m/s	Temp, °C	Start Time	Wind Speed, m/s	Temp, °C			
19:10	0.8	12.6	01:00	0.0	9.3	06:50	0.0	8.6	12:40	0.0	13.8	18:30	0.5	14.2	00:20	0.0	7.0	06:10	0.0	8.7	12:00	0.0	12.9
19:20	0.0	12.2	01:10	0.0	9.1	07:00	0.0	8.6	12:50	0.0	12.0	18:40	0.4	14.3	00:30	0.0	6.8	06:20	0.0	8.9	12:10	0.0	13.9
19:30	0.5	11.9	01:20	0.0	9.2	07:10	0.0	9.0	13:00	0.0	11.7	18:50	0.0	14.3	00:40	0.0	6.8	06:30	0.0	9.1	12:20	0.0	13.0
19:40	0.4	11.8	01:30	0.0	9.2	07:20	0.0	9.0	13:10	0.0	13.6	19:00	0.5	14.4	00:50	0.0	7.2	06:40	0.0	9.2	12:30	0.6	12.7
19:50	0.0	11.7	01:40	0.0	9.0	07:30	0.0	9.4	13:20	0.0	13.9	19:10	0.4	13.7	01:00	0.0	7.5	06:50	0.0	9.5	12:40	0.0	14.0
20:00	0.6	11.6	01:50	0.0	9.1	07:40	0.0	9.6	13:30	0.0	14.4	19:20	0.0	13.8	01:10	0.0	6.3	07:00	0.0	10.0	12:50	0.0	16.2
20:10	0.0	11.4	02:00	0.0	9.0	07:50	0.0	10.3	13:40	0.0	14.9	19:30	0.0	13.7	01:20	0.0	5.8	07:10	0.0	10.3	13:00	0.9	13.9
20:20	0.5	11.2	02:10	0.0	9.0	08:00	0.0	10.8	13:50	0.4	13.9	19:40	0.7	13.4	01:30	0.0	5.4	07:20	0.0	10.7	13:10	0.3	14.1
20:30	0.0	11.1	02:20	0.0	8.7	08:10	0.0	10.5	14:00	0.0	15.6	19:50	0.0	13.2	01:40	0.0	5.6	07:30	0.0	10.8	13:20	1.4	15.0
20:40	0.0	11.2	02:30	0.0	8.7	08:20	0.0	10.9	14:10	0.0	13.7	20:00	0.0	13.0	01:50	0.0	6.3	07:40	0.0	12.7	13:30	0.0	15.0
20:50	0.0	10.9	02:40	0.0	8.7	08:30	0.0	15.3	14:20	0.0	12.6	20:10	0.0	12.6	02:00	0.0	5.6	07:50	0.0	19.0	13:40	0.0	13.8
21:00	0.0	10.8	02:50	0.0	8.4	08:40	0.0	12.0	14:30	0.0	13.1	20:20	0.0	12.2	02:10	0.0	5.5	08:00	0.0	17.4	13:50	0.0	13.8
21:10	0.0	10.8	03:00	0.0	7.9	08:50	0.0	12.7	14:40	0.0	12.6	20:30	0.0	11.1	02:20	0.0	6.9	08:10	0.0	15.4	14:00	0.0	14.4
21:20	0.0	10.8	03:10	0.0	7.1	09:00	0.0	14.4	14:50	0.0	14.2	20:40	0.0	11.9	02:30	0.0	7.1	08:20	0.0	21.3	14:10	0.0	14.0
21:30	0.0	10.5	03:20	0.0	6.5	09:10	0.0	13.7	15:00	0.5	14.3	20:50	0.0	11.6	02:40	0.0	7.4	08:30	0.4	15.2	14:20	0.0	15.1
21:40	0.0	10.4	03:30	0.0	5.9	09:20	0.0	20.0	15:10	0.0	14.0	21:00	0.0	10.9	02:50	0.0	7.8	08:40	0.0	16.0	14:30	0.0	15.3
21:50	0.0	10.4	03:40	0.0	6.1	09:30	0.5	14.8	15:20	0.0	13.4	21:10	0.0	10.7	03:00	0.0	9.5	08:50	0.0	22.6	14:40	0.0	15.6
22:00	0.0	10.3	03:50	0.0	7.1	09:40	0.0	16.6	15:30	0.0	17.1	21:20	0.0	10.5	03:10	0.0	8.1	09:00	0.5	14.9	14:50	0.0	15.5
22:10	0.0	10.3	04:00	0.0	6.4	09:50	0.0	19.3	15:40	0.0	14.4	21:30	0.0	10.0	03:20	0.0	7.9	09:10	0.5	14.2	15:00	0.9	14.8
22:20	0.0	9.7	04:10	0.0	6.6	10:00	0.0	17.7	15:50	0.4	14.2	21:40	0.0	9.5	03:30	0.0	8.1	09:20	0.4	13.5	15:10	1.2	15.5
22:30	0.0	9.8	04:20	0.0	6.7	10:10	0.0	14.0	16:00	0.0	13.8	21:50	0.0	8.3	03:40	0.0	8.3	09:30	0.0	16.4	15:20	0.0	15.7
22:40	0.0	9.7	04:30	0.0	6.6	10:20	0.0	12.7	16:10	0.0	14.3	22:00	0.0	9.3	03:50	0.0	8.1	09:40	0.0	16.3	15:30	0.6	16.5
22:50	0.0	9.8	04:40	0.0	7.1	10:30	1.6	14.9	16:20	0.0	13.8	22:10	0.0	9.2	04:00	0.0	8.1	09:50	0.3	12.7	15:40	0.6	16.0
23:00	0.0	9.7	04:50	0.0	7.0	10:40	0.0	13.7	16:30	0.6	15.7	22:20	0.0	8.7	04:10	0.0	8.2	10:00	0.5	12.7	15:50	0.6	15.3
23:10	0.0	9.7	05:00	0.0	7.0	10:50	0.7	12.9	16:40	0.0	16.0	22:30	0.0	8.2	04:20	0.0	8.1	10:10	0.0	12.6	16:00	0.0	17.2
23:20	0.0	9.9	05:10	0.0	7.1	11:00	1.2	14.3	16:50	0.6	15.6	22:40	0.0	8.9	04:30	0.0	8.2	10:20	0.0	13.1	16:10	0.0	16.9
23:30	0.0	9.8	05:20	0.0	7.4	11:10	0.5	14.0	17:00	1.0	15.3	22:50	0.4	8.8	04:40	0.0	8.2	10:30	0.0	14.2	16:20	0.0	17.8
23:40	0.0	9.8	05:30	0.0	7.4	11:20	0.0	12.8	17:10	0.9	15.1	23:00	0.0	8.7	04:50	0.0	8.1	10:40	0.0	14.4	16:30	0.5	16.6
23:50	0.0	9.6	05:40	0.0	7.6	11:30	0.0	10.9	17:20	1.0	15.1	23:10	0.5	8.7	05:00	0.0	8.1	10:50	0.0	14.7	16:40	0.0	15.8
00:00	0.0	9.8	05:50	0.0	7.7	11:40	0.0	12.1	17:30	0.5	14.9	23:20	0.0	8.6	05:10	0.0	8.1	11:00	0.0	17.8			
00:10	0.0	9.6	06:00	0.0	8.0	11:50	0.0	12.9	17:40	0.6	14.3	23:30	0.0	8.7	05:20	0.0	8.2	11:10	0.0	16.0			
00:20	0.0	9.5	06:10	0.0	8.0	12:00	0.7	14.1	17:50	0.9	14.4	23:40	0.0	7.8	05:30	0.0	8.2	11:20	0.0	13.5			
00:30	0.0	9.5	06:20	0.0	8.1	12:10	0.7	13.8	18:00	1.5	14.4	23:50	0.0	7.3	05:40	0.0	8.3	11:30	0.0	13.3			
00:40	0.0	9.6	06:30	0.0	8.3	12:20	2.2	13.3	18:10	1.5	14.2	00:00	0.0	8.1	05:50	0.0	8.5	11:40	0.7	13.4			
00:50	0.0	9.2	06:40	0.0	8.3	12:30	1.8	13.4	18:20	0.6	14.9	00:10	0.0	7.7	06:00	0.0	8.6	11:50	0.0	13.3			

Table B1. Calculation of extract fan Rating Levels at Dwelling A															
Octave Band Centre Frequency, Hz															
63 125 250 500 1k 2k 4k 8k															
[A] Lp at 2m, 45° lateral: 72 68 66 63 65 63 63 70															
[B] directivity correction (45° to 90°): 0 1.5 3 4.5 9 11 18															
[C] Reflection off poultry shed roof: 3 3 3 3 3 3 3															
[A] - [B] + [C] Lp at 2m, 90° lateral: 75 69 66 62 59 55 48 64.6															
[D] Lp at 2m, 45° lateral: 84 78 74 74 68 66 62 75															
[E] directivity correction (45° to 90°) : 2.5 4.5 9 23 23 23 23															
[F] Reflection off poultry shed facade: 3 3 3 3 3 3 3															
[D] - [E] + [F] Lp at 2m, 90° lateral: 85 76 68 54 48 46 42 64.6															
Fan	Shed 5		Shed 6		Shed 6		Shed 6		Shed 6		Shed 6		Shed 6		
	Roof Fans	Gable Fans	Roof Fans	Gable Fans	Roof Fans	Gable Fans	Roof Fans	Gable Fans	Roof Fans	Gable Fans	Roof Fans	Gable Fans	Roof Fans	Gable Fans	
	North Row	South Row	North Row	South Row	North Row	South Row	North Row	South Row	North Row	South Row	North Row	South Row	North Row	South Row	
	622.8	626.8	636.7	654.4	658.4	657.4	49.9	49.9	50.1	50.3	50.3	50.3	50.3	23.9	23.9
	623.4	655.0	635.2	655.0	655.0	655.9	49.9	50.3	50.0	50.3	50.4	50.3	50.3	24.0	24.0
	624.2	655.7	633.7	655.7	659.7	654.4	49.9	50.3	50.0	50.3	50.4	50.3	50.3	24.0	24.0
	625.2	656.7	632.3	656.7	660.7	652.9	49.9	50.3	50.0	50.3	50.4	50.3	50.3	24.0	24.1
	626.5	657.9	630.7	657.9	661.9	651.3	49.9	50.3	50.0	50.3	50.4	50.3	50.3	24.1	24.1
627.9	659.2	629.3	659.2	663.2	649.8	49.9	50.4	50.0	50.4	50.4	50.4	50.2	24.1	24.1	
629.5	660.8	627.8	660.8	664.8	648.3	50.0	50.4	49.9	50.4	50.4	50.4	50.2	24.1	24.1	
631.4	662.6	626.3	662.6	666.5	646.8	50.0	50.4	49.9	50.4	50.5	50.5	50.2	24.2	24.2	
0.0	0.0	0.0	0.0	0.0	0.0	1.2	1.2	1.2	1.2	1.3	1.2	1.2	-10.3	-10.4	
0.0	0.0	0.0	0.0	0.0	0.0	1.2	1.2	1.2	1.2	1.3	1.2	1.2	-10.5	-10.9	
0.0	0.0	0.0	0.0	0.0	0.0	1.2	1.2	1.2	1.2	1.3	1.2	1.2	-10.5	-11.0	
0.0	0.0	0.0	0.0	0.0	0.0	1.2	1.2	1.2	1.2	1.3	1.2	1.2	-10.5	-11.1	
0.0	0.0	0.0	0.0	0.0	0.0	1.2	1.2	1.2	1.2	1.3	1.2	1.2	-10.5	-11.1	
0.0	0.0	0.0	0.0	0.0	0.0	1.2	1.2	1.2	1.2	1.3	1.2	1.2	-10.6	-11.1	
0.0	0.0	0.0	0.0	0.0	0.0	1.2	1.2	1.2	1.2	1.3	1.2	1.2	-10.6	-11.1	
0.0	0.0	0.0	0.0	0.0	0.0	1.2	1.2	1.2	1.2	1.3	1.2	1.2	-10.7	-11.1	
0.0	0.0	0.0	0.0	0.0	0.0	1.2	1.2	1.2	1.2	1.3	1.2	1.2	-10.7	-11.1	
0.0	0.0	0.0	0.0	0.0	0.0	1.2	1.2	1.2	1.2	1.3	1.2	1.2	-10.8	-11.3	
BS4142 character correction															
0															
Day (07:00 - 20:00hrs):															
100% roof & gable end extract fans operating															
Specific Level, dB															
Rating Level, dB															
6															
Evening (20:00 - 23:00hrs):															
100% roof extract fans operating															
Specific Level, dB															
Rating Level, dB															
4															
Night (23:00 - 07:00hrs):															
50% roof extract fans operating Note 1															
Specific Level, dB															
Rating Level, dB															
1															

Note 1: Assumed only odd numbered roof fans operating

Table B2. Calculation of extract fan Rating Levels at Dwelling B																	
Octave Band Centre Frequency, Hz																	
63 125 250 500 1k 2k 4k 8k																	
(A)																	
(B)																	
Roof Fans: Fancorm 3680	[A] Lp at 2m, 45° lateral: 63 125 250 500 1k 2k 4k 8k																
	[B] directivity correction (45° to 90°): 72 68 66 63 65 63 63 70																
[C] Reflection off poultry shed roof: 0 1.5 3 4.5 9 11 18																	
[A] - [B] + [C] Lp at 2m, 90° lateral: 3 3 3 3 3 3 3 3																	
Gable End Fans: Fancorm 34130	[D] Lp at 2m, 45° lateral: 75 69 66 62 59 55 48 64.6																
	[E] directivity correction (45° to 20°): 84 78 74 74 68 66 62 75																
	[F] Reflection off poultry shed facade: [-1 -0.5 -1 -1 -1 -1 -1 -1]																
	[D] - [E] + [F] Lp at 2m, 20° lateral: 3 3 3 3 3 3 3 3																
	Fan	Shed 5				Shed 6				Shed 6				Shed 6			
		Roof Fans		Gable Fans		Roof Fans		Gable Fans		Roof Fans		Gable Fans		Roof Fans		Gable Fans	
	North Row	South Row	North Row	South Row	North Row	South Row	North Row	South Row	North Row	South Row	North Row	South Row	North Row	South Row	North Row	South Row	
	680.1	679.3	589.5	674.4	673.8	683.8	50.6	50.6	49.4	50.6	50.6	50.7	50.7	19.9	19.9	18.2	19.9
	668.9	668.1	589.9	663.1	662.4	684.0	50.5	50.5	49.4	50.4	50.4	50.7	50.7	20.0	20.0	18.2	20.0
	657.6	656.8	590.2	651.7	651.1	684.2	50.3	50.3	49.4	50.3	50.3	50.7	50.7	20.0	20.0	18.2	20.1
646.4	645.5	590.5	640.4	639.7	684.5	50.2	50.2	49.4	50.1	50.1	50.7	50.7	20.1	20.1	18.2	20.2	
635.1	634.3	590.9	629.0	628.4	684.7	50.0	50.0	49.4	50.0	49.9	50.7	50.7	20.2	20.2	18.2	20.2	
623.9	623.0	591.3	617.7	617.0	685.0	49.9	49.9	49.4	49.8	49.8	50.7	50.7	20.3	20.3	18.2	20.3	
612.7	611.8	591.6	606.3	605.7	685.2	49.7	49.7	49.4	49.6	49.6	50.7	50.7	20.3	20.3	18.2	20.4	
601.5	600.6	592.0	595.0	594.3	685.4	49.6	49.6	49.4	49.5	49.5	50.7	50.7	20.4	20.4	18.2	20.5	
0.0	0.0	0.0	0.0	0.0	0.0	1.3	1.3	1.1	1.3	1.3	1.3	1.3	-7.2	-7.2	10.3	-7.1	
0.0	0.0	0.0	0.0	0.0	0.0	1.3	1.3	1.1	1.3	1.3	1.3	1.3	-7.2	-7.1	10.3	-7.1	
0.0	0.0	0.0	0.0	0.0	0.0	1.2	1.2	1.1	1.2	1.2	1.3	1.3	-7.0	-7.0	10.3	-7.0	
0.0	0.0	0.0	0.0	0.0	0.0	1.2	1.2	1.1	1.2	1.2	1.3	1.3	-6.9	-6.9	10.3	-6.9	
0.0	0.0	0.0	0.0	0.0	0.0	1.2	1.2	1.1	1.2	1.2	1.3	1.3	-6.8	-6.8	10.3	-6.7	
0.0	0.0	0.0	0.0	0.0	0.0	1.2	1.2	1.1	1.2	1.2	1.3	1.3	-6.8	-6.8	10.3	-6.7	
0.0	0.0	0.0	0.0	0.0	0.0	1.2	1.2	1.1	1.2	1.2	1.3	1.3	-6.6	-6.6	10.3	-6.6	
0.0	0.0	0.0	0.0	0.0	0.0	1.1	1.1	1.1	1.1	1.1	1.3	1.3	-6.5	-6.5	10.2	-6.5	
BS4142 character correction																	
0																	
Day (07:00 - 20:00hrs):																	
100% roof & gable end extract fans operating																	
Specific Level, dB																	
22																	
Evening (20:00 - 23:00hrs):																	
100% roof extract fans operating																	
Specific Level, dB																	
8																	
Night (23:00 - 07:00hrs):																	
50% roof extract fans operating <small>Note 1</small>																	
Specific Level, dB																	
5																	

Note 1: Assumed only odd numbered roof fans operating

Table B3. Calculation of extract fan Rating Levels at Dwelling C

		Octave Band Centre Frequency, Hz															
		63		125		250		500		1k		2k		4k		8k (A)	
Roof Fans: Fancom 3680	[A] Lp at 2m, 45° lateral: [B] directivity correction (45° to 90°): [C] Reflection off poultry shed roof: [A] - [B] + [C] Lp at 2m, 90° lateral::	72		68		66		63		65		63		63		70	
		0		1.5		3		4.5		9		23		23		18	
Gable End Fans: Fancom 34130	[E] directivity correction (45° to 90°): [F] Reflection off poultry shed facade: [D] - [E] + [F] Lp at 2m, 90° lateral:	84		78		74		74		68		66		62		64.6	
		2.5		4.5		9		23		23		23		23		3	
		85		76		68		54		48		46		42		64.6	
Fan	Direct distance, m	Shed 5		Shed 6		Shed 5		Shed 6		Shed 6		Shed 5		Shed 6		Shed 6	
		Roof Fans North Row	Roof Fans South Row	Gable Fans	Roof Fans North Row	Roof Fans South Row	Gable Fans	Roof Fans North Row	Roof Fans South Row	Gable Fans	Roof Fans North Row	Roof Fans South Row	Gable Fans	Roof Fans North Row	Roof Fans South Row	Gable Fans	Roof Fans North Row
1	515.6	516.2	607.1	521.3	522.2	512.2	48.2	48.2	49.6	48.3	48.3	48.2	23.7	23.7	22.5	23.7	23.7
2	526.9	527.5	606.9	532.6	533.4	511.9	48.4	48.4	49.6	48.5	48.5	48.2	23.8	23.8	22.5	23.8	23.8
3	538.3	538.9	606.7	543.8	544.6	511.6	48.6	48.6	49.6	48.7	48.7	48.2	23.8	23.8	22.5	23.8	23.8
4	549.7	550.3	606.5	555.1	555.9	511.3	48.8	48.8	49.6	48.9	48.9	48.2	23.8	23.8	22.5	23.8	23.8
5	561.1	561.7	606.4	566.4	567.2	511.0	49.0	49.0	49.6	49.0	49.1	48.1	23.8	23.8	22.5	23.8	23.8
6	572.5	573.0	606.2	577.7	578.4	510.6	49.1	49.1	49.6	49.2	49.2	48.1	23.8	23.8	22.5	23.8	23.8
7	583.9	584.4	606.0	589.0	589.7	510.3	49.3	49.3	49.6	49.4	49.4	48.1	23.9	23.9	22.5	23.9	23.9
8	595.3	595.8	605.8	600.3	601.0	510.0	49.5	49.5	49.6	49.5	49.5	48.1	23.9	23.9	22.5	23.9	23.9
Ground absorption, dB		0.0	0.0	0.0	0.0	0.0	1.0	1.0	1.2	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Atmospheric attenuation, dB		0.0	0.0	0.0	0.0	0.0	1.0	1.0	1.2	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Distance correction, dB		0.0	0.0	0.0	0.0	0.0	1.0	1.0	1.2	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Shielding attenuation, dB		0.0	0.0	0.0	0.0	0.0	1.1	1.1	1.2	1.1	1.1	1.0	1.0	1.0	1.0	1.0	1.0
Sound pressure level at dwelling, dB		0.0	0.0	0.0	0.0	0.0	-8.3	-8.3	-8.7	-8.4	-8.4	-8.4	-8.4	-8.3	-8.3	-8.4	-8.4
BS4142 character correction		0.0	0.0	0.0	0.0	0.0	-8.6	-8.6	-8.7	-8.7	-8.7	-8.7	-8.7	-8.6	-8.6	-8.7	-8.7
Day (07:00 - 20:00hrs):		100% roof & gable end extract fans operating															
Evening (20:00 - 23:00hrs):		100% roof extract fans operating															
Night (23:00 - 07:00hrs):		50% roof extract fans operating <small>Note 1</small>															
Note 1: Assumed only odd numbered roof fans operating																	

Table B4. Calculation of extract fan Rating Levels at Dwelling D																				
						Octave Band Centre Frequency, Hz														
						63	125	250	500	1k	2k	4k	(Σ) dB							
Roof Fans: Fancom 3680						[A] Lp at 2m, 45° lateral:	72	68	66	63	65	63	63	70						
						[B] directivity correction (45° to 90°):	0	1.5	3	4.5	9	11	18							
						[C] Reflection off poultry shed roof:	3	3	3	3	3	3	3							
						[A] - [B] + [C] L _p at 2m, 90° lateral::	75	69	66	62	59	55	48	64.6						
Gable End Fans: Fancom 34130						[D] Lp at 2m, 45° lateral:	84	78	74	74	68	66	62	75						
						[E] directivity correction (45° to 90°):	2.5	4.5	9	23	23	23	23							
						[F] Reflection off poultry shed facade:	3	3	3	3	3	3	3							
						[D] - [E] + [F] L _p at 2m, 90° lateral:	85	76	68	54	48	46	42	64.6						
Ln	Shed 5			Shed 6			Shed			Shed 6			Shed 6							
	Roof Fans North Row	Roof Fans South Row	Gable Fans	Roof Fans North Row	Roof Fans South Row	Gable Fans	Roof Fans North Row	Roof Fans South Row	Gable Fans	Roof Fans North Row	Roof Fans South Row	Gable Fans	Roof Fans North Row	Roof Fans South Row	Gable Fans					
1	444.6	448.0	502.1	471.7	475.2	469.7	46.9	47.0	48.0	47.5	47.5	47.4	24.5	24.5	23.7	24.5	24.5	23.7		
2	450.8	454.2	500.9	477.6	481.0	468.4	47.1	47.1	48.0	47.6	47.6	47.4	24.5	24.5	23.7	24.5	24.5	23.7		
3	457.2	460.5	499.8	483.6	487.0	467.1	47.2	47.2	48.0	47.7	47.7	47.4	24.5	24.5	23.7	24.5	24.5	23.7		
4	463.8	467.1	498.7	489.9	493.2	465.7	47.3	47.4	47.9	47.8	47.8	47.3	24.5	24.5	23.7	24.5	24.5	23.7		
5	470.6	473.8	497.5	496.4	499.6	464.4	47.4	47.5	47.9	47.9	48.0	47.3	24.5	24.5	23.7	24.5	24.5	23.7		
6	477.6	480.8	496.4	503.0	506.2	463.1	47.6	47.6	48.0	48.0	48.1	47.3	24.5	24.5	23.7	24.5	24.5	23.7		
7	484.8	487.9	495.2	509.8	513.0	461.8	47.7	47.7	47.9	48.1	48.2	47.3	24.5	24.5	23.7	24.5	24.5	23.7		
8	492.1	495.2	494.1	516.7	519.9	460.5	47.8	47.9	47.9	48.2	48.3	47.2	24.5	24.5	23.7	24.5	24.5	23.7		
1	0.0	0.0	0.0	0.0	0.0	0.0	0.8	0.9	1.0	0.9	0.9	0.9	-7.7	-7.8	-8.0	-8.2	-8.3	-7.4		
2	0.0	0.0	0.0	0.0	0.0	0.0	0.9	0.9	1.0	0.9	0.9	0.9	-7.8	-7.9	-8.0	-8.4	-8.4	-7.4		
3	0.0	0.0	0.0	0.0	0.0	0.0	0.9	0.9	0.9	0.9	0.9	0.9	-8.0	-8.0	-8.0	-8.5	-8.6	-7.4		
4	0.0	0.0	0.0	0.0	0.0	0.0	0.9	0.9	0.9	0.9	0.9	0.9	-8.1	-8.2	-8.0	-8.6	-8.7	-7.3		
5	0.0	0.0	0.0	0.0	0.0	0.0	0.9	0.9	0.9	0.9	0.9	0.9	-8.2	-8.3	-8.0	-8.7	-8.8	-7.3		
6	0.0	0.0	0.0	0.0	0.0	0.0	0.9	0.9	0.9	1.0	1.0	0.9	-8.4	-8.4	-7.9	-8.9	-8.9	-7.3		
7	0.0	0.0	0.0	0.0	0.0	0.0	0.9	0.9	0.9	1.0	1.0	0.9	-8.5	-8.6	-7.9	-9.0	-9.1	-7.2		
8	0.0	0.0	0.0	0.0	0.0	0.0	0.9	0.9	0.9	1.0	1.0	0.9	-8.7	-8.7	-7.9	-9.1	-9.2	-7.2		
Ground absorption, dB						Distance correction, dB						Shielding attenuation, dB								
Atmospheric attenuation, dB						Sound pressure level at dwelling, dB						BS4142 character correction								
Day (07:00 - 20:00hrs):						100% roof & gable end extract fans operating						Specific Level, dB Rating Level, dB								
Evening (20:00 - 23:00hrs):						100% roof extract fans operating						Specific Level, dB Rating Level, dB								
Night (23:00 - 07:00hrs):						50% roof extract fans operating						Specific Level, dB Rating Level, dB								
Note 1: Assumed only odd numbered roof fans operating												0			9			9		

Table B5. Calculation of heat exchangers Rating Level at Dwellings A - C

Big Dutchman Earmy 2 Heat Exchanger: 76,3dB at 1m																									
	Dwelling A					Dwelling B					Dwelling C			Dwelling D											
	Heat Exchanger					Heat Exchanger					Heat Exchanger			Heat Exchanger											
Reflections, dB	1	2	3	4	5	6	6	3	3	3	1	2	3	3	3	3	3	3	3	3	3	3			
Direct distance, m	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3			
Distance correction, dB	593	595	659	662	644	644	644	550	558	529	537	630	639	661	652	668	659	566	556	502	498	550	546	486	481
Shielding Correction, dB	56	56	56	56	56	56	56	55	55	55	55	56	56	56	56	57	56	55	55	54	54	55	55	54	54
Ground absorption, dB	23	23	23	23	23	23	23	18	18	19	18	18	18	22	22	22	22	22	22	23	23	23	24	24	24
Atmospheric attenuation, dB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lp at dwelling, dB	1,1	1,1	1,3	1,3	1,2	1,2	1,2	1	1,1	1	1	1,2	1,2	1,3	1,2	1,3	1,3	1,1	1,1	1	0,9	1	1	0,9	0,9
Aggregate Lp, dB	0	0	-2	-2	-1	-1	-1	5	5	5	5	5	5	-1	-1	-1	-1	1	1	1	1	0	0	1	1
BS4142 character correction	5	5	2	2	2	2	2	11	11	8	8	8	8	5	5	5	4	4	4	4	7	7	7	4	4
Rating Level	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	5	5	2	2	2	2	2	11	11	8	8	8	8	5	5	5	4	4	4	4	7	7	7	4	4

Table B6. Calculation of HGVs loading/unloading BS4142 Assessment Levels at Dwellings A - D

Source noise levels	Stock delivery/collection (HGV arriving/departing, manoeuvring and loading/unloading using a diesel forklift) at 20m	L _{Aeq,1hr} dB		L _{Aeq,15 mins} dB		L _{Amax,F} dB	
		60	62	79			
		Dwelling A	Dwelling B	Dwelling C	Dwelling D		
Corrections	Distance to nearest shed, m	642	698	497	450		
	Distance correction, dB	30.1	30.9	27.9	27.0		
	Shielding correction, dB	22.4	17.2	22.0	23.6		
	Ground absorption, dB	0.0	0.0	0.0	0.0		
	Atmospheric attenuation, dB	1.2	1.3	0.9	0.9		
BS4142 Specific Level							
Day	Specific Level, dB	6	11	9	8		
Night	Specific Level, dB	8	13	11	10		
BS4142 Rating & Assessment Level							
BS4142 character corrections		6	6	6	6		
Day	Rating Level	12	17	15	14		
Night	Rating Level	14	19	17	16		
Night noise ingress via open window		-2	3	1	0		
		15	20	18	17		

C1 Fancom 3680 Extract Fan

AGRICULTURAL FANS

Fancom fans are specially developed for the use in livestock buildings and they have an IP66 classification. Fancom fans have an aluminium motor housing, synthetic or coated steel housing and synthetic fan blades. The fans combine high air flow capacity with low energy consumption and noise levels. The low energy consumption and superb controllability mean that the motors run at a lower temperature - which also benefits the durability.



Complete fan

The complete fan from Fancom is extremely easy to mount either in or on a wall. The fans in the 35 to 56cm diameter series are supplied in a robust synthetic housing. Fans with diameters of 63, 71 and 80 cm are solidly housed in steel. The coated housing prevents corrosion.

Modular fan

To mount fans underneath a chimney module Fancom's fans are supplied in a robust, shape retaining synthetic module with the Fancom quick mounting system. Fancom measuring and damping units complete the ventilation system. The control valve and air flow transmitter have been built into the same module which can be directly connected to the fan module.

Central exhaust systems

Fancom has specially developed the 3480P and 3480D fans for central air exhaust systems and other installations which operate with high counter pressures. The maximum counter pressures are 270Pa, resp. 320Pa. This fan is notable for its large air displacement capacity. Noise production and energy consumption are, however, kept to a minimum.

TYPE	Diameter cm	Voltage (V / V _N)	Revolutions RPM	Motor current (A) (nom)	Power (kW)	RMS POWER (kW)	Noise level (dB _A) (standard)	Control	Airflow in m ³ /h										
									Pressure in Pa (Pascal)										
									0	30	50	100	150	200	250	300	Delta max./pressure min.		
1435	35	230-240	1404	0.98	211	111	61	50	T, E	3940	3590	3250							2660 / 78
1440	40	230-240	1347	1.19	270	155	64	53	T, E	5040	4630	4250							3300 / 92
1445	45	230-240	1306	1.4	370	235	66	54	T, E	6800	6140	5750	4400						4910 / 102
1450	50	230-240	1317	2.08	474	314	66	55	T, E	8550	7800	7300	5180						5710 / 102
1450P	50	230-240	1381	2.99	730	535	69	58	T, E	9720	8950	8470	7550						6500 / 126
1456	56	230-240	1366	3.18	741	550	70	59	T, E	12060	11280	10830	9250						8520 / 119
1656	56	230-240	954	2.23	686	378	66	55	T, E	10360	9250	8340							6920 / 51
1463	63	230-240	1381	3.1	721	590	66	57	T, E	14000	13200	12360	8070						8900 / 101
1671	71	230-240	901	4.10	904	635	66	57	T, E	18000	16410	15320							11620 / 92
1680	80	230-240	903	4.54	1031	756	69	58	T, E	20750	19050	17820	14160						13020 / 113
1692	92	230-240	905	4.34	1028	778	66	57	T, E	24400	21640	19940	13760						13540 / 103
3425	35	V400 Δ230	1426	Y0.94 Δ0.59	157	116	61	50	F	3710	3400	3140							2550 / 88
3440	40	V400 Δ230	1316	Y0.42 Δ0.13	227	175	64	53	F	5120	4750	4370							3430 / 96
3445	45	V400 Δ230	1297	Y0.55 Δ0.30	312	220	60	54	F	6240	5910	5470							4020 / 99
3460	50	V400 Δ230	1304	Y0.72 Δ1.26	414	305	66	55	F	8240	7630	7010	5440						5240 / 105
3456	56	V400 Δ230	1364	Y1.17 Δ2.03	657	557	70	59	F	11830	10920	10260	6490						7700 / 120
3620	56	V400 Δ230	930	Y1.05 Δ1.02	384	322	60	54	F	10190	9090	8020							6690 / 85
3483P	63	V400 Δ230	1439	Y2.75 Δ4.76	1361	1224	74	63	F	17620	16140	14670	11560	19030	12970	10240			10240 / 250
3663	63	V400 Δ230	931	Y1.98 Δ2.58	881	512	67	56	F	14160	12920	12060							9000 / 97
3671	71	V400 Δ230	940	Y1.69 Δ3.27	884	741	66	59	F	17970	16500	15450	12190						11320 / 110
3680	80	V400 Δ230	941	Y2.09 Δ3.62	1047	860	70	59	F	22220	20555	19380	15910						14070 / 128
3680P	80	V400 Δ230	1429	Y4.58 Δ7.93	2268	2150	77	66	F	28650	27520	26810	25290	23580	21225	19655			17440 / 258
3480D	80	V400 Δ230	1436	Y4.20 Δ7.30	1991	1520	69	58	F	21610	21100	20610	18980	19030	17920	19485	14770		11650 / 380
3602	92	V400 Δ230	936	Y2.16 Δ3.74	1033	850	68	57	F	24870	23570	20840	15410						14110 / 110
3692P	92	V400 Δ230	929	Y3.64 Δ6.3	1650	1324	71	60	F	28060	26600	25560	22810	17820					15200 / 167

C2 Fancom 34130 Extract Fan



Fan 34130 BOX 400V 50Hz	4305110
Fan 34130 BOX KIT 400V 50Hz	4305140

Images



4305110

KIT

4305140

Technical data

Voltage:	400 [±V ac] +/-10%
Phase:	3
Frequency:	50 [Hz]
Max. current:	3,08 [A]
Current (at 50 Pa and 400V):	3,08 [A]
Input power (at 50 Pa and 400V):	1695 [W]
Max. input power:	1716 [W]
Max. air volume:	44650 [m ³ /h]
Max. pressure:	70 [pa]
Max. rotations:	570 [RPM]
Poles:	4
Cos phi:	0,81
Controllable:	On / Off
Insulation class:	F
Protection class:	IP 55
Sound production (calculated):	75 (64) [dB(A)]
Impeller:	10 / 3 / N Type / n / system
Weight 4305110 (excl. pack.):	65,3 / 144 [Kg] / [lbs]

- Air density 1,2 kg/m³, 1 Pa (Pascal) = 1N/m² ~ 0,102 mm wk. (20°C).
- Sound production is measured according to "free field method" at a distance of 2 meter. (The value between brackets is the sound production at a distance of 7 meter).
- The above data is from a fully assembled fan with safety grid and shutter...
- According to AMCA 210 / ISO 5801.
- Images may differ slightly from reality.

C3 Big Dutchman Earny 2 Heat Exchanger

