

**Proposed Poultry Units
at land north of the B6478
and north-east of Standridge Farm,
Slaidburn,
Lancashire**

PLANT NOISE ASSESSMENT

Acoustics Report M1539/R03
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To: Richard Robinson
The Cottage
Lower Edge Farm
Tinkers Lane
Slaidburn
BB7 4TP

By: Paul Smith BSc MIOA

1. Introduction

This acoustic report documents a plant noise assessment for the extract fans on two proposed additional poultry units at land north of the B6478 and north-east of Standridge Farm (Dwelling A); Figure 1.

The report is divided into the following sections:

- Section 2: Overview of the Development
- Section 3: BS4142:2014
- Section 4: Background Noise survey
- Section 5: Plant Noise Assessment
- Section 6: Conclusion
- Appendix A: Noise monitor and weather station data
- Appendix B: Calculations
- Appendix C: Fan noise data

2. Overview of the Development

The proposal is for two 80m long poultry units at land north of B6478 and north-east of Standridge Farm (Dwelling A); Figure 1. The new units will be 400m north-east of two existing poultry units.

The only plant associated with both the existing and proposed poultry units are the roof mounted extract fans. The proposed sheds will use the same extract fans as the existing poultry units, namely Big Dutchman type F091-6DT axial fans; see Appendix C for manufacturers' data sheet. The existing poultry units have 9 extract fans per shed whilst the proposed poultry units will have 4 extract fans per shed.

The closest dwellings to the proposed units, labelled A and B in Figure 1, are approximately 270 and 265m respectively from the edge of the proposed development.

For the proposed poultry units there will be an unobstructed noise path between the duct terminations and both Dwellings A and B. However, for the existing poultry units the duct terminations are fully shielded from Dwelling A by a combination of an approximately 5m high earth bund to the north-east of the sheds and topography.

The proposed poultry units are within context of the existing poultry development.

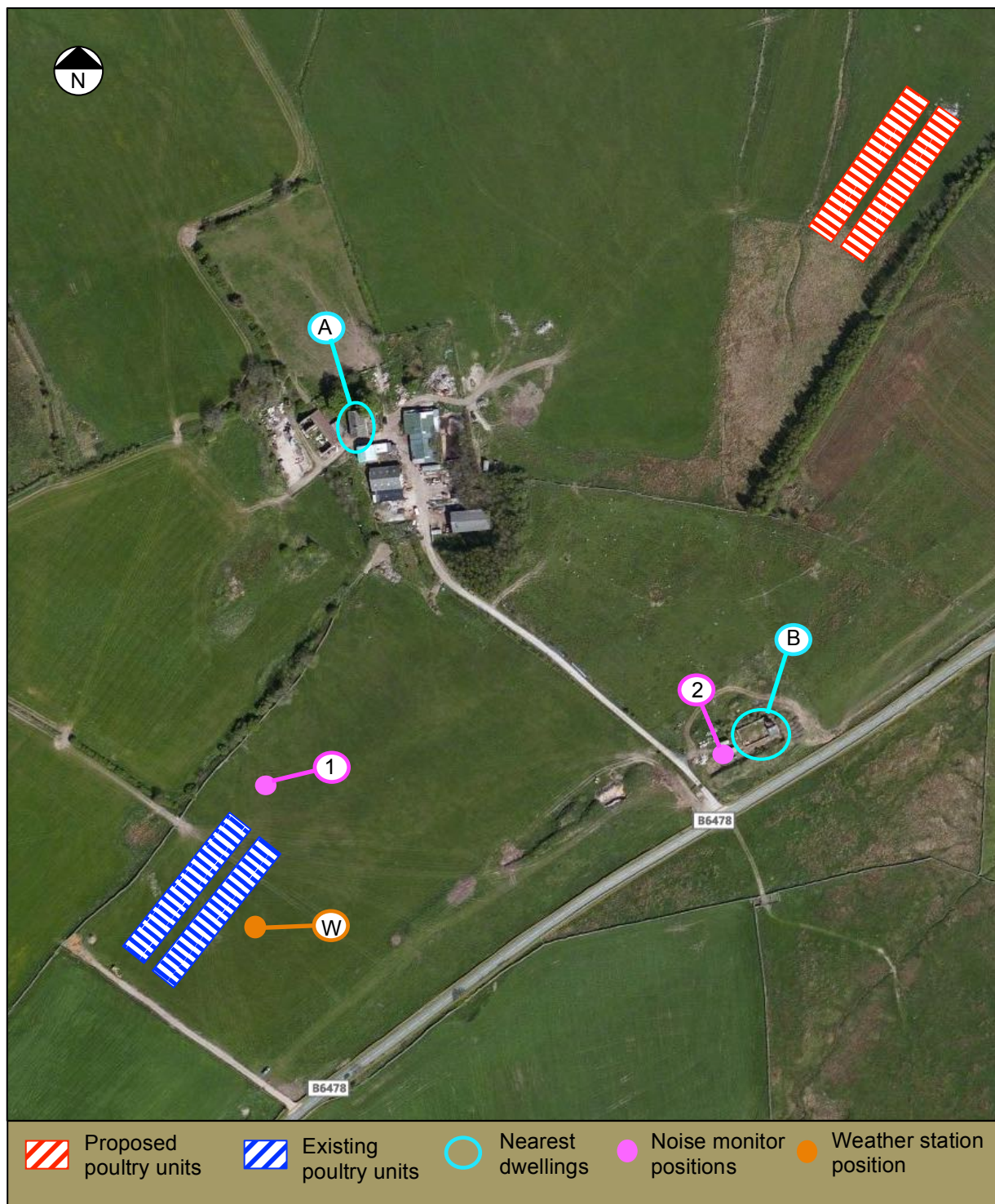


Figure 1. Aerial view (source: www.google.com) showing footprint of existing and proposed poultry units, nearest dwellings and noise monitor and weather station

3. BS4142:2014

The plant noise assessments detailed in this report has been conducted in accordance of BS4142:2014 'Methods for Rating and Assessing Industrial and Commercial Sound'.

3.1 BS4142:2014

BS4142:2014 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 3.2 and 3.3 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
- A difference of +5dB is likely to be an indication of an adverse impact
- 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

Where background noise and Rating Levels are low, BS4142:2014 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*'.

3.2 On-time correction

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

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

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.

3.3 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. Background Noise Survey

- **Survey dates:** 29th – 30th September 2015
- **Weather;** Table A1, Appendix A:
 - Precipitation: Dry
 - Wind Speed: Highest recorded wind speed of 4.4m/sec
- **Noise monitor locations:** With the microphones attached to tripods they were located at Positions 1 and 2 as shown in Figure 1
- **Weather station location:** Weather station, mounted on a tripod, located at position W; Figure 1
- **Equipment:**
 - Weather Station: Kestrel type 4000
 - Noise monitors: Brüel & Kjær Type 2238 (Positions 1) and Brüel & Kjær Type 2260 (Position 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.

Note that the noise survey was conducted prior to the operation of the existing poultry units.

3.1 Survey observations

During the setting up and collection of the noise monitors it was observed that the:

- general environmental noise levels were very low in the surrounding area to the proposed free-range egg unit
- dominant noise affecting the area is agricultural related activities (e.g. tractor movements) and nature related noise (e.g. rustling leaves/bird song)
- on the 30/9/15 during the collection of the monitors diggers were operating nearby
- traffic flow on the nearby roads is very low

3.2 Typical background noise level, L_{A90} , at nearest Dwelling A and B

Figure 3 shows the variation of the measured background (L_{A90}) noise levels obtained at Positions 1 and 2.

The fluctuation in the background noise levels follows the same pattern at both measurement positions, with very similar noise levels being recorded. This indicates that the same noise sources are affecting both receptor positions.

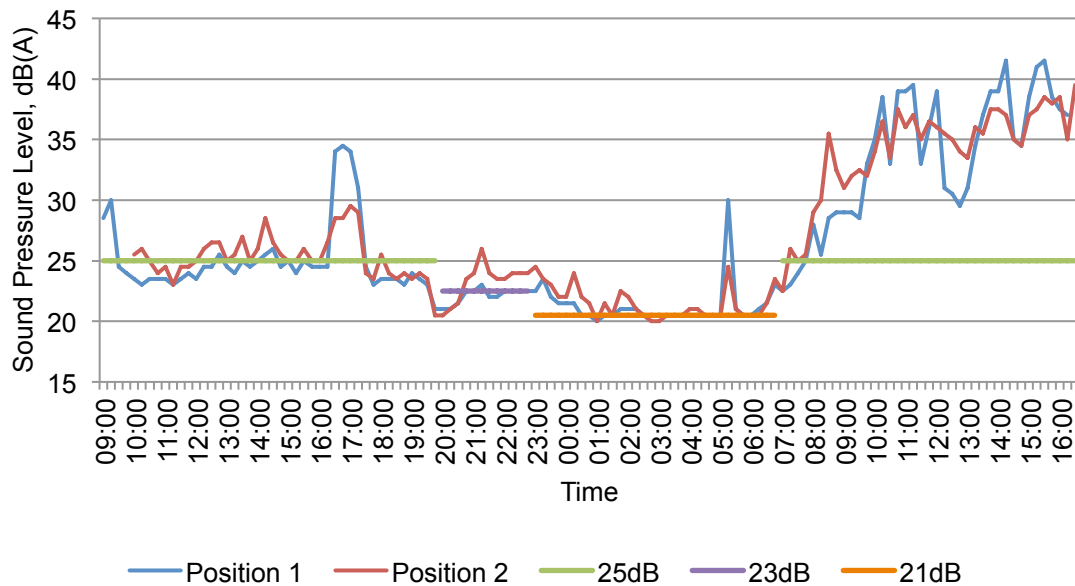
From 08:00hrs onwards on the 30/9/15 the background noise levels increase substantially. This is likely to be due to the observed diggers operating nearby to the site. The background noise levels obtained during this period are not considered typical and have therefore not been included in the determination of representative background noise levels.

From the measurement data the typical measured day, evening and night background noise levels have been established as; Figures 3:

- Day (07:00 – 20:00hrs): L_{A90} 25dB
- Evening (20:00 – 23:00hrs): L_{A90} 23dB
- Night (23:00 – 07:00hrs): L_{A90} 21dB

The above typical background noise levels, which are very low, are expected to represent the typical values that will occur at Dwellings A and B; Figure 1

Figure 3. Positions 1 & 2 measured background noise levels (free-field)



5. Plant Noise Assessment

5.1 Calculation of aggregate extract fan noise at nearest dwelling

The full calculation of the aggregate (existing and proposed sheds) extract fan noise is provided in Tables B1 and B2, Appendix B with the resultant BS4142 Rating and Assessment Level at Dwellings A and B given in Table 1.

5.2 Fan noise data

- **Fan type:** Big Dutchman type FF091-6DT
- **Sound pressure level:** 50dB(A), measured at 7m, 45° lateral; see Appendix C for manufacturers data sheet
- **Duct termination:** Roof mounted 800mm diameter duct, terminating 6.3m above ground
- **Total number of fans:**
 - Existing poultry units: 9 per shed
 - Proposed poultry units: 4 per shed

5.3 Extract fan operation

The extract fans on both the existing and proposed poultry units are thermostatically controlled, with the total number of fans operating at any one time dependent on the bird's ventilation requirements, which is dictated by the external temperature.

To maintain the ideal or 'set' temperature the fans are operated in Stages. Stage 1 will be triggered when the internal temperature rises 1°C above the set temperature; further Stages are activated with further 0.5°C increments.

The highest Stage (100% extract fans operating) will typically only be triggered when the external temperature is above 23°; this is only expected to occur between 09:00 – 20:00hrs.

During the evening and night the external temperature will fall; the highest expected percentage of extract fans required to maintain the set temperature are 50% and 20% respectively.

The calculation has therefore been based on:

- Day (07:00 – 20:00hrs): 100% extract fans operating
- Evening (20:00 – 23:00hrs): 50% extract fans operating
- Night (23:00 – 07:00hrs): 20% extract fans operating

5.4 Derivation of aggregate Specific Level

The individual noise level of each of the existing and proposed extract fans has been calculated at Dwellings A and B; Figure 1. The following corrections have been applied to the manufacturers extract fan noise data; Appendix C

- **Directivity correction:** correction to convert the fan noise data from the manufacturers stated level at 45° from the termination to 90° (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 typical axial frequency spectra has been used
- **Reflections:** 3dB added to account for reflections off the poultry shed roof
- **Distance correction:** $20 \times \log (d_1/d_0)$, where d_1 = distance between receptor and the proposed extract fan and d_0 = measurement distance used for manufacturers reference extract fan (7m).
- **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

In accordance with ISO 9613-2 the attenuation at 500Hz has been used as only the dB(A) value of the extract fans is known

- **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)

- **Shielding correction:** Where the line of sight between a duct termination and dwelling is fully blocked by a solid barrier, which in this case due a combination of an earth bund and topography for Dwelling A, 10dB shielding correction is applicable in accordance with BS5228-1 2009.

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

The aggregate of the extract fan noise at the dwellings is the Specific Level.

Tables B1 and B2, Appendix B provide the full calculations with the resultant aggregate Specific Level at Dwellings A and B.

5.5 Rating Level

To establish the Rating Level the following BS4142 character corrections have been applied to the Specific Level:

- **Tonality:**
 - Correction: 0dB
 - Reason: the proposed units, like the majority of modern extract fans, are not expected to be tonal.
- **Impulsivity:**
 - Correction: 0dB
 - Reason: 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:**
 - Correction: 0dB
 - Reason: It is possible on occasion that two or more extract fans will start/stop at the same time. However, the greatest expected increase/decrease in the aggregate fan noise is 3dB, which will only occur if the total number of fans operating doubles/halves. A 3dB increase/decrease is a just perceptible change in noise, which would not incur a BS4142 intermittency penalty (i.e. the change or 'intermittency' would not be 'readily distinctive against the residual noise environment').
- **Other**
 - Correction: 3dB
 - Reason: allows for any potential 'other' noise characteristics of the fans.

The resultant Rating Levels are provided in Table 1.

5.6 Assessment Level

We define Assessment Level = RL – min L_{A90} dB, where:

RL = Rating Level, dB(A)

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

Table 1 provides the resultant aggregate (existing and proposed) extract fan Assessment Level at Dwellings A and B.

The highest calculated Assessment Levels at any of the nearest dwellings during the day, evening and night are 1dB, 0dB and -1dB respectively.

Where the Rating Level is at parity with the background BS4142 states that the Specific Level will have a low impact. On the basis 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 the aggregate noise impact of the existing and proposed poultry unit's extract fans will be **low**.

During the night it is reasonable to assume that the occupiers of the nearest dwellings will be within their houses. A room with an open window will provide 10 – 15dB sound reduction. For a room facing the proposed development in the dwelling exposed to the highest extract fan noise

(Dwelling B) this would result in an extremely low noise ingress level of up to 7dB; this would be inaudible.

Table 1. Typical background and calculated aggregate (existing + proposed) extract fan Rating and Assessment Levels at Dwellings A and B; Figure 1									
Dwelling	100% extract fans operating			50% extract fans operating			20% extract fans operating		
	[A] Rating Level, dB	Day: 07:00 - 20:00hrs		[C] Rating Level, dB	Evening: 20:00 - 23:00hrs		[E] Rating Level, dB	Night: 23:00 - 07:00hrs	
		[B] Typical L _{A90} dB	[A] - [B] Assessment Level, dB		[D] Typical L _{A90} dB	[C] - [D] Assessment Level, dB		[F] Typical L _{A90} dB	[E] - [F] Assessment Level, dB
A	24	25	-1	21	23	-2	17	21	-4
B	26	25	1	23	23	0	20	21	-1

5.7 Calculation uncertainty

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

6. Conclusion

A noise survey has been conducted to determine the typical background noise levels at the nearest dwellings to the proposed poultry units.

The aggregate extract fan noise as a result of the existing and proposed poultry units has been assessed in accordance with BS4142:2014.

Via calculation (Appendix B) it has been demonstrated that at the nearest dwellings, labelled A and B in Figure 1, the aggregate BS4142:2014 noise impact will be **low** during the day, evening and night.

During the night the highest noise ingress within a habitable room with windows open will be 7dB; this will be inaudible.

On the basis that the extract fan Rating Level will not result in an adverse noise impact and will be inaudible within bedrooms during the night we conclude that the aggregate plant noise emissions from the existing and proposed poultry units will be acceptable.

Table A1: Noise monitor data (free-field)

Start Time	Position 1			Position 2			Start Time	Position 1			Position 2		
	L _{Amax,F} dB	L _{Aeq} dB	L _{A90} dB	L _{Amax,F} dB	L _{Aeq} dB	L _{A90} dB		L _{Amax,F} dB	L _{Aeq} dB	L _{A90} dB	L _{Amax,F} dB	L _{Aeq} dB	L _{A90} dB
09:00	74.0	51.5	28.5				01:00	32.7	20.9	20.0	32.0	21.4	20.0
09:15	72.1	50.6	30.0				01:15	30.5	20.8	20.5	41.7	25.1	21.5
09:30	76.5	47.7	24.5				01:30	38.3	20.8	20.5	42.6	23.9	20.5
09:45	50.4	34.6	24.0				01:45	32.7	21.8	21.0	41.5	25.7	22.5
10:00	50.9	35.3	23.5	80.5	45.9	25.5	02:00	37.0	23.9	21.0	36.5	25.6	22.0
10:15	56.0	38.6	23.0	52.0	33.1	26.0	02:15	35.6	23.6	21.0	40.0	23.4	21.0
10:30	48.8	33.0	23.5	44.7	31.0	25.0	02:30	28.3	20.9	20.5	32.5	21.9	20.5
10:45	50.6	32.6	23.5	47.2	29.9	24.0	02:45	25.7	20.8	20.5	38.9	22.0	20.0
11:00	51.9	35.0	23.5	52.1	32.3	24.5	03:00	39.2	21.0	20.5	39.9	24.5	20.0
11:15	48.3	33.6	23.0	51.0	31.1	23.0	03:15	34.7	21.4	20.5	53.3	24.0	20.5
11:30	51.6	32.9	23.5	47.0	29.6	24.5	03:30	33.4	20.9	20.5	33.0	21.4	20.5
11:45	47.9	31.6	24.0	47.5	29.3	24.5	03:45	36.5	21.2	20.5	36.0	22.2	20.5
12:00	50.3	33.2	23.5	58.2	40.1	25.0	04:00	48.7	28.9	20.5	45.1	26.0	21.0
12:15	46.8	33.7	24.5	51.4	31.6	26.0	04:15	35.0	20.9	20.5	39.2	22.5	21.0
12:30	57.2	39.6	24.5	54.4	35.5	26.5	04:30	31.6	20.9	20.5	29.1	21.2	20.5
12:45	57.9	36.0	25.5	53.5	33.4	26.5	04:45	31.7	21.7	20.5	37.7	24.9	20.5
13:00	48.8	33.3	24.5	47.3	31.8	25.0	05:00	46.1	31.6	20.5	42.6	28.4	20.5
13:15	53.3	38.0	24.0	48.9	34.7	25.5	05:15	51.6	37.6	30.0	45.2	31.9	24.5
13:30	51.9	33.5	25.0	47.3	32.1	27.0	05:30	44.8	29.4	21.0	39.4	26.3	21.0
13:45	55.4	32.7	24.5	45.0	30.7	25.0	05:45	52.5	32.1	20.5	52.7	30.3	20.5
14:00	60.2	37.8	25.0	46.7	32.7	26.0	06:00	48.5	30.8	20.5	45.9	28.5	20.5
14:15	61.0	37.0	25.5	60.0	39.0	28.5	06:15	53.7	33.0	21.0	52.6	32.2	20.5
14:30	51.1	35.0	26.0	46.3	33.0	26.5	06:30	53.6	30.3	21.5	60.0	32.3	21.5
14:45	47.6	32.2	24.5	55.5	32.0	25.5	06:45	60.3	34.6	23.0	53.7	32.9	23.5
15:00	50.9	32.1	25.0	52.1	31.0	25.0	07:00	48.8	32.5	22.5	43.2	29.1	22.5
15:15	47.2	32.1	24.0	64.5	34.7	25.0	07:15	48.7	33.4	23.0	54.1	33.7	26.0
15:30	50.1	33.4	25.0	52.1	32.1	26.0	07:30	52.2	34.6	24.0	56.0	34.0	25.0
15:45	49.5	34.4	24.5	47.1	32.1	25.0	07:45	51.1	35.7	25.0	64.6	35.1	25.5
16:00	59.1	36.8	24.5	60.4	35.5	25.0	08:00	57.5	40.8	28.0	52.0	36.8	29.0
16:15	53.3	35.6	24.5	46.8	32.3	26.5	08:15	49.2	36.4	25.5	51.3	37.7	30.0
16:30	57.3	41.2	34.0	52.7	35.0	28.5	08:30	64.5	46.1	28.5	64.4	47.9	35.5
16:45	60.6	41.1	34.5	54.7	35.1	28.5	08:45	65.7	44.6	29.0	60.6	43.3	32.5
17:00	61.0	41.1	34.0	57.5	35.7	29.5	09:00	62.2	43.0	29.0	61.0	42.7	31.0
17:15	57.0	39.6	31.0	58.9	36.1	29.0	09:15	58.5	41.1	29.0	63.0	43.5	32.0
17:30	51.6	36.4	24.5	48.6	33.2	24.0	09:30	59.2	40.8	28.5	64.7	43.2	32.5
17:45	65.9	40.3	23.0	54.1	34.3	23.5	09:45	62.7	46.0	33.0	63.6	43.8	32.0
18:00	55.8	40.4	23.5	56.7	38.5	25.5	10:00	62.5	45.6	35.0	61.2	42.7	34.0
18:15	59.4	39.1	23.5	48.5	33.2	24.0	10:15	61.6	46.3	38.5	71.3	46.2	36.5
18:30	55.6	36.0	23.5	53.5	33.6	23.5	10:30	60.3	44.7	33.0	58.1	42.1	33.5
18:45	52.7	32.7	23.0	48.9	31.9	24.0	10:45	63.4	46.1	39.0	60.8	44.9	37.5
19:00	48.4	34.7	24.0	50.3	33.6	23.5	11:00	64.2	46.4	39.0	59.3	43.5	36.0
19:15	50.5	33.7	23.5	47.7	31.4	24.0	11:15	66.8	47.9	39.5	63.5	45.7	37.0
19:30	49.0	30.7	23.0	49.3	31.5	23.5	11:30	62.0	45.4	33.0	63.1	46.6	35.0
19:45	59.8	36.6	21.0	60.5	35.8	20.5	11:45	62.6	46.6	36.0	65.8	46.4	36.5
20:00	49.8	30.7	21.0	46.6	28.8	20.5	12:00	64.1	47.2	39.0	62.9	47.7	36.0
20:15	50.2	32.9	21.0	46.8	30.9	21.0	12:15	59.7	40.4	31.0	63.8	47.1	35.5
20:30	47.5	31.7	21.5	46.1	31.0	21.5	12:30	56.1	38.2	30.5	62.3	44.5	35.0
20:45	51.8	35.6	22.5	45.4	33.4	23.5	12:45	55.6	40.3	29.5	65.8	43.6	34.0
21:00	50.8	33.9	22.5	48.4	32.7	24.0	13:00	58.6	41.4	31.0	60.4	44.4	33.5
21:15	50.0	36.8	23.0	47.3	35.8	26.0	13:15	66.6	44.9	34.5	61.6	42.2	36.0
21:30	48.5	33.9	22.0	47.7	32.4	24.0	13:30	64.3	45.3	37.0	60.8	42.4	35.5
21:45	50.4	34.2	22.0	47.7	31.5	23.5	13:45	64.2	46.4	39.0	58.7	42.8	37.5
22:00	50.4	30.4	22.5	55.3	30.8	23.5	14:00	64.2	46.0	39.0	59.5	43.6	37.5
22:15	43.7	29.3	22.5	40.3	28.9	24.0	14:15	67.6	49.5	41.5	62.2	44.1	37.0
22:30	33.4	23.4	22.5	44.2	27.0	24.0	14:30	62.9	45.8	35.0	56.6	41.4	35.0
22:45	50.4	32.1	22.5	44.8	29.6	24.0	14:45	61.7	42.0	34.5	66.3	43.6	34.5
23:00	44.2	25.8	22.5	41.8	28.1	24.5	15:00	62.1	46.4	38.5	65.4	44.7	37.0
23:15	42.2	26.3	23.5	39.9	27.5	23.5	15:15	62.0	47.2	41.0	60.1	44.6	37.5
23:30	35.7	24.4	22.0	38.2	26.4	23.0	15:30	76.0	53.4	41.5	87.6	62.5	38.5
23:45	34.9	22.8	21.5	44.5	25.5	22.0	15:45	62.5	47.2	38.5	70.3	45.7	38.0
00:00	38.2	25.7	21.5	40.3	27.3	22.0	16:00	65.0	45.6	37.5	61.5	46.3	38.5
00:15	34.9	22.9	21.5	38.7	28.2	24.0	16:15	68.6	45.6	37.0	73.5	46.0	35.0
00:30	38.1	24.7	20.5	47.2	27.2	22.0	16:30				67.6	48.1	39.5
00:45	30.7	20.8	20.5	38.5	24.6	21.5							

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
09:00	0.0	15.2	19:40	1.1	10.3	06:20	1.2	9.0
09:10	0.3	14.7	19:50	1.2	10.1	06:30	0.4	9.0
09:20	2.3	10.6	20:00	0.6	9.9	06:40	1.2	9.1
09:30	3.1	10.3	20:10	0.9	9.8	06:50	1.1	9.3
09:40	2.1	11.3	20:20	1.4	9.9	07:00	1.3	9.4
09:50	1.5	11.0	20:30	2.0	10.0	07:10	1.3	9.5
10:00	2.8	10.3	20:40	1.6	9.6	07:20	1.6	9.6
10:10	1.7	10.5	20:50	1.3	9.4	07:30	1.3	9.5
10:20	2.0	10.8	21:00	1.5	9.4	07:40	1.7	9.6
10:30	1.2	10.9	21:10	1.7	9.4	07:50	1.7	9.6
10:40	2.0	11.6	21:20	2.9	10.0	08:00	0.4	9.7
10:50	2.1	11.4	21:30	2.3	9.8	08:10	1.1	9.8
11:00	1.1	12.3	21:40	1.7	9.4	08:20	0.0	10.0
11:10	2.1	12.5	21:50	1.6	9.3	08:30	1.6	10.2
11:20	2.1	12.5	22:00	1.4	8.8	08:40	1.9	10.3
11:30	1.5	12.6	22:10	2.2	8.8	08:50	2.0	10.3
11:40	1.2	12.4	22:20	1.5	8.9	09:00	1.9	10.3
11:50	2.2	12.4	22:30	2.2	9.0	09:10	1.2	10.5
12:00	2.7	12.3	22:40	1.5	8.7	09:20	1.9	10.5
12:10	2.2	12.4	22:50	1.7	8.5	09:30	2.4	10.6
12:20	2.9	12.4	23:00	1.8	8.6	09:40	2.0	10.7
12:30	2.6	12.5	23:10	1.6	8.7	09:50	2.4	10.9
12:40	1.3	13.6	23:20	2.2	8.5	10:00	2.6	11.3
12:50	3.0	13.0	23:30	1.7	8.6	10:10	1.5	11.5
13:00	3.4	13.1	23:40	2.2	8.9	10:20	1.9	12.2
13:10	1.4	13.5	23:50	1.7	8.6	10:30	3.9	12.0
13:20	2.0	13.4	00:00	1.7	8.3	10:40	2.2	13.0
13:30	2.5	13.4	00:10	2.0	8.5	10:50	2.7	12.8
13:40	2.2	13.6	00:20	2.6	8.7	11:00	2.3	12.6
13:50	2.4	13.6	00:30	1.5	8.4	11:10	2.3	13.7
14:00	2.7	14.3	00:40	1.4	8.3	11:20	2.0	12.6
14:10	1.7	14.1	00:50	1.6	8.1	11:30	2.2	13.4
14:20	0.9	14.6	01:00	1.5	7.5	11:40	2.7	12.3
14:30	2.7	13.6	01:10	1.2	7.3	11:50	3.1	13.2
14:40	2.5	14.0	01:20	1.2	7.8	12:00	1.7	12.9
14:50	2.0	14.1	01:30	2.1	8.2	12:10	3.4	13.2
15:00	1.8	13.9	01:40	1.7	8.2	12:20	3.2	13.1
15:10	2.4	13.9	01:50	2.3	8.4	12:30	4.0	13.6
15:20	1.1	15.0	02:00	2.5	8.6	12:40	2.7	12.8
15:30	1.7	14.6	02:10	1.3	8.4	12:50	1.9	13.7
15:40	1.9	14.5	02:20	1.0	8.7	13:00	2.4	14.4
15:50	3.2	14.7	02:30	1.5	8.6	13:10	1.5	14.2
16:00	1.8	14.8	02:40	1.5	8.4	13:20	3.7	14.5
16:10	2.0	14.3	02:50	1.2	8.1	13:30	4.4	14.7
16:20	2.5	14.3	03:00	0.7	7.8	13:40	0.9	15.0
16:30	1.8	14.6	03:10	1.2	7.8	13:50	2.5	15.6
16:40	2.0	14.6	03:20	2.0	8.2	14:00	2.5	15.2
16:50	2.2	14.1	03:30	1.3	7.9	14:10	2.6	14.9
17:00	2.9	14.1	03:40	1.3	7.6	14:20	3.3	15.1
17:10	1.7	13.2	03:50	1.1	7.8	14:30	2.2	14.7
17:20	1.5	13.7	04:00	2.3	8.3	14:40	2.0	15.8
17:30	2.3	13.6	04:10	1.9	8.3	14:50	3.4	15.6
17:40	2.3	13.5	04:20	1.6	8.7	15:00	3.7	15.1
17:50	0.6	13.6	04:30	1.9	8.7	15:10	2.5	15.7
18:00	1.2	13.0	04:40	1.5	8.9	15:20	1.7	15.8
18:10	0.8	12.5	04:50	1.5	9.0	15:30	3.3	15.4
18:20	1.4	12.0	05:00	0.8	8.5	15:40	1.5	15.4
18:30	1.1	11.6	05:10	1.3	8.4	15:50	2.8	15.3
18:40	1.3	11.8	05:20	0.8	8.3	16:00	2.0	15.9
18:50	1.4	11.3	05:30	0.9	8.6	16:10	2.9	15.3
19:00	1.5	11.2	05:40	0.9	8.9	16:20	3.0	15.2
19:10	1.7	10.9	05:50	1.0	8.9	16:30	2.5	15.3
19:20	1.2	10.1	06:00	0.5	8.8	16:40	1.7	15.2
19:30	0.7	10.0	06:10	0.4	8.8			

Table B1. Calculation of aggregate extract fan noise from existing and proposed poultry units at Dwelling A																														
Extract fan: Big Dutchman FF091-6DT																														
[A] Sound Pressure Level, L _p , at 7m, 45° lateral: 50 dB													[C] Reflection off poultry shed roof: 3 dB																	
[B] Directivity correction (45° to 90°, 800mm dim fan): 6 dB													[A] - [B] + [C] L _p at 7m, 90° lateral: 47 dB																	
Fan		Existing		Proposed			Existing		Proposed			Existing		Proposed			Existing		Proposed			Existing		Proposed						
		Shed 1	Shed 2	Shed 3	Shed 4		Shed 1	Shed 2	Shed 3	Shed 4		Shed 1	Shed 2	Shed 3	Shed 4		Shed 1	Shed 2	Shed 3	Shed 4		Shed 1	Shed 2	Shed 3	Shed 4					
1	Direct distance, m	333.8	327.5	286.8	299.4	Distance correction, dB	33.6	33.4	32.2	32.6	Shielding attenuation, dB	10	10	0	0	Ground absorption, dB	0.0	0.0	4.1	4.2	Atmospheric attenuation, dB	0.6	0.6	0.5	0.6	Sound pressure level at dwelling, dB	2.8	3.0	10.1	9.7
2		325.4	318.9	300.5	312.7		33.3	33.2	32.7	33.0		10	10	0	0		0.0	0.0	4.2	4.2		0.6	0.6	0.6	0.6		3.0	3.2	9.6	9.2
3		317.0	310.4	314.5	326.2		33.1	32.9	33.1	33.4		10	10	0	0		0.0	0.0	4.2	4.2		0.6	0.6	0.6	0.6		3.3	3.5	9.2	8.8
4		308.6	301.9	328.7	339.9		32.9	32.7	33.4	33.7		10	10	0	0		0.0	0.0	4.2	4.2		0.6	0.6	0.6	0.6		3.5	3.7	8.7	8.4
5		300.3	293.3				32.6	32.4				10	10	0	0		0.0	0.0				0.6	0.6				3.8	4.0		
6		292.0	284.9				32.4	32.2				10	10	0	0		0.0	0.0				0.6	0.5				4.0	4.3		
7		283.7	276.4				32.2	31.9				10	10	0	0		0.0	0.0				0.5	0.5				4.3	4.5		
8		275.4	267.9				31.9	31.7				10	10	0	0		0.0	0.0				0.5	0.5				4.6	4.8		
9		267.2	259.5				31.6	31.4				10	10	0	0		0.0	0.0				0.5	0.5				4.9	5.1		
																							Tonality		0					
																							Impulsivity		0					
																							Intermittency		0					
																							Other		3					
100% fans operating																		Specific Level, dB		21										
																		Rating Level, dB		24										
																		Typical Background, L _{A90}		25										
																		Assessment Level, dB		-1										
50% fans operating ^{Note 1}																		Specific Level, dB		18										
																		Rating Level, dB		21										
																		Typical Background, L _{A90}		23										
																		Assessment Level, dB		-2										
20% fans operating ^{Note 2}																		Specific Level, dB		14										
																		Rating Level, dB		17										
																		Typical Background, L _{A90}		21										
																		Assessment Level, dB		-4										
Note 1: Assumed only odd numbered fans operating																														
Note 2: Assumed only 2 & 8 numbered fans operating																														

Table B2. Calculation of aggregate extract fan noise from existing and proposed poultry units at Dwelling B																														
Extract fan: Big Dutchman FF091-6DT																														
[A] Sound Pressure Level, L _p , at 7m, 45° lateral: 50 dB													[C] Reflection off poultry shed roof: 3 dB																	
[B] Directivity correction (45° to 90°, 800mm dim fan): 6 dB													[A] - [B] + [C] L _p at 7m, 90° lateral: 47 dB																	
Fan		Existing		Proposed			Existing		Proposed			Existing		Proposed			Existing		Proposed			Existing		Proposed						
		Shed 1	Shed 2	Shed 3	Shed 4		Shed 1	Shed 2	Shed 3	Shed 4		Shed 1	Shed 2	Shed 3	Shed 4		Shed 1	Shed 2	Shed 3	Shed 4		Shed 1	Shed 2	Shed 3	Shed 4					
1	Direct distance, m	366.3	377.0	290.0	281.6	Distance correction, dB	34.4	34.6	32.3	32.1	Shielding attenuation, dB	0	0	0	0	Ground absorption, dB	4.3	4.3	4.1	4.1	Atmospheric attenuation, dB	0.7	0.7	0.6	0.5	Sound pressure level at dwelling, dB	7.6	7.4	10.0	10.0
2		358.9	369.7	304.3	296.3		34.2	34.5	32.8	32.5		0	0	0	0		4.3	4.3	4.2	4.1		0.7	0.7	0.6	0.6		7.9	7.6	9.5	9.8
3		351.5	362.5	318.8	311.2		34.0	34.3	33.2	33.0		0	0	0	0		4.3	4.3	4.2	4.2		0.7	0.7	0.6	0.6		8.1	7.8	9.0	9.3
4		344.1	355.4	333.4	326.2		33.8	34.1	33.6	33.4		0	0	0	0		4.2	4.3	4.2	4.2		0.7	0.7	0.6	0.6		8.3	7.9	8.6	8.8
5		336.8	348.4				33.6	33.9				0	0	0	0		4.2	4.3				0.6	0.7				8.5	8.1		
6		329.6	341.5				33.5	33.8				0	0	0	0		4.2	4.2				0.6	0.6				8.7	8.3		
7		322.5	334.6				33.3	33.6				0	0	0	0		4.2	4.2				0.6	0.6				8.9	8.5		
8		315.5	327.9				33.1	33.4				0	0	0	0		4.2	4.2				0.6	0.6				9.1	8.7		
9		308.5	321.2				32.9	33.2				0	0	0	0		4.2	4.2				0.6	0.6				9.4	9.0		
BS4142 character correction																					Tonality		0							
																					Impulsivity		0							
																					Intermittency		0							
																					Other		3							
100% fans operating																	Specific Level, dB		23											
																	Rating Level, dB		26											
Day (07:00 - 20:00hrs)																	Typical Background, L _{A90}		25											
																	Assessment Level, dB		1											
50% fans operating ^{Note 1}																	Specific Level, dB		20											
																	Rating Level, dB		23											
Evening (20:00 - 23:00hrs)																	Typical Background, L _{A90}		23											
																	Assessment Level, dB		0											
20% fans operating ^{Note 2}																	Specific Level, dB		17											
																	Rating Level, dB		20											
Night (23:00 - 07:00hrs)																	Typical Background, L _{A90}		21											
																	Assessment Level, dB		-1											
Note 1: Assumed only odd numbered fans operating																														
Note 2: Assumed only 2 & 8 numbered fans operating																														


Data sheet: Fan for exhaust air chimney

Code no	Description
60-47-7907	Fan FF091-6DT 3x400V 50/60Hz 1.9/2.4A f/tube
valid for the following chimney types:	
60-39-0130	Exhaust air chimney CL920-30-VC-2900 gray
60-39-0140	Exhaust air chimney CL920-30-VC-2900 brown
60-39-0150	Exhaust air chimney CL920-30-AF-2900 gray
60-39-0160	Exhaust air chimney CL920-30-AF-2900 brown

Parameter	Unit	Value	Comment
Nominal voltage	[V] / [Hz]	400/50	460/60
Allowable voltage	[V]	360-440	
Current consumption	[A]	1.9	2.4 at 60 Hz
Max. ambient temperature	[°C]	40°C	
Sound power level (L_{wA})	[dB(A)]	-	
Sound pressure level (L_{pA})	[dB(A)]	50	Distance 7m / 30 Pa
Weight	[kg]	19.5	
Speed control	[-]	FU, Triac	
Protection class	[-]	IP 54	
Certificate	[-]	CE, ErP2015	

Pressure	Air volume	Air speed	Specific capacity	Illustration
[Pa]	[m³/h]	[m/s]	[W/1000m³]	
0	-	-	-	
10	25,100	10.5	29.3	
20	24,100	10.1	-	
30	23,200	9.7	-	
40	22,200	-	-	
50	21,000	-	-	
60	19,600	-	-	
80	16,000	-	-	
100	-	-	-	
120	-	-	-	
140	-	-	-	
160	-	-	-	
Big Dutchman International GmbH Big Dutchman Pig Equipment GmbH P.O Box 1163 · D-49360 Vechta · Germany Tel. +49(0)4447 / 801-0 · Fax. +49(0)4447 / 801-237 E-mail: big@bigdutchman.de				