

Tofts Lane, Hunshelf
Installation of stand-by generator sets
Environmental Noise Impact Assessment

Green Frog Power 214 Ltd

12 March 2012

Final Report

9X2896

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1 INTRODUCTION

Royal Haskoning were commissioned by Green Frog Power 214 Ltd to conduct an environmental noise impact assessment for the installation of a new stand-by generator plant at Tofts Lane, Hunshelf, Stocksbridge, Sheffield S36 2BS.

1.1 Background

The purpose of the assessment was to assess the level of noise impact the installation of a new stand-by electricity generating plant will have on the surrounding vicinity. Green Frog Power Ltd has entered a long term contract to supply Short Term Operating Reserve (STOR) to National Grid. STOR is part of National Grid's reserve mechanism for balancing the UK power network. Because electricity cannot be stored in volume, the amount generated must always balance the amount used by industry and consumers. The electricity network needs to be able to respond quickly to sudden increases or decreases in power availability and demand; a power station failure could leave the network short of 660MW, and STOR is one of the sources of this standby power that NG calls upon to restore the balance.

Most STOR call ups are at the times of highest demand on the network and finish around 7.30 to 8.00 pm. However, in exceptional circumstances (e.g. World Cup finals, Olympic Games, or a failure of the network elsewhere) a spike of 10 to 20 minutes can occur later than these normal operational hours. It will be seen that this amounts historically to less than 2 hours a year in total (see Appendix E).

The National Grid has a legal obligation to maintain the electricity supply; therefore they have contracts with STOR providers to cover for periods after the normal operational hours as a precaution. When the generators are called up, it is an interim measure until the larger power stations can supply the required power; this can take up to 20 minutes, which is where the stand-by generator systems come into play. Therefore any call ups, are of a temporary nature until the larger power stations are 'on-line'. Generators installed at other locations in the UK operate on average for durations of 45 minutes each.

1.2 Liaison

A consultation was undertaken with the Environmental Health Department at Barnsley MBC. It was agreed that a noise impact assessment of the proposed stand-by generator scheme would be undertaken following the guidance in BS 4142 (BSI, 1997).

1.3 Objectives

This report presents:

- An outline of the proposed scheme and site location;
- The results of the noise modelling exercise of the electricity generation scheme;
- The predicted noise levels at locations surrounding the site;
- Results of the noise survey conducted at nearby residential locations;
- A noise contour map illustrating the noise propagation from the proposed scheme; and
- A noise impact assessment comparing the background noise levels to the calculated noise levels using the methodology in BS 4142.

2 SCHEME DETAILS

2.1 Site description

The electricity generation plant is to be located in the Parish of Hunshelf, approximately 1.4km north of the town of Stocksbridge. The area is mainly rural in character with scattered residential properties approximately 500 - 600 metres away from the development site. Approximately 800 metres to the south is the A616; a main road connecting Manchester and Sheffield through the Peak District.

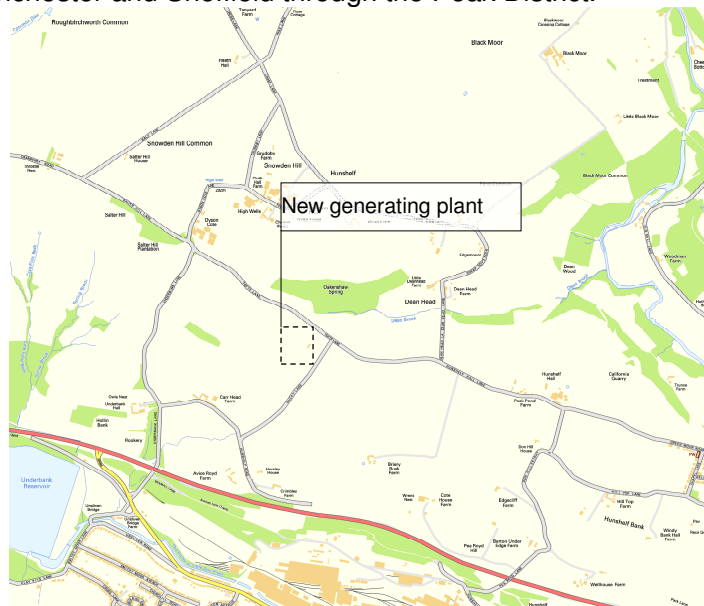


Figure 2-1 Location of generating plant development

(Source: OS OpenData)

The location of the proposed electricity generating plant is adjacent to an existing electricity sub station.

2.2 Noise Sources

The generating plant to be installed are 52 No. model P500P3 generating sets supplied by FG Wilson Ltd. The generating sets each comprise Perkins 2506A-E15-TAG2, 6 cylinder turbo-charged engines housed within a bespoke acoustic enclosure. The FG Wilson acoustic enclosures with the generating set P500P3 installed are rated with a Sound Power Level of 98 dBA at 100% load and have been measured with a Sound Pressure Level of 80dB L_{Aeq} at 1 metre from the unit. These noise level emissions include all areas of panel-radiated noise from the enclosure and from the exhaust mounted on the top. The datasheet is attached in Appendix C for reference.

The stand-by generator compound is surrounded by a 4.5 metre high perimeter wall, which will serve as a noise barrier to reduce the noise emissions from the site. The perimeter wall is constructed of a composite panel construction with sound absorbent properties. The manufacturers of the panels, Genworks Ltd, indicate that the DL08dB model used at this site has an average sound absorption co-efficient of 0.8 Sabines. The datasheet of this product is provided in Appendix D for reference.

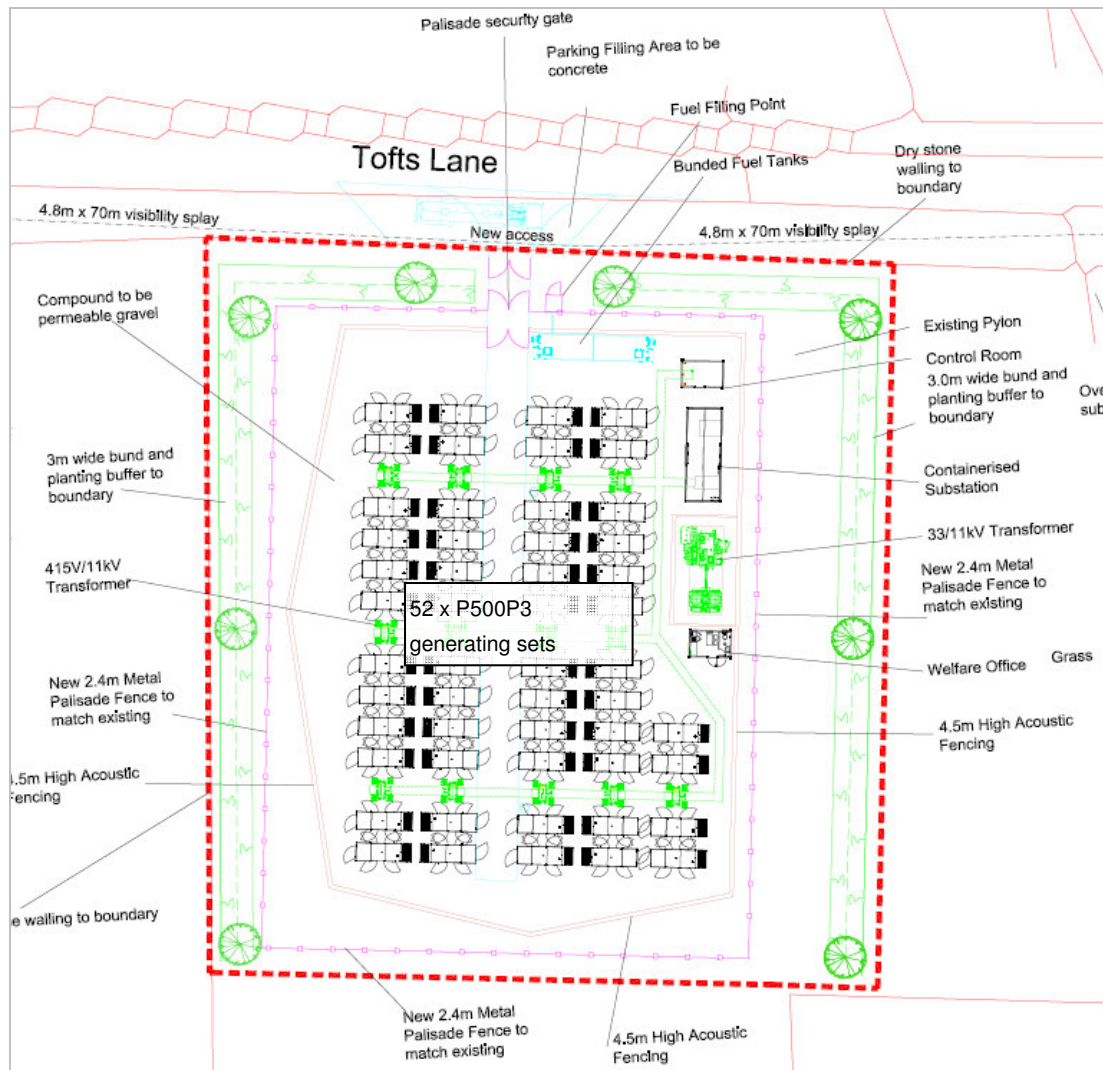


Figure 2-2 Generating plant scheme layout

2.3 Noise Sensitive Properties

The closest noise sensitive properties to the generator compound are:

- Carr Head Farm (480 metres, south);
- Dean Head Farm (580 metres, north-east);
- Briary Busk Farm (590 metres, south-east); and
- Dyson Cote (600 metres north-west).

3 GUIDANCE AND PLANNING POLICY CONTEXT

3.1 National Guidance

British Standard (BS) 7445: Parts 1 and 2 - Description and measurement of environmental noise^{1&2}. The Standard provides details of the instrumentation and measurement techniques to be used when assessing environmental noise, and defines the basic noise quantity as the continuous A-weighted sound pressure level (L_{Aeq}). Part 2 of BS 7445 replicates ISO standard 1996-2.

BS 4142: 1997 - Method for rating industrial noise affecting mixed residential and industrial areas³. The Standard provides a method for determining noise levels from factories and other industrial premises, and the existing background noise level. It also prescribes a method for assessing whether the industrial noise is likely to give rise to complaints.

3.2 International Guidance

World Health Organisation (WHO) Guidelines for community noise⁴. These guidelines present health-based noise limits intended to protect the population from exposure to excess noise. The document presents guideline limit values at which the likelihood of particular effects, such as sleep disturbance or annoyance, may increase. The guideline values are 50 or 55dB L_{Aeq} during the day, related to annoyance, and 45 dB L_{Aeq} or 60dB L_{Amax} at night, related to sleep disturbance.

¹ British Standards Institution (BSI), 2003. BS 7445-1:2003 - Description and measurement of environmental noise. Guide to quantities and procedures. BSI, London

² BSI, 1991. BS 7445-2:1991 - Description and measurement of environmental noise. Guide to the acquisition of data pertinent to land use. BSI, London

³ BSI, 1997. BS 4142:1997 - Method for rating industrial noise affecting mixed residential and industrial areas. BSI, London

⁴ Berglund et al, 1999. Guidelines for Community Noise. Geneva, World Health Organisation (WHO)

4 NOISE CALCULATIONS

The noise levels generated by the new electricity generation scheme were calculated using SoundPlan noise modelling software. The software implements the ISO 9613⁵ calculation method which includes corrections for distance, ground and atmospheric absorption, and intervening barriers. The physical model was constructed using the drawing⁶ supplied by Green Frog Power.

The following assumptions were made to complete the modelling exercise:

- The scheme layout is as provided by Green Frog Power⁶;
- The noise sources will be 52 No. P500P3 generating sets operating at 100% load with a Sound Pressure Level of 80dB(A) at 1 metre from all sides of the enclosure, including the roof;
- All buildings are 6 metres in height, with a floor height of 2.8 metres per floor;
- Receivers were placed on facades of properties at 2.0 metres above ground on first and second floor levels; and
- Noise contours were calculated at a height of 4 metres above ground representative of a first floor bedroom.

4.1 Results

Table 4-1 below shows the results of the noise modelling at the nearest noise-sensitive properties. The predicted noise propagation is also illustrated as a noise contour map (9X2896 Tofts Lane, Hunshelf – Noise Contour Map.pdf). The calculations have assumed full operation of the facility, with all generators operating at 100% load.

Table 4-1 Noise calculation results - 100% load – 4.5 metre compound wall

Object No.	Receiver	Usage	Fl	Dir	L _{Aeq} , (dB)
1	Little Deanhead Farm	GR	GF	S	41.5
1	Little Deanhead Farm	GR	1.FL	S	41.6
2	Dean head farm	GR	GF	W	39.4
2	Dean head farm	GR	1.FL	W	41.5
3	Pond Farm	GR	GF	SW	39.9
3	Pond Farm	GR	1.FL	SW	41.6
4	Tenter House	GR	GF	SW	39.1
4	Tenter House	GR	1.FL	SW	39.8
5	Chapel Farm	GR	GF	SW	39.3
5	Chapel Farm	GR	1.FL	SW	40.7
6	Dyson Cote	GR	GF	SE	36.0
6	Dyson Cote	GR	1.FL	SE	38.0
7	Briery Busk Farm	GR	GF	N	30.4
7	Briery Busk Farm	GR	1.FL	N	31.1
8	Crimbles Farm	GR	GF	N	36.1

⁵ International Standards Organisation 9613-2 'Acoustics - Attenuation of sound during propagation outdoors -- Part 2: General method of calculation', BSI 1996.

⁶ Site Plan 23-01-12.dxf

Object No.	Receiver	Usage	Fl	Dir	L _{Aeq} , (dB)
8	Crimbles Farm	GR	1.FL	N	38.8
9	Horsley House	GR	GF	NE	38.5
9	Horsley House	GR	1.FL	NE	38.8
10	Avic Royd Farm	GR	GF	NE	35.2
10	Avic Royd Farm	GR	1.FL	NE	35.4
11	Carr Head Farm	GR	GF	NE	35.2
11	Carr Head Farm	GR	1.FL	NE	35.4
12	Underbank Hall	GR	GF	E	32.0
12	Underbank Hall	GR	1.FL	E	32.2

GR = General residential

GF = Ground floor, 1.FL = First floor

The highest noise level is predicted at little Deanhead Farm and Pond Farm at 41.6dB L_{Aeq}. Noise levels predicted at the other residential properties range from 41.5dB at Deanhead Farm to 30.4dB L_{Aeq} Briary Busk Farm.

All noise levels predicted are beneath the level of 50dB L_{Aeq} recommended by the WHO for the onset of moderate annoyance in outdoor living areas.

5 NOISE SURVEY

To conduct a noise impact assessment of the predicted noise from the electricity generation plant a noise survey was conducted on 23 – 24 February 2012 to establish the existing ambient noise levels. The noise survey was conducted from 19:00 to 22:00 hours on Thursday 23 February 2012 and 07:00 to 10:00 hours on Friday 24 February 2012.

5.1 Methodology

The noise measurements were taken at the three locations considered representative of Briary Busk Farm (1), Deanhead Farm (2) and Carr Head Farm (3). The noise measurements were conducted with regard to the procedure outlined in BS 4142. All noise levels were measured using fully calibrated instrumentation traceable to UKAS standards. Noise levels were measured at a microphone height of 1.5 metres in free-field conditions, 3.5 metres away from any reflecting surface other than the ground. Calibration checks were conducted before and after the measurement surveys with no significant variance in sensitivity observed.

The weather on Thursday 23 and Friday 24 February 2012 with scattered cloud cover, wind speeds of 3 – 4m/s and a temperature of 8 °C.

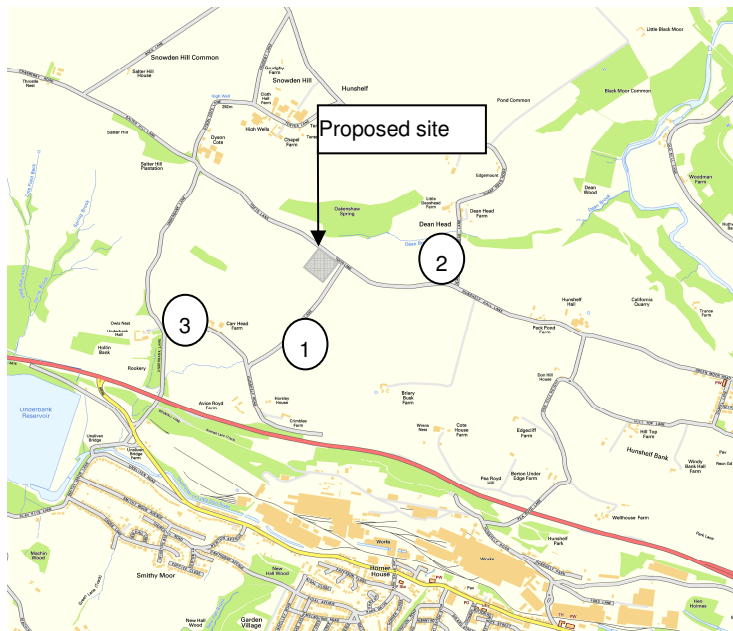


Figure 5-1 Noise measurement locations

5.2 Survey Results

A summary of the average measured noise levels are shown in Table 5-1 below.

Table 5-1 Summary of survey results

Pos	Period	L _{Aeq} (dB)	L _{Amax} (dB)	L _{A10} (dB)	L _{A90} (dB)
1	Evening (19:00-22:00)	54.1	73.1	57.4	45.6
	Morning (07:00-10:00)	48.3	65.8	50.9	42.6
2	Evening (19:00-22:00)	58.6	96.0	59.3	45.1
	Morning (07:00-10:00)	52.5	80.1	52.5	42.7
3	Evening (19:00-22:00)	51.1	62.2	54.3	45.3
	Morning (07:00-10:00)	56.1	75.1	59.7	48.2

During the noise survey the character of the ambient noise at measurement locations 1 – 3 was largely influenced by vehicle movements along A616 and vehicles along the local road network. A continuous tonal ‘hum’ was audible at locations 1 and 2, generated by the existing electricity substation adjacent to the site of the proposed stand-by generation plant.

6 NOISE IMPACT ASSESSMENT

6.1 Methodology

BS4142:1997 describes a method of determining the level of noise of an industrial nature, together with procedures for assessing whether the noise in question is likely to give rise to complaints. The noise rating level ($L_{Ar,Tr}$) of the industrial noise source is compared to the measured background noise level (L_{A90}) at noise sensitive positions. The difference between the noise rating level and the background is referred to as the assessment level. BS4142:1997 gives the following guidelines on assessing the likelihood of complaints;

- An assessment level of around +10dB or more indicates that complaints are likely;
- An assessment level of +5dB is of marginal significance;
- An assessment level of -10dB is a positive indication that complaints are unlikely.

The calculated noise rating levels at the residential properties were compared to the measured background noise levels to indicate the likelihood of complaints.

6.2 Determination of Noise Rating Level

The assessment method of BS 4142 requires the noise rating level ($L_{Ar,Tr}$) to be assessed over a reference time period of 1 hour during daytime hours (07:00-23:00). If the 'on-time' of the specific noise level is less than the reference time period, then the rating level ($L_{Ar,Tr}$) is calculated using the expression below.

$$L_{Ar,Tr} = L_{Ar,Tm} + 10 \log \left\{ \frac{T_0}{T_r} \right\}$$

Where,

$L_{Ar,Tr}$ = Noise Rating Level

$L_{Ar,Tm}$ = Noise level for the noise source whilst it is on

T_0 = The 'on-time' of the specific noise level

T_r = The reference time period (1 hour daytime)

In this instance the 'on-time' of the noise level is 45 minutes and the reference time period is 60 minutes/1 hour, therefore the expression above was used to correct the specific noise levels in Table 4-1 to determine the noise rating levels.

The noise rating levels were then compared to the existing background noise levels to determine the likelihood of complaints. The results of these comparisons are shown in Table 6-1.

Table 6-1 Noise impact assessment

Survey Pos	Receiver	FI	Specific Noise L_{Aeq} (dB)	Noise rating level $L_{Ar,Tr}$ (dB)	Average measured L_{A90} (dB)	Diff.
2	Little Deanhead Farm	GF	41.5	40.3	42.7	-2.5
2	Little Deanhead Farm	1.FL	41.6	40.4	42.7	-2.4
3	Carr Head Farm	GF	35.2	34.0	45.3	-11.3
3	Carr Head Farm	1.FL	35.4	34.2	45.3	-11.1
1	Briery Busk Farm	GF	30.4	29.2	42.6	-13.4
1	Briery Busk Farm	1.FL	31.1	29.9	42.6	-12.7

6.3 Results

The highest assessment level is calculated at Little Deanhead Farm where the predicted noise levels are 2.5dB below the average background noise level. At the other assessment locations the noise rating levels are more than 10dB beneath the average measured background noise level.

When noise rating levels are 10dB beneath the measured background noise levels, the corresponding guidance in BS4142 states that this is a positive indication that complaints are unlikely.

The results of the assessment indicate that the noise levels from the generation plant are less than the background noise levels at all locations therefore are not considered to give rise to complaints.

6.4 Summary

The results of the noise impact assessments indicate that the predicted noise levels at residential premises will be beneath the average measured background noise levels at all assessment locations and are not expected to give rise to complaints.

The BS4142 assessment method used here is generally used for permanent operational noise sources. Historic data from the usage of similar STOR stand-by generators throughout the UK indicate that the stand-by generators at Tofts Lane are to be activated for typically 65 hours per year, most of which are during business hours when the background noise levels are above those generated by the plant. Appendix E provides historical information on the average hours of STOR calls per year.

These levels of noise will not be experienced on a daily basis, but on average 100 times per year when required by the demands of the grid and for approximately 45 minutes in duration. Therefore the noise levels reported here will be of a temporary nature and will not be a regular occurrence, therefore further reducing the degree of impact.

7 SUMMARY AND CONCLUSIONS

A noise impact assessment was undertaken by Royal Haskoning for Green Frog Power 214 Ltd for a stand-by electricity generating plant at Tofts Lane, Hunshelf, Stocksbridge S36 2BS. The noise levels generated by the stand-by generators on 100% load were calculated at the nearest residential properties and at the surrounding premises using SoundPlan noise modelling software. The results of our assessment can be summarised as follows:

- Noise levels at the closest residential properties were calculated to be up to 41.6dB L_{Aeq} at first floor level of Little Deanhead Farm when the generating plant is operational. Predicted noise levels at nearby residential properties range from 41.5dB at Deanhead Farm to 30.4dB L_{Aeq} Briery Busk Farm during periods of operation. All predicted noise levels are beneath the level of 50 dB L_{Aeq} recommended by the WHO for the onset of moderate annoyance in outdoor living areas;
- A noise impact assessment was conducted using the methodology contained in BS 4142. The predicted noise level at the assessment location was used to derive the noise rating level by correcting for the 'on-time' of the noise source. The noise rating level was then compared to the measured background noise levels at three locations around the proposed site to derive the assessment level;
- The results of the assessment indicate a maximum assessment level of 2.5dB beneath the measured background noise level at Little Deanhead Farm. At the other assessment locations the assessment level was more than 10dB beneath the measured background noise level. Using the guidance in BS 4142, this is a positive indication that complaints are unlikely;
- All noise level predictions are based on the generators operating for 100% of the time. In practice the generators operate for on average 65 hours per year, for typically 45 minutes in duration, therefore the noise levels reported here will be of an infrequent and temporary nature, further reducing the degree of impact.
- The results of the noise impact assessment indicate that the noise produced by the stand-by generators operating is not expected to give rise to adverse impacts or reduce the level of residential amenity in the surrounding area.

APPENDIX A

Glossary of Acoustic Terms

Term	Description
Decibel (dB)	A unit of noise level derived from the logarithm of the ratio between the value of a quantity and a reference value. It is used to describe the level of many different quantities. For sound pressure level the reference quantity is 20 μPa , the threshold of normal hearing is in the region of 0 dB, and 140 dB is the threshold of pain. A change of 1 dB is only perceptible under controlled conditions.
dB(A)	Decibels measured on a sound level meter incorporating a frequency weighting (A weighting) which differentiates between sounds of different frequency (pitch) in a similar way to the human ear. Measurements in dB(A) broadly agree with people's assessment of loudness. A change of 3 dB(A) is the minimum perceptible under normal conditions, and a change of 10 dB(A) corresponds roughly to halving or doubling the loudness of a sound. The background noise level in a living room may be about 30 dB(A); normal conversation about 60 dB(A) at 1 metre; heavy road traffic about 80 dB(A) at 10 metres; the level near a pneumatic drill about 100 dB(A).
$L_{Aeq,T}$	The equivalent continuous sound level – the sound level of a notionally steady sound having the same energy as a fluctuating sound over a specified measurement period (T). $L_{Aeq,T}$ is used to describe many types of noise and can be measured directly with an integrating sound level meter.
$L_{A10,T}$	The A weighted noise level exceeded for 10% of the specified measurement period (T). L_{A10} is the index generally adopted to assess traffic noise.
$L_{A90,T}$	The A weighted noise level exceeded for 90% of the specified measurement period (T). In BS 4142: 1990 it is used to define the 'background' noise level.
L_{Amax}	The maximum A-weighted sound pressure level recorded during a measurement.
L_{Amin}	The minimum A-weighted sound pressure level recorded during a measurement.
R_w	The weighted sound reduction index, R_w , is a single figure description of sound reduction index which is defined in BS EN ISO 717-1: 1997. The R_w is calculated from measurements in an acoustic laboratory to BS EN ISO 140-3:1997 and ratings to BS EN ISO 717-1:1997. Sound insulation ratings derived from site (which are invariably lower than the laboratory figures) are referred to as the R'_w ratings and measured to BS EN ISO 140-4:1998

APPENDIX B

Noise Survey Data

Survey Details

Personnel: Peter Simcock, MIOA
 Date : 23 – 24 February 2012
 Location: Hunshelf, Stocksbridge, S36 2BS
 Equipment Details:

Table 7-1 Noise Measurement Equipment

Equipment	Make/model	Serial number	Calibration date
Sound level meter	Rion NL-32	00872237	06/10/2010
Pre-amplifier	Rion NH-21	04499	06/10/2010
Microphone	Rion UC-53A	102848	06/10/2010
Sound calibrator	Bruël & Kjaer -	01020506	06/10/2010

Table 7-2 Noise survey results

Location	Date / Time	L _{Aeq} (dB)	L _{Amax} (dB)	L _{A10} (dB)	L _{A90} (dB)
1	23/02/2012 20:11	51.7	61.2	55.3	46.3
	24/02/2012 20:23	56.4	73.1	59.5	44.8
	24/02/2012 08:52	48.7	65.5	51.3	43.6
	24/02/2012 09:09	47.9	65.8	50.5	41.6
2	23/02/2012 21:44	62.3	96.0	58.0	45.0
	23/02/2012 21:50	56.8	73.5	59.9	45.2
	23/02/2012 21:51	56.8	73.5	59.9	45.2
	24/02/2012 08:09	51.4	80.1	51.9	43.4
	24/02/2012 08:21	49.0	66.8	51.1	42.9
	24/02/2012 08:33	57.0	78.2	54.5	41.9
3	23/02/2012 20:32	51.3	60.8	54.9	45.9
	23/02/2012 21:11	51.1	62.2	54.2	45.0
	23/02/2012 21:22	50.9	61.2	53.8	44.9
	23/02/2012 21:33	51.6	65.1	54.0	47.1
	24/02/2012 07:30	57.5	73.3	61.3	48.4
	24/02/2012 07:42	59.3	75.1	63.9	49.0

APPENDIX C

Stand-by generator datasheet

The FG Wilson enclosure for the range of Perkins powered P450P3 to P688ER2 generating sets are a result of continuing research and development by our specialist acoustic engineers. These enclosures reduce sound levels to comply with the stage II levels of the European Community Directive 2000/14/EC which became effective 3 January 2006.

The fully weatherproof and sound attenuated enclosure incorporates internally mounted exhaust silencers and is extremely robust in order to withstand the rough handling common on many construction sites. It is designed on modular principles with many interchangeable components permitting on-site repair.

Robust/Highly Corrosion Resistant Construction

- ▶ Black finish stainless steel locks and hinges
- ▶ Zinc plated or stainless steel fasteners
- ▶ Body made from steel components treated with polyester powder coating

Excellent Access for Maintenance

- ▶ Two large doors on each side
- ▶ Radiator fill access plate
- ▶ Lube oil and cooling water drains piped to exterior of the enclosure

Security and Safety

- ▶ Control panel viewing window in a lockable access door
- ▶ Emergency stop push button (red) mounted on enclosure exterior
- ▶ Cooling fan and battery charging alternator fully guarded
- ▶ Fuel fill and battery can only be reached via lockable access doors
- ▶ Exhaust silencing system totally enclosed for operator safety

Transportability

- ▶ Tested and certified single point lifting facility
- ▶ Lifting points on baseframe

Optional Features

- ▶ Oil field type skid with dragging points and fork lift truck pockets



450 - 688 kVA Generating Set Range



Modular Acoustic Enclosure

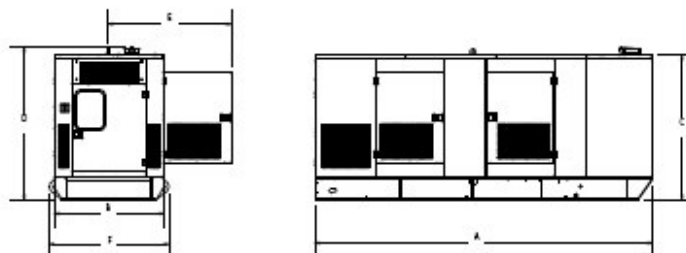


Sound Pressure Levels (dBA)

Generating Set Model	LWA	50 Hz						60 Hz					
		15m (50ft)	7m (23ft)	1m (3ft)	15m (50ft)	7m (23ft)	1m (3ft)	15m (50ft)	7m (23ft)	1m (3ft)	15m (50ft)	7m (23ft)	1m (3ft)
75% Load	100% Load	75% Load	100% Load	75% Load	100% Load	75% Load	100% Load	75% Load	100% Load	75% Load	100% Load	75% Load	100% Load
P450P3	98	63.7	64.6	69.7	70.6	79.2	80.0	-	-	-	-	-	-
P500E3	98	64.0	65.0	70.0	71.0	79.5	80.4	-	-	-	-	-	-
P500P3	98	62.9	64.4	68.9	70.4	78.6	80.0	-	-	-	-	-	-
P550E3	98	63.3	65.1	69.3	71.1	79.0	80.7	-	-	-	-	-	-
P513P1	98	-	-	-	-	-	-	64.7	65.9	70.7	71.9	81.4	82.4
P563E1	98	-	-	-	-	-	-	65.0	66.4	71.0	72.4	81.6	82.8
P563P3	98	-	-	-	-	-	-	65.0	66.4	71.0	72.4	81.6	82.8
P625E3	98	-	-	-	-	-	-	65.4	67.2	71.4	73.2	82.0	83.5
P450P2	96	62.6	63.9	68.6	69.9	78.5	79.7	-	-	-	-	-	-
P500E2	96	63.0	64.6	69.0	70.6	78.9	80.3	-	-	-	-	-	-
P500P2	96	62.9	64.4	68.9	70.4	78.7	80.1	-	-	-	-	-	-
P550E2	96	63.3	65.0	69.3	71.0	79.1	80.7	-	-	-	-	-	-
P688ER2*	98	-	-	-	-	-	-	65.6	67.4	71.6	73.4	82.2	83.8

Levels in accordance with European Noise Directive (2000/14/EC). All sound figures are preliminary until further notice.

*Emergency Rating (Models with suffix "ER") - these ratings are applicable for supplying continuous electrical power (at variable load) in the event of a utility power failure, up to a maximum of 200 hours per year. No overload is permitted on these ratings. Exceeding 200 hours operation per year may result in a reduced product life.



Dimensions and Weights

Generating Set Model	A: mm (in)	B: mm (in)	C: mm (in)	D: mm (in)	E*: mm (in)	F: mm (in)	Weight: kg (lb)	Fuel Capacity:
P450P3	4990 (196.5)	1620 (63.8)	2140 (84.3)	2262 (89.1)	1810 (71.3)	1717 (67.6)	5463 (12044)	1000 (264)
P500E3	4990 (196.5)	1620 (63.8)	2140 (84.3)	2262 (89.1)	1810 (71.3)	1717 (67.6)	5463 (12044)	1000 (264)
P500P3	4990 (196.5)	1620 (63.8)	2140 (84.3)	2262 (89.1)	1810 (71.3)	1717 (67.6)	5590 (12324)	1000 (264)
P550E3	4990 (196.5)	1620 (63.8)	2140 (84.3)	2262 (89.1)	1810 (71.3)	1717 (67.6)	5590 (12324)	1000 (264)
P513P1	4990 (196.5)	1620 (63.8)	2140 (84.3)	2262 (89.1)	1810 (71.3)	1717 (67.6)	5463 (12044)	1000 (264)
P563E1	4990 (196.5)	1620 (63.8)	2140 (84.3)	2262 (89.1)	1810 (71.3)	1717 (67.6)	5463 (12044)	1000 (264)
P563P3	4990 (196.5)	1620 (63.8)	2140 (84.3)	2262 (89.1)	1810 (71.3)	1717 (67.6)	5590 (12324)	1000 (264)
P625E3	4990 (196.5)	1620 (63.8)	2140 (84.3)	2262 (89.1)	1810 (71.3)	1717 (67.6)	5590 (12324)	1000 (264)
P450P2	4990 (196.5)	1620 (63.8)	2140 (84.3)	2262 (89.1)	1810 (71.3)	1717 (67.6)	5463 (12044)	1000 (264)
P500E2	4990 (196.5)	1620 (63.8)	2140 (84.3)	2262 (89.1)	1810 (71.3)	1717 (67.6)	5463 (12044)	1000 (264)
P500P2	4990 (196.5)	1620 (63.8)	2140 (84.3)	2262 (89.1)	1810 (71.3)	1717 (67.6)	5590 (12324)	1000 (264)
P550E2	4990 (196.5)	1620 (63.8)	2140 (84.3)	2262 (89.1)	1810 (71.3)	1717 (67.6)	5590 (12324)	1000 (264)
P688ER2	4990 (196.5)	1620 (63.8)	2140 (84.3)	2262 (89.1)	1810 (71.3)	1717 (67.6)	5612 (12372)	1000 (264)

Weight with lube oil, no coolant, no fuel. * Clearance required on both sides.



FG Wilson has manufacturing facilities in the following locations:

Northern Ireland • Brazil • China • India • USA

With headquarters in Northern Ireland, FG Wilson operates through a Global Dealer Network. To contact your local Sales Office please visit the FG Wilson website at www.FGWilson.com



In line with our policy of continuous product development, we reserve the right to change specification without notice. 450-688VAENCLOSURE/1107/GB

APPENDIX D

Absorbing Acoustic Barrier datasheet

deceuninck®

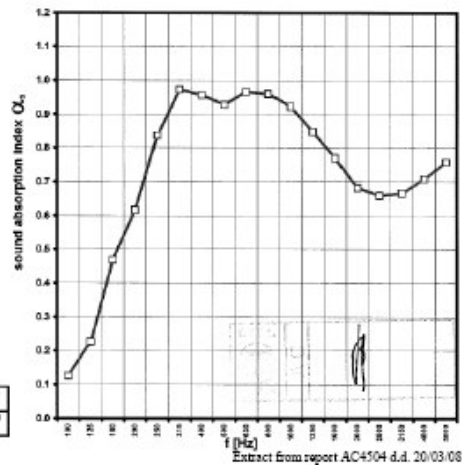
CYCLEFOAM

5. ACOUSTIC CHARACTERISTICS of ELEMENT.

Characteristic	Value	Complying standard
Acoustic absorption-index Roads & Traffic	9 dB(A)	EN-ISO 354 EN1793-1
Acoustic insulation Roads & Traffic	1) Element loosely stacked on each other DLr = 28 dB(A) 2) Elements with blocking profile on the back DLr = 30 dB(A) 3) Elements with sealing strip & blocking profile on the back DLr = 33 dB(A)	EN 1793-2
Acoustic absorption-index Railway traffic	Part Bulk transport <50% = 9dB(A) Part Bulk transport ≥50% = 10dB(A)	Conform spec's Railway traffic

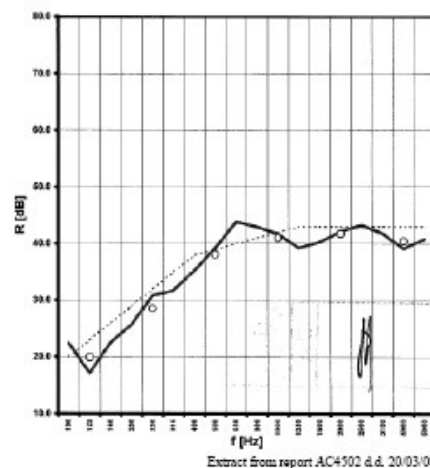
f [Hz]	$\alpha_{1,0}$	$\alpha_{1,1}$	$\alpha_{1,2}$
50			
63			
80			
100	0.20	0.33	0.13
125	0.30	0.49	0.23
160	0.50	0.70	0.47
200	0.50	0.55	0.62
250	0.60	0.89	0.84
315	0.50	0.50	0.97
400	0.50	0.50	0.98
500	0.60	0.89	0.89
630	0.70	0.40	0.67
800	0.70	0.40	0.66
1000	0.60	0.40	0.66
1250	0.40	0.30	0.65
1600	0.60	0.60	0.77
2000	0.40	0.40	0.66
2500	0.40	0.40	0.66
3150	0.60	0.30	0.67
4000	0.50	0.40	0.71
5000	0.70	0.50	0.70
f [Hz]	$\alpha_{2,0}$	$\alpha_{2,1}$	$\alpha_{2,2}$
50	0.24		
100	0.40		
200	0.46		
500	0.90		
1000	0.90		
2000	0.90		
5000	0.90		

$\alpha_{n,0} = 0.80$ (1)
acoustic absorption class: 0
DLr = 0 dB
Performance Class: A1



f [Hz]	R
125	17.1
160	22.4
200	22.5
250	25.7
315	30.8
400	31.7
500	35.2
630	36.2
800	40.3
1000	41.7
1250	41.7
1600	42.2
2000	42.2
2500	43.2
3150	41.8
4000	38.1
5000	40.5

$R_w (C; C_0) = 29 (-2;-5)$ dB
DkR = 35 dB
Performance Class: B3



APPENDIX E

Historic Generator Usage

