patel tonra ltd
environmental solutions

For the Attention of
Administration
Environmental Licensing Programme
Office of Climate, Licensing & Resource Use
Environmental Protection Agency
PO Box 3000
Johnstown Castle Estate
Co. Wexford

Our Ref.: RG0201/WLA
Direct Dial: 01 8020523
Direct Fax: 01 8050525
Email: louise.odonnell@pateltonra.com
Date: 28th Feb. 2014

Re.: EPA Ref. W0279-01 – Additional Information (Unsolicited)

Rehab Glassco Ltd. - Application to the Environmental Protection Agency for a Waste Licence for a Glass and Can Recycling Facility at an Existing Waste Management Facility *at* Unit 4, Osberstown Industrial Park, Caragh Road, Naas, Co. Kildare

Dear EPA,

Patel Tonra Ltd., Environmental Solutions, is acting for Rehab Glassco Ltd., under the instruction of Mr Zeki Mustafa, Managing Director of Rehab Glassco Ltd.

Please find enclosed additional information (unsolicited), which is a copy of Further Information submitted to An Bord Pleanála on 24th February 2014 in relation to the application. The information includes, *inter alia*, recent environmental monitoring reports for noise and dust.

I enclose 2 No. print copies (1 signed original and 1 copy) and 15 No. CD-ROM copies. I confirm that the content of the electronic files on the accompanying CD-ROMs is a true copy of the original.

If you have any further queries, please do not hesitate to contact me.

Yours sincerely,

Louise O'Donnell
Director, Patel Tonra Ltd.

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The Secretary
An Bord Pleanála
64 Marlborough Street
Dublin 1

Monday, 24 February 2014

[By Hand]

Dear Sir

RE: GLASS RECYCLING FACILITY, UNIT 4, OSBERSTOWN INDUSTRIAL PARK, CARAGH ROAD, NAAS, CO. KILDARE

ABP REF: SU 09.SU0015 (KCC REG. REF. 11/508)

1.0 INTRODUCTION

Rehab Glassco Limited[1] has retained Tom Phillips + Associates[2] to respond to the issues raised in the An Bord Pleanála *Request for Further Information*, dated 6 December 2013, in accordance with Section 132 of the *Planning and Development Act 2000-2013*.

This Response to the *Request for Further Information* has been prepared in association with Patel Tonra Limited, Environmental Solutions, who have provided a Report providing detailed Further Information in respect of the noise and dust monitoring. That Report is accompanied by environmental monitoring reports prepared by ORS Consulting Engineers:

- Environmental Dust Monitoring Report; and
- 2 No. Environmental Noise Monitoring Reports (January and February 2014).

2.0 RESPONSE TO REQUEST FOR FURTHER INFORMATION

The Board's *Request for Further Information*, dated 6 December 2013, invited the Applicant to submit further information in relation to noise and dust emissions.

Patel Tonra Ltd, Environmental Solutions prepared the Remedial Environmental Impact Statement (REIS) (March 2013), which accompanied the Application for Substitute Consent. Patel Tonra Ltd has prepared a cover report that accompanies the new noise and dust surveys.

[1] Unit No. 4, Osberstown Industrial Par, Caragh Road, Naas, Co. Kildare.
[2] 2-3 Roger's Lane, Lower Baggot Street, Dublin 2.

2.1 Dust

ORS Consulting Engineers carried out dust monitoring at 3 No. locations at the site boundary between 20 December 2013 and 20 January 2014. This robust contemporary survey demonstrates that all three monitoring locations were below the Waste Facility Permit dust limit of 350 mg m^2 day, a measurement which is typically used as a limit by the EPA in respect of dust monitoring at waste transfer and material recovery sites.

The monitoring results show that the monitoring locations closest to the nearest sensitive receptor (residential dwelling) are significantly below the WFP limit. Thus, the most recent monitoring demonstrates the proposed development is operating below the relevant limit and that the remedial and mitigation measures in place on the site are having the desired effect. The Board is invited to condition the ongoing operation of these mitigation measures as appropriate.

2.2 Noise

ORS Consulting Engineers also carried out noise monitoring outside the boundary close to the nearest sensitive noise receptor on 16 and 17 January 2014 with Rehab Glassco plant operating and again at the same location on 20 February while the Rehab Glassco plant was not operating.

The January noise survey concluded that noise for daytime was within the appropriate levels. In the January (plant operational) survey, noise limits were exceeded during the evening and night time monitoring periods. However, much of the noise at evening and night time was attributed to external noise sources and not the Rehab Glassco facility.

The survey was repeated in February in order to establish the evening and night time noise levels when the plant was not operational. This survey shows that the daytime and evening noise levels are unaffected by the Rehab Glassco plant being turned off. The results definitively confirm that the night time noise levels exceed the appropriate levels, irrespective of the operation of Rehab Glassco's plant.

An additional 2dB L_{Aeq} was recorded during noise monitoring at night time in January (plant operational) compared to when the motoring was carried out during February (plant off). ORS Consulting Engineers state the following in their assessment of the two night time results:

> "*this difference is not deemed to be significant and would not be attributable to operations at the Rehab Glassco Site. It is also noted that at the time of the 55dB reading an increase of truck movements was noted within the neighbouring warehousing facility site*."

The subject site is located within an active industrial estate and in proximity to roads and a motorway and these factors result in background noise levels that effect the noise emissions measured at the monitoring location. However, it is predicted that the Rehab Glassco plant noise emission will be below the proposed limit values, subject to the proposed mitigation measures. The Board is invited to condition the ongoing operation of these mitigation measures as appropriate.

3.0 CONCLUSION

We submit that the issues raised in the issues raised in the *Request for Further Information* has been comprehensively addressed in the REIS and the attached reports. The results of this round of monitoring demonstrates full compliance with the relevant standards for dust and noise and that the development is acceptable on environmental grounds having regard to the proper planning and sustainable development of the area in which it is situate.

We invite the Board to condition the mitigation measures for noise and dust, as per the enclosed Patel Tonra report (see Sections 2.3.11 to 2.3.23 and 3.3.7 to 3.3.13) including all proposed monitoring measures.

The results confirm there are no adverse impacts arising from dust emissions for the nearest sensitive receptor and the existing Rehab Glassco operation is not the primary source of noise impact at this location.

We trust the above is in order, should you require any clarification please don't hesitate to contact the undersigned.

Yours faithfully

_____

John Gannon
Director
Tom Phillips + Associates

patel tonra ltd
environmental solutions

For the Attention of
An Bord Pleanála
64 Marlborough Street,
Dublin 1

Our Ref.: RG0202/AI
Tel: 01 8020520
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e-mail: louise.odonnell@pateltonra.com

Date: 24th February 2014

Dear Sir/Madam,

Re: ABP Ref. SU 09.SU0015 – Application for Substitute Consent
Glass Recycling Facility - Rehab Glassco Ltd., Unit 4, Osberstown Industrial Park, Caragh Road, Naas, Co. Kildare

1.0 Introduction

1.1 Background

1.1.1 We refer to the Board's correspondence of 6th December 2013 regarding the aforementioned application.

1.1.2 The Board invited submission of the following further information:

1. *A contemporary robust baseline survey, conducted by a suitably qualified person, of the current levels of dust and noise at the site boundary (dust) and in the case of noise at the nearest sensitive receptor;*
2. *A statement of the predicted daytime and night time emission limits for dust and noise during the normal operation of the facility;*
3. *A programme of mitigation measures proposed in order to meet the predicted emission limits for dust and noise; and*
4. *A timescale for the implementation of the mitigation measures required in order to meet the predicted emission levels for dust and noise.*

1.2 Remedial EIS

1.2.1 Patel Tonra Ltd., Environmental Solutions prepared a Remedial Environmental Impact Statement (REIS) (March 2013) for the glass recycling facility at Unit 4, Osberstown Industrial Park, Caragh Road, Naas, Co. Kildare.

1.2.2 The REIS (March 2013) identified both remedial and mitigation measures. In the interests of clarity, the following definitions apply:

- Remedial measures are measures undertaken or proposed to be undertaken to remedy any significant adverse effects on the environment[1]. Timeframes for remedial measures have been specified.
- Mitigation measures are measures designed to avoid, reduce, remedy (when an adverse effect is replaced with a more acceptable effect) or compensate for impacts[2].

1.3 Review of Remedial / Mitigation Measures

1.3.1 Remedial and mitigation measures have been reviewed by Patel Tonra Ltd., Environmental Solutions, based on the results of recent monitoring, the requirement to comply with emission limit values, and the implementation of remedial/mitigation measures at the facility, which post-date the REIS (March 2013).

1.3.2 Patel Tonra Ltd., Environmental Solutions conducted a site inspection on 29th January 2014. Particular attention was paid to operations at the Drying Plant and control of emissions from this activity.

1.3.3 Patel Tonra Ltd., Environmental Solutions, on the instruction of the Applicant, provides the following further information in relation to dust and noise.

2.0 Dust

2.1 *A contemporary robust baseline survey, conducted by a suitably qualified person, of the current levels of dust at the site boundary.*

2.1.1 ORS Consulting Engineers were commissioned by Rehab Glassco to conduct dust monitoring at the site boundary.

2.1.2 Dust deposition was monitored at three locations at the site between the 20th December 2013 and 20th January 2014.

2.1.3 The report is attached as **Appendix 1**.

2.1.4 The report concludes that "*The dust fall concentrations are laid down in the waste facility permit no. WFP-KE-08-0357-01, which specifies a limit of 350 mg* m^{-2} *day*$^{-1}$*. The dust levels measured on site do not exceed this limit*."

2.1.5 Dust was monitored at three locations on site, i.e. D1, D2 and D3. Results for dust monitoring at D1 and D2 were significantly below the emission limit value. Results for dust monitoring at D3, whilst below the emission limit value, were notably higher than D1 and D2. D3 is located on the north-eastern boundary of the site, in close proximity to the Drying Plant building. There are no sensitive receptors located at, or adjacent to, D3.

[1] Section 177F of the *Planning and Development (Amendment) Act 2010*

[2] EPA (2003) *Guidelines on the Information to be contained in EISs*

2.2 ***A statement of the predicted emission limits for dust during the normal operation of the facility.***

2.2.1 It is recommended that an emission limit value for dust is conditioned at 350 mg/m^2/day, as per the existing Waste Facility Permit, WFP-KE-08-0357-01, Schedule B.2.

2.2.2 The EPA (Dec. 2011) *BAT Guidance Note on Best Available Techniques for the Waste Sector: Waste Transfer and Materials Recovery* recommends a Trigger Level for Total Dust Deposition of 240-350 mg/m^2/day. It is noted that dust monitoring locations at Rehab Glassco are on-site, and are a considerable distance from potential neighbouring receptors; therefore it is our opinion that the upper range of the EPA emission limit value is appropriate for the monitoring locations D1, D2 and D3 at the Rehab Glassco facility.

2.2.3 Dust emissions at the prescribed monitoring locations are predicted to be below an emission limit value of 350 mg/m^2/day, with implementation of the remedial/mitigation measures outlined in **Section 2.3** below.

2.3 ***A programme of mitigation measures proposed in order to meet the predicted emission limits for dust. A timescale for the implementation of the mitigation measures required in order to meet the predicted emission levels for dust.***

2.3.1 Remedial and mitigation measures for dust were included in the REIS (March 2013), in Sections 5.6 and 5.8, respectively. These remedial and mitigation measures have been reviewed by Patel Tomra Ltd., Environmental Solutions, as described in **Section 1.3**.

2.3.2 The following items have been considered:

- Remedial Measures which have been completed;
- Remedial Measures yet to be implemented; and
- Mitigation Measures which are in place and are required to be implemented on an ongoing basis.

Remedial Measures – completed (Dust)

2.3.3 The following remedial measures have been put in place for dust management (timeframe provided).

2.3.4 A new industrial vacuum system was installed in the Drying Plant on the 18th December 2013 – see specification in **Appendix 2** and photographs in **Appendix 3**. This has resulted in a marked improvement in housekeeping and dust levels in the Drying Plant building, including the clean-up of spilled product/dust from the floor area, plant, equipment, conveyors and ledges. Use of the vacuum system and daily spot and targeted cleaning in the Drying Plant is identified as a mitigation measure, which is required to be implemented on an ongoing basis, as **Section 2.3.12**.

2.3.5 A new water misting system was installed on the two doors at the Drying Plant in on the 15th January 2014, to prevent the egress of dust emissions from the Drying Plant building. See photographs in **Appendix 3** and specification details in **Appendix 4**. Visual observation of the misting system during the Patel Tonra Ltd. site inspection of 29th January 2014 indicated that it was very effective in reducing dust emissions from the Drying Plant building to the external environment. Deployment of the misting system at the Drying Plant is identified as a mitigation measure, which is required to be implemented on an ongoing basis, as **Section 2.3.13**.

2.3.6 The primary dust suppression system (e.g. at conveyors, material drop points/chutes/hoppers) in the Drying Plant building was modified at the end of December 2012, to include the installation of a new fan which provided additional extraction capacity, and new dust hoods at critical points. In addition, improvements have been made in recent months to seal/contain transfer chutes and openings in the Drying Plant to prevent dust emissions (see photograph in **Appendix 3)**.

2.3.7 2 No. water guns were installed at the facility in November 2013 (affixed externally on the Main Process building, on the south-western and north-eastern sides). The water guns operate at a steady rotation speed and provide the required distance and water volume intensity for water distribution in the main yard areas. See photographs in **Appendix 3** and specification details in **Appendix 5**. Deployment of the water guns at the Main Process building is identified as a mitigation measure, which is required to be implemented on an ongoing basis, as **Section 2.3.17**.

2.3.8 A water bowser was purchased by the operator to minimise dust in concrete hard-standing areas. Its use on site commenced in February 2013; it is used on an ongoing basis, under dry weather conditions. Deployment of the water bowser is identified as a mitigation measure, which is required to be implemented on an ongoing basis, as **Section 2.3.18**.

2.3.9 Repeat dust monitoring was completed at the site in December 2013 - January 2014; results for all three dust monitoring locations were below the relevant Emission Limit Value (see **Section 2.1**). Routine dust monitoring is identified as a mitigation measure, which is required to be implemented on an ongoing basis, as **Section 2.3.21**.

Remedial Measures – to be implemented (Dust)

2.3.10 No additional dust remedial measures are prescribed. Ongoing dust mitigation is considered in **Section 2.3.11** below.

Mitigation Measures – to be implemented on ongoing basis (Dust)

2.3.11 The following dust mitigation measures are in place, and are proposed to be implemented on an ongoing basis.

2.3.12 Continued use of the vacuum system in the Drying Plant and daily cleaning after plant shut-down, to ensure clean-up of spilled product/dust from the floor area, plant, equipment, conveyors and ledges. The vacuum system allows for spot cleaning of loose dust and debris.

2.3.13 Continued deployment of the misting system at the Drying Plant during operating hours of the Drying Plant to minimise emissions to the external environment.

2.3.14 Continued monthly inspection of on-site plant and equipment. The maintenance inspections are documented and records retained on site. Any required corrective actions are identified, reported to the management team and actioned accordingly.

2.3.15 All emissions from the Drying Plant are managed through the plant's primary and secondary (whole-building) air suppression and filtration system, which includes a combination of cyclone filters and bag-house filtration systems. Continued implementation of a filter checking, maintenance and replacement programme, with filters replaced regularly (and annually, as a minimum). Records of the maintenance/replacement programme will be retained on site.

2.3.16 Continued storage of fine product (i.e. output from the Drying Plant <0.2mm), which is light and has the potential to become wind-blown, in sealed bags and covered/wrapped.

2.3.17 Continued deployment of the water guns positioned at the Main Process building, depending on weather/site conditions.

2.3.18 The continued use of the water bowser during spells of dry weather, or as otherwise may be required, as a dust control measure.

2.3.19 The continued regular sweeping of the yard/hardstanding areas using a mechanical sweeper.

2.3.20 Continued implementation of regular and routine housekeeping measures on site, i.e. dust cleaning/wiping and sweeping.

2.3.21 Continued bi-annual dust monitoring, in line with regulatory requirements, will be undertaken (one round of dust monitoring per annum will be undertaken between the months of May to September, in line with standard EPA licensing requirements). Results will be reported to the regulator. Any exceedance of prescribed limit values will be recorded as an incident, with an appropriate level of response identified.

2.3.22 Continued annual monitoring of point source emissions from the Drying Plant, in line with regulatory requirements. Emission Limit Values will be agreed with the EPA, as part of the waste licensing process. Any exceedance of prescribed limit values will be recorded as an incident, with an appropriate level of response identified.

2.3.23 The dust management remedial and mitigation measures outlined herein will be implemented as part of an Environmental Management System (EMS). The facility will designate a suitably qualified and experienced manager, who will be responsible for implementing the EMS. The Applicant is willing to accept a condition in this regard.

3.0 Noise

3.1 *A contemporary robust baseline survey, conducted by a suitably qualified person, of the current levels of noise at the nearest sensitive receptor.*

3.1.1 ORS Consulting Engineers were commissioned by Rehab Glassco to conduct an environmental noise survey at the Rehab Glassco facility.

3.1.2 Monitoring was conducted at one noise sensitive location (NSL1) outside the boundary of the facility on the 16th and 17th of January 2014. The report is attached as **Appendix 6**. The report concludes that "*Noise levels for Day Times at the Noise Sensitive Location are within acceptable limits as set out in [EPA Guidance Note] NG4, however there is exceedance during the evening and night-time monitoring period which was very clearly attributable to external noise sources which are discussed further in this report.*" The report notes that, during the monitoring period, "*noise from the Rehab Glassco facility is barely audible and intermittent*".

3.1.3 As stated in **Section 3.1.2** above, results from the 16-17th January 2014 noise monitoring period were seen to exceed recommended levels, with some tonal noise present. It was concluded that some of this exceedance could be attributed to external noise sources that were outside the control of Rehab Glassco. In an attempt to conclusively identify these external noise sources and the extent of their impact, an additional period of noise monitoring was conducted when all operations at the Rehab Glassco plant were stopped; this environmental noise survey was conducted on the 20th-21st February 2014 at 1 noise sensitive location (NSL1) outside the boundary of the Rehab Glassco facility[3]. This noise monitoring report (Rehab Glassco operations off) is attached as **Appendix 7.**

3.1.4 Noise levels at the Noise Sensitive Location for the 20th-21st February 2014 monitoring period (Rehab Glassco operations off) were outside acceptable limits as set out in [EPA Guidance Note] NG4. The noise monitoring report (**Appendix 7**) notes that "*as the Rehab Glassco Plant was not in operation during this period of monitoring, this exceedance can clearly be attributable to external noise sources….. it can be concluded that any exceedance in noise limits is attributable to external influences such as the constant traffic noise associated with the R409, M7 and the adjacent 24hr Warehousing Facility and not the Rehab Glassco facility.*"

3.2 *A statement of the predicted daytime and night time emission limits for noise during the normal operation of the facility.*

3.2.1 It is recommended that an emission limit value for noise is conditioned at 55 dB(A) for daytime (07:00 – 19:00); 50 dB(A) for evening-time (19:00 – 23:00); and 45 dB(A) for night-time (23:00 – 07:00), as per EPA Guidance NG4[4].

3.2.2 Noise emissions from the Rehab Glassco Ltd. facility are predicted to be below the emission limit values stated in **Section 3.2.1** above, with implementation of the remedial/mitigation measures outlined in **Section 3.3**; however it is noted that background noise levels at NSL1 may exceed these emission limit values as a result of external noise sources, e.g. noise from neighbouring activities and/or background road/motorway traffic.

3.3 *A programme of mitigation measures proposed in order to meet the predicted emission limits for noise. A timescale for the implementation of the mitigation measures required in order to meet the predicted emission levels for noise.*

3.3.1 Remedial and mitigation measures for noise were included in the REIS (March 2013), in Sections 6.6 and 6.8, respectively. These remedial and mitigation measures have been reviewed by Patel Tonra Ltd., Environmental Solutions, based on the results of recent monitoring, the requirement to comply with emission limit values for noise, and the implementation of remedial/mitigation measures at the facility, which post-date the REIS (March 2013).

[3] The position of the noise monitoring location, NSL1, outside of the site, next to the boundary to the nearest dwelling, remained the same for all noise surveys.

[4] EPA (2012) *Guidance Note for Noise: Licence Applications, Surveys and Assessments in Relation to Scheduled Activities (NG4)*

3.3.2 The following items have been considered:

- Remedial Measures which have been completed;
- Remedial Measures yet to be implemented; and
- Mitigation Measures which are in place and are required to be implemented on an ongoing basis.

Remedial Measures – completed (Noise)

3.3.3 The following remedial measures have been put in place for noise management (timeframe provided).

3.3.4 As per Additional Information submitted to An Bord Pleanála (Tom Phillips & Associates, 09/07/2013), the Drying Plant has ceased evening-time and night-time operations, i.e. the Drying Plant no longer operates between 19:00 and 07:00. The Applicant is happy to accept a condition in this regard, on the basis that the facility (except the Drying Plant) continues to operate on a 24-hour basis. This restriction is identified as a mitigation measure, which is required to be implemented on an ongoing basis, as **Section 3.3.9**.

3.3.5 A noise barrier/screen was installed at the western site boundary (in proximity to the nearest residential neighbour) in January 2013. A noise barrier/screen has also been installed at the loading bay of the Main Process building. See photographs in **Appendix 3**.

Remedial Measures – to be implemented (Noise)

3.3.6 No additional noise remedial measures are prescribed. Ongoing noise mitigation is considered in **Sections 3.3.7** below.

Mitigation Measures – to be implemented on ongoing basis (Noise)

3.3.7 The following noise mitigation measures are in place, and are proposed to be implemented on an ongoing basis.

3.3.8 No material is accepted into or removed from the facility between the hours of 19:00 and 07:00; therefore there is no related HGV noise at this time.

3.3.9 Continued restriction of operation of the Drying Plant to daytime hours only, i.e. 07:00 to 19:00. The Applicant is happy to accept a condition in this regard, on the basis that the facility (except the Drying Plant) continues to operate on a 24-hour basis.

3.3.10 Continued implementation of a plant and equipment maintenance procedure to minimise noise levels. Any new equipment acquired will conform to EU noise standards.

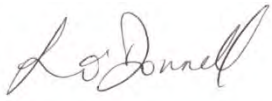
3.3.11 Continued monthly inspection of on-site plant and equipment. The maintenance inspections are documented and records retained on site. Any required corrective actions are identified, reported to the management team and actioned accordingly.

3.3.12 Any noise complaints will be recorded and investigated, with corrective actions identified, as appropriate.

3.3.13 Ongoing noise monitoring to be conducted annually (as a minimum), or as per waste regulatory requirements. Any incidents will be reported to the regulator, with corrective actions identified, as appropriate.

Please do not hesitate to contact us, should you require any further information or clarification.

Yours Sincerely
for Patel Tonra Limited



Louise O'Donnell
Director

Vip Patel
Director

List of Appendices

Appendix 1:	ORS Consulting Engineers (27/01/2014) *Environmental Dust Monitoring Report*
Appendix 2:	Specification details for vacuum system in the Drying Plant building
Appendix 3:	Photographs
Appendix 4:	Specification details for misting system at the Drying Plant building
Appendix 5:	Specification details for water canons positioned at the Main Process building
Appendix 6:	ORS Consulting Engineers (January 2014) *Environmental Noise Survey*
Appendix 7:	ORS Consulting Engineers (February 2014) *Environmental Noise Survey*

Appendix 1:

ORS Consulting Engineers (27/01/2014)
Environmental Dust Monitoring Report

patel tonra ltd
environmental solutions

Patel Tonra Ltd. *for*
Rehab Glassco Ltd.

Feb. 2014

Engineering a Sustainable Future

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Environmental Dust Monitoring
Rehab Glassco,
Unit 4 Osberstown Industrial Park,
Caragh Road,
Naas,
Co. Kildare.

Client	Revision	Date	Compiled	Checked	Approved
Rehab Glassco	D3	10/02/2014	DOD	DH	DC
Unit 4 Osberstown Industrial Park, Caragh Road, Naas, Co. Kildare					

Index

Executive Summary

Dust deposition was monitored at three locations at the Rehab Glassco site, Osberstown Industrial Park, Caragh Road, Naas, Co. Kildare between the 20th December 2013 and 20th January 2014.

The dust fall concentrations are laid down in the waste facility permit no. WFP-KE-08-0357-01 which specifies a limit of 350 mg m^{-2} day^{-1}. The dust levels measured on site do not exceed this limit.

1 Scope

ORS Environmental Consultants were commissioned by Zeki Mustafa of Rehab Glassco to carry out environmental dust monitoring at the Rehab Glassco plant at Caragh Rd, Naas, Co. Kildare. Monitoring was as a result of requirements set out in the waste facility permit no. WFP-KE-08-0357-01.

The dust deposition monitors were installed on Friday 20th December and left in situ for 31 days. The monitors were collected on Monday 20th January 2014.

Dust is a natural occurring product of the environment with typical background levels in the region of <70mg m^{-2} day^{-1} TA Luft VDI 2119 guidelines. Human activities will generally increase this level due to the creation of hard standing areas, vehicle movements and dust associated with the reduction of dampened areas.

Dust generation within the Rehab Glassco plant is generated from traffic movements within the site, stock piling material, material movement and general day to day activities. Dust monitoring is carried out at the site boundaries to ascertain the potential dust leaving the site.

2 Monitoring Locations

Environmental dust deposition monitoring was carried out at the predetermined locations D1, D2 & D3. The monitoring locations are detailed below in Table 1 and presented in the attached map in Appendix B.

Table 1. Monitoring Locations

Monitoring Locations	Description
D1	Located on the South western boundary of the site adjacent site entrance
D2	Located to the north boundary of the site
D3	Located on the eastern boundary of the site

3 Activities on Site

Activities that take place on the site that may generate dust include the entering / exiting of vehicles from the site via the site entrance, stock piling material and vehicle movements within the site etc.

4 Methodology

The standard method used for monitoring dust deposition is VDI 2119 *'Measurement of Dustfall, Determination of Dustfall using Bergerhoff Instrument (Standard Method)'*, (EPA Guidance Notes). With this method, atmospheric deposits are collected in vessels over a 30-day period ± 2 days. The collected samples are then concentrated and the residue subjected to gravimetric weight analysis.

Collecting jars with a volume of 1.5 litres were placed in the deposition stands. The top of the jar was positioned 1.5 metres above ground level.

4.1 Jar Preparation

Prior to sampling the jars and lids were acid washed and dried in a fan assisted oven at 100°C. The lids were placed on the jars and labelled. On arrival at the site the lids were removed and the jars were placed in wire containers for a period of 30days (± 2 days).

4.2 Sample Preparation

On completion of the collection period the jars were removed and immediately sealed air tight and transported directly to the laboratory.

Sample preparation and analysis was carried out in accordance with the VDI 2119 standard.

5 Calculations

Results were calculated from the formula correlating the dust collected, sampling period and the collecting surface of the jars. Results were expressed as mg m^{-2} d^{-1}.

6 Results

6.1 Dust Gauges

Dust Deposition Results
Results are quoted as mg m^{-2} d^{-1} (milligrams per metre^2 per day)

Monitoring Locations	Dust Deposition mg m^{-2} d^{-1}	Waste Facility Permit Limit 350 mg m^{-2} d^{-1}
D1	45	350
D2	51	350
D3	326	350

The quantity of dust fall is determined as the difference between the gross weight of the evaporating dish and the final weight of the evaporating dish (containing the residue). The quantity is then converted into general reference quantities (mg m^{-2} d^{-1}) using the following formula:

$$X = \frac{G}{F.T}$$

Where;

X = dustfall in g m^{-2} d^{-1}
F = collecting surface in m^2
G = mass of dustfall in g
T = sampling period in days

7 Evaluation of Results

The Rehab Glassco monitoring locations are deemed to be indicative of the level of dust likely to arise from the on-site activities. Monitoring stations were located within the site boundary and were fully exposed to typical on-site activities.

The schedule of conditions for the Rehab Glassco Site states that the total dust depositions arising from the on-site activities shall not exceed 350 mg m^{-2} d^{-1} averaged over a continuous period of thirty days at any position along the boundary of the development.

8 Conclusion

Dustfall limits are laid down in the waste facility permit for the site or issued by the Local Authority or EPA. The dust fall concentrations laid down specifies a limit of 350 mg m^{-2} d^{-1}.

Dust concentrations at all monitoring points are now below the 350 mg m^{-2} d^{-1} limit compared to the previous round of monitoring. It should be noted that the dryer is located adjacent to monitoring location D3 which would result in the elevated dust levels at this location. However it is noted that it is still within limits.

In recent months Rehab Glassco have implemented a number of dust abatement measures to their plant operation in an effort to reduce the amount of dust particles following the previous monitoring period. Shown below is a comparison between current results and those calculated from the previous monitoring period.

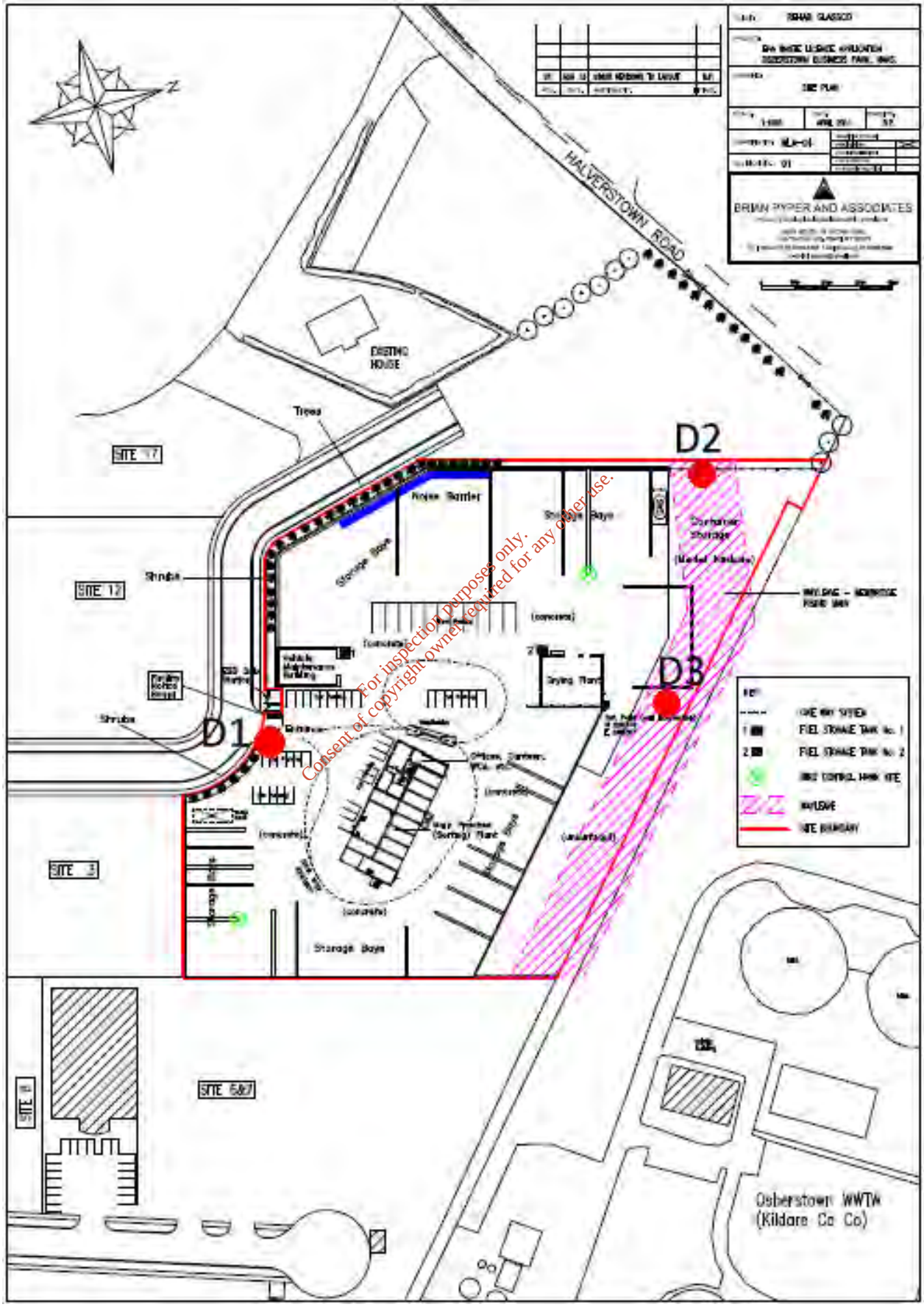
Monitoring Location	Dust Deposition July 2013/August 2013 (mg m^{-2} d^{-1})	Dust Deposition December 2013/January 2014 (mg m^{-2} d^{-1})	% Reduction in Dust Deposition
D1	605	45	93%
D2	367	51	86%
D3	850	326	62%

These figures show that the measures employed by Rehab Glassco to reduce the level of measured dust particles from the site, appear to have had a hugely positive effect on dust levels from the site.

Appendix A – Dust Analysis

	Units	Dust		
		D1	D2	D3
Date In (Oven)	dd/mm/yy	20/01/14	20/01/14	20/01/14
Date Out (Oven)	dd/mm/yy	21/01/14	21/01/14	21/01/14
Mass of Undissovled Solids	grams	0.039	0.044	0.283
Calculation of Dust Deposition	mg m^{-2} d^{-1}	44.93	50.7	326.15
Description of Dust		Traces of grey dust matter	Traces of grey dust matter	Large traces of grey dust matter with the presence of plant & organic material
No. of Days Exposed		31	31	31

Appendix B – Dust Monitoring Locations



Appendix 2:

Specification details for vacuum system in the Drying Plant building

patel tonra ltd
environmental solutions

Patel Tonra Ltd. *for*
Rehab Glassco Ltd.

Feb. 2014

DISAB Industrial Cleaning Machines

Suction unit DISAB BagVac™

BagVac is an electrical powered suction unit mounted onto a rigid stand equipped with retractable legs. The unit is designed for both mobile use and fixed installations and also for collection of material into Big-Bag.

BagVac is an electrical powered suction unit mounted on a rigid stand equipped with retractable legs. With this type of legs its easy to adjust the discharge outlet height, to fit any size of big-bag used. The unit is in most applications used as a free standing suction unit with the connection of a 3" or 4" hose.

However the unit is also suitable for fixed installations, connected to a fixed installed pipe system with multiple suction outlets.

WHY BagVac

- Robust unit for temporary mobile use
- Automatically big-bag filling of collected material
- Power alternatives 12,5 or 16,5 kW
- CEE power intake for 32 or 63 A respectively
- Filter system for dry and moist material
- Automatically ATM filter cleaning system, without compressed air
- Complete start/stop and controls system
- Retractable legs for easy adjustment to various big-bags
- Various options of safety filters

OPTIMAL SOLUTION

The unit is easily manoeuvred using a standard forklift truck or crane. As the unit is designed and equipped with outlet for big-bag collection, it is also frequently used for material that shall be recycled or needs to be packed into bags. .

The high suction capacity together with its flexible discharge system makes the unit very useful in most vacuum cleaning situations. Due to its flexibility the BagVac unit gets access to most areas where cleaning needs to be carried out without the use of fixed pipe network

OPERATION

The vacuumed material is first separated in a special designed fall chamber/hopper with inlet wear protection. In this section all heavier or larger material will by gravity fall into the bottom of the hopper. From this section the air stream will continue to the main filter system, where the remaining fine airborne dust will be separated. Collected material from both the above sections is commonly collected in the conical hopper in the unit.

Discharge of material is made via the automatically operated balance valve at the bottom of the hopper. Discharge is executed parallel to each filter cleaning sequence, which normally takes place each 30 minute.

Cleaning of filters is automatically and executed by a filter cleaning valve (ATM) located between the filter and the vacuum pump. When this valve is activated and opens up, a counter flow of air is sucked in backwards trough the filter bags, thus cleaning all filter bags simultaneously in a very short period. There after the valve is closed again. Cleaning intervals are normally each 30 minutes, and lasting for only app. 20 seconds after which full vacuum is restored. This valve also ensures that when the unit is stared it starts unloaded, and vacuum load is introduced app. 10 seconds after Star/Delta sequence is ended.

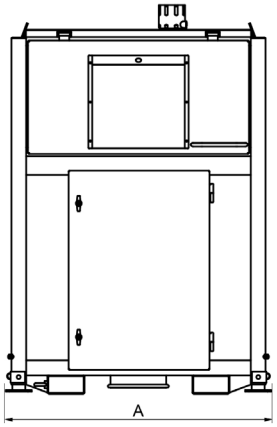
All functions for the operation of the unit is controlled from the built in electrical panel.

TYPICAL APPLICATIONS

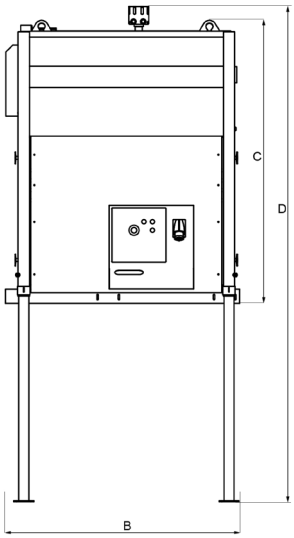
BagVac is in first hand designed for temporary vacuum/ cleaning needs, where the vacuumed material shall be collected in big-bags. At the same time the unit shall be robust, powerful and easy to transport at site. The unit is aimed for general cleaning, collection of spillages, of reuse of for example shot blasting abrasive in conjunction with surface treatment.

TYPICAL USERS

Shot blasting- and surface treatment industry, concrete- and cement industry, chemical industry, steel- and aluminium works, paper- and pulp industry, sawmills, wood pellets, plastic industry, bakeries, incineration- and power plants, etc



Transport



Operation

Suction unit DISAB BagVac™

VACUUM PUMP

The vacuum producer is a turbo pump of side channel blower type, with direct coupled motor. Pump and motor is mounted on an anti-vibration support and to the steel structure of the unit.
Vacuum pump is equipped with a spring loaded safety vacuum valve, preventing the unit not to exceed its maximum operating vacuum level.
Inlet- and outlet silencers secures low noise operation.

FILTER SYSTEM

The filter compartment contains a cassette filter with flat filter bags. Filters are made from special treated polyester needle felt. Service of filters is easy accessible from the clean gas side and from the outside of the unit.
The unit is equipped with a vacuum assisted ATM (air- repulse) filter cleaning system. When activated, a large air inlet will ensure a fast backwards air direction through all the filter bags simultaneously, thus in an efficient way knocking off collected dust from the filter surfaces.
Filter Surface: 10 m2

DUST BIN

Type:	Conical hopper
Hopper volume:	0,5 m³
Bottom valve:	250 mm, dust tight balance valve, Big-Bag
Discharge:	Automatically, at filter cleaning

MISCELLANEOUS

Filter class:	E.M. IEC EN 60335.2-69
Electrical:	IP 65, 3x400V 50Hz. incl. Star/Delta-start, motor overload, vacuum meter
Dust inlet:	108 mm
Steel:	S 235 JG2
Painting:	Class C 2 , colour RAL 3003 red

OPTIONS

- DP-Gauge with Ball Valve
- Level Control; Paddle or Vibrating type
- Line (Circuit) Breaker
- Pre Designed for Remote Control 24 V
- Radio Remote Control (CE, Carrier vave interr.)
- Timer Auto Stop
- Control Filter 10 m2
- DP-Switch
- ATEX max ST1 Execution

Item/Model		BagVac-125	BagVac-165
Dimensions, mm	A	1430	1430
	B	1650	1650
	C	1990	1990
	D	3480	3480
Weight, kg (empty)		1030	1130
Max Vacuum, mbar		290	400
Max. Air Volume m³/h (unloaded)		1100	1100
Electrical Motor, kW		12,5	16,5
Voltage Frequency, V/Hz		400/50	400/50
Filter surface, m²		10	10
Noise Level dB(A) (at 1 m/5 m distance)		75/70	75/70
Dimension dustinlet, dia mm		108	108
Layout drawing		SD-10043	SD-10043

201303

We reserve the right to alter any design of the unit without prior notice.

Manufacturer:
DISAB-TELLA AB
Cedersdalsvägen 1
SE-186 40 Vallentuna
Sweden

Tel: +46 (0) 8 514 505 70
Fax: +46 (0) 8 511 754 66
E-mail: industrial@disab.com
www.disab.com

Distributor:

Appendix 3:

Photographs

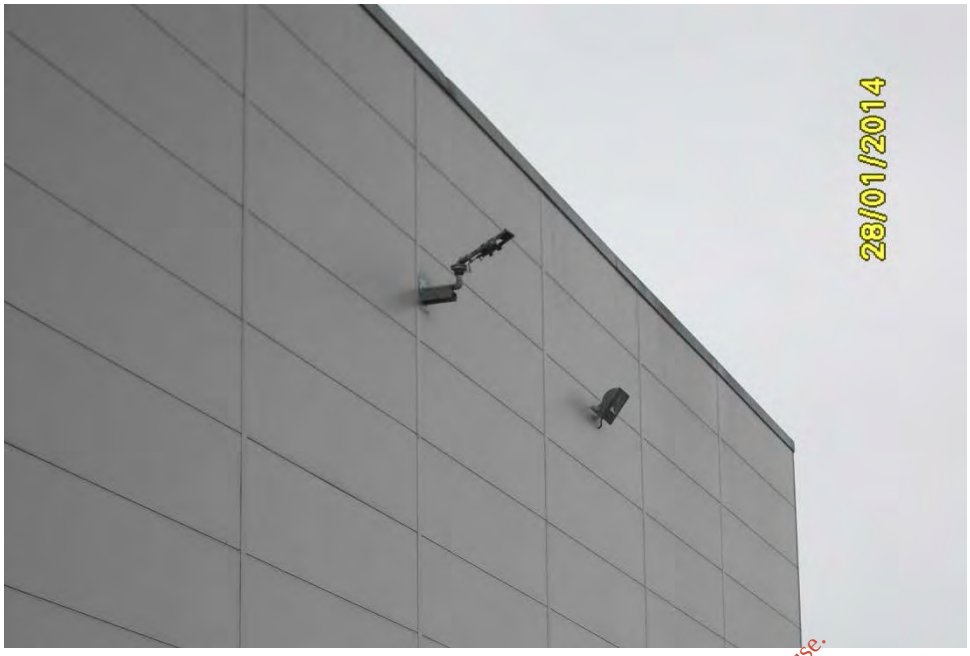
patel tonra ltd
environmental solutions

Patel Tonra Ltd. *for*
Rehab Glassco Ltd.

Feb. 2014

Index of Photographs

Photograph 1: Water gun #1 positioned at Main Process building



Photograph 2: Water gun #2 positioned at Main Process building

Photograph 3: Misting system at Drying Plant (1)

Photograph 4: Misting system at Drying Plant (2)

Photograph 5: Misting system at Drying Plant (3)

Photograph 6: Misting system at Drying Plant (4) – spray nozzles

Photograph 7: Industrial vacuum system in Drying Plant (1)

Photograph 8: Industrial vacuum system spot cleaning hose in Drying Plant (2)

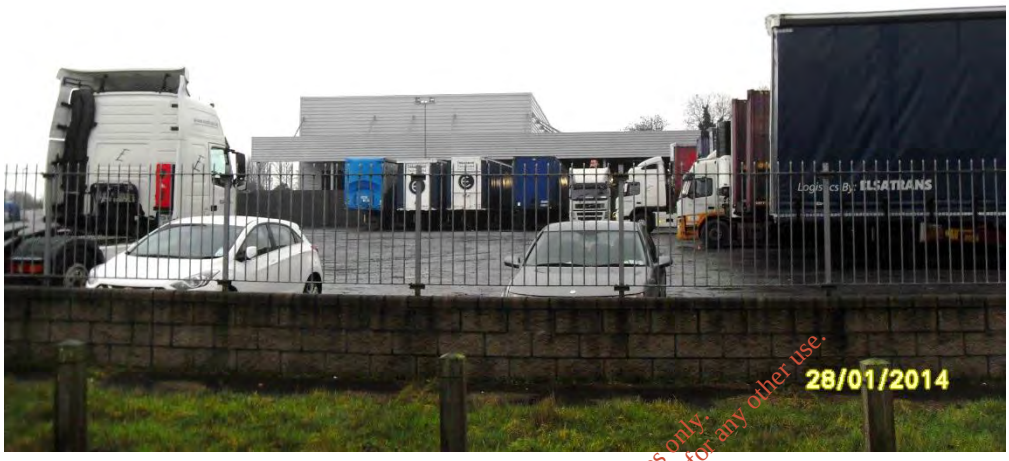
Photograph 9: Sealed / contained chutes / silos to storage bags in Drying Plant (2)

Photograph 10: Product from Drying Plant – bagged and sealed

Photograph 11: Noise barrier and boundary planting adjacent to neighbouring property (1)

Photograph 12: Noise barrier and boundary planting adjacent to neighbouring property (2)

Photograph 13: Neighbouring logistics facility



Appendix 4:

Specification details for misting system at the Drying Plant building

patel tonra ltd
environmental solutions

Patel Tonra Ltd. *for*
Rehab Glassco Ltd.

Feb. 2014

Environmental Control Systems

Unit 2 Oak Lane Ind. Est., Oak Lane
Kingswinford, West Midlands
DY6 7JD, UK
Tel +44 1384 402991
Fax +44 1384 402989
sales@e-cs.co.uk www.e-cs.co.uk

Quotation

David Farrelly
Rehab Glassco Ltd

Quotation Ref: MS18/13
Date: 10/07/13

Dear David,

Further to your email, please find below our quotation for a misting system to meet your requirements.

We recommend installing 5 x 0.3mm nozzles across the smaller door, and 15 around the larger door spaced 50cm apart. The two lines of misting nozzles will be joined together and the pump can be positioned anywhere within 20m. The system is very easy to install and adapt in order to finetune the number and position of nozzles. We have included a few extra nozzles and fittings in order to give you a small stock of spares.

Part No.	Item	Quantity
RR4	RR2 - 4L/min misting pump 240V 0.75kW 4A	1
0305001	Triple filter – 5 + 10 + 20 micron	1

0201000	3/8” 100 cm straight black high pressure tubing	15
0201001	3/8” Black high pressure tubing – coil	25m
0205010	Low pressure tubing for incoming water supply from filter	1m
0301013	3/8” Stainless steel clamps for HP tubing	40
NM30BH	0.3mm Nozzles	40
0301005	3/8” Elbow fitting	3
0301004	3/8” T fitting	5
0301008	3/8” End plug	5
0301003	3/8” Tube coupling	1
0305009-B	3/8” High pressure in line filter	1

The system will require a maximum of 4L per minute of water at 2 bar

pressure. Our price for the above scheme is XXXXX plus Vat.

Delivery charge **XXXX**

Optional Extras –

1 x Ultra Violet Water Filter **XXXX**

I trust that this is satisfactory and look forward to hearing from you soon.

Kind Regards,

Kieran Naik
Projects Manager

Appendix 5:

Specification details for water canons positioned at the Main Process building

patel tonra ltd
environmental solutions

Patel Tonra Ltd. *for*
Rehab Glassco Ltd.

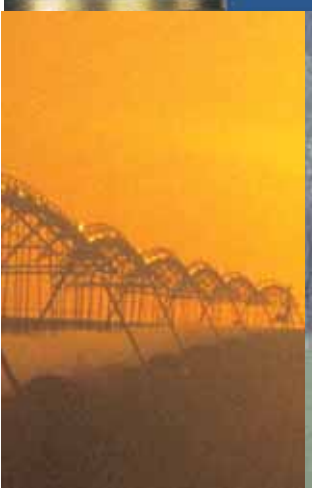
Feb. 2014

komet®
innovative irrigation products

TWIN®

Big Volume Guns >>> Weitstrahlregner

for Travellers, Solid-sets & Pivots, >>> für Maschinen, Anlagen & Pivots



- Superior performance
- Maintenance free
- Easy to use
- Versatile in its application
- Slow reverse operation
- Variable trajectory angle

- Hervorragende Leistung
- Keine Wartung
- Einfache Handhabung
- Flexible Anwendung
- Langsamer Rücklauf
- Veränderbarer Strahlwinkel

THE KOMET ADVANTAGE > superior performance through innovative technology

Twin

Travellers
Beregnungsmaschinen

Pivots
Kreisberegnungen

The perfect choice: excellent results for all types of applications

Twin Big volume Guns are the result of decades of research, development and innovation in irrigation products. The unique operational advantages, combined with high quality manufacturing standards make the Twin the finest big volume gun available!

Die perfekte Wahl: optimale Resultate mit allen Beregnungssystemen

Der Twin verkörpert den neuesten Stand der Technik und setzt neue Maßstäbe in der Anwendung, Bedienung und Leistung. Die Flexibilität im Gebrauch ist beispiellos, läßt keine Wünsche offen und ist für alle Beregnungssysteme gleichermaßen geeignet.

Solid-Set applications
Ortsfeste und bewegliche Anlagen

industrial applications / Dust suppression
Industrieanwendungen / Staubfreihaltung

Optimal flexibility for all applications

Innovative drive system: excellent response at any system pressure

Optimale Flexibilität für jeden Einsatz

Innovatives Antriebssystem: ein ausgezeichnetes Ansprechverhalten in allen Druckbereichen

Drive system: powerful, efficient stream diffusion
Innovatives Antriebssystem: wirkungsvoller Antrieb

Dispersed jet at the start-up procedure of the gun
Gefächerter Strahl beim Anfahren des Regners

Excellent uniformity / Hervorragende Verteilung

The unique drive system allows for a much better stream diffusion. The operational performance over the whole pressure range is excellent. An additional advantage of this unique drive system is that at the start-up procedure of the gun, the normally compact water stream is dispersed into a spray before the gun is set in motion. This dispersed jet greatly reduces crop damage, furrows and run-off. Also, because of the Twin's superior distribution close to the gun, spreader nozzles are not required.

Durch den speziellen Antrieb wird eine bessere und wirkungsvolle Strahlauflösung erzielt. In den unterschiedlichen Druckstufen ist die Arbeitsweise ausgezeichnet. Außerdem wird durch das System des Antriebes der Strahl beim Anfahren des Regners breit gefächert. Es entsteht kein schwerer, kompakter Strahl, dadurch werden Furchen weitgehend vermieden. Zusätzlich sind durch die gute Nahverteilung Nebendüsen, wie oft verwendet, überflüssig.

Slow reverse / Langsamer Rücklauf

The gun's slow, steady rotation will greatly reduce vibration in both directions. The significant advantage is that the carts of hose reel travellers stay straight on track and the risk of tip-over is greatly reduced. This smooth operation feature is essential for all irrigation systems, especially as an end gun on center pivots where stress on the end boom is kept to a minimum.

Die ruhige, vibrationsarme Gangart des Regners, sein Rücklauf ohne heftige Schläge beim Wenden haben den Vorteil, daß bei Beregnungsmaschinen die Regnerwagen nicht aus der Spur laufen und die Gefahr des Umkippens derselben vermindert wird. Diese ausgewogene Betriebsweise eignet sich auch hervorragend für den Einsatz als Endgun auf Pivots, aber auch in ortsfesten und beweglichen Anlagen.

Patents and Int'l Patents Pending

Innovative drive system for a smooth and steady operation of the gun
Ruhige, vibrationsarme Gangart des Regners

Automatic adjustment / Automatische Einstellung

Pressure variations and nozzle changes are no longer a problem. Manual adjustments are not needed. The innovative drive system adapts its operation automatically to all variations of operating conditions, contributing to the gun's great versatility. The drive system is mounted on a strong and rigid drive arm.

Druckschwankungen und Düsenwechsel sind nicht länger ein Problem, da manuelle Adjustierungen wegfallen. Der innovative Antrieb paßt sich selbsttätig allen Änderungen der Einsatzbedingungen an und verleiht dem Regner dadurch seine große Flexibilität.

Steady rotation speed for uniform water distribution

Automatic brake system: correct brake force at any system pressure

Gleichmäßige Drehgeschwindigkeit für eine gute Wasserverteilung

Automatisches Bremssystem: eine dem Betriebsdruck immer angepaßte Bremskraft

Automatic brake system,
no ball bearings, maintenance free
Automatisches Bremssystem
ohne Kugellager, wartungsfrei

Self-adjusting brake force / Regulierte Bremskraft

The self-adjusting system adapts its brake force to the existing system pressure. The gun therefore achieves a steady rotation speed over its whole nozzle-pressure range. This is essential for uniform water application. The automatically adjusting brake system contributes significantly to the gun's excellent performance over the entire operating range.

Das selbstregulierende System paßt seine Bremskraft dem jeweiligen Betriebsdruck an. Der Regner erzielt dadurch immer eine, dem Betriebsdruck angepaßte, gleichmäßige und kompensierte Drehgeschwindigkeit, welche zur Erzielung einer guten Wasserverteilung Voraussetzung ist. Das selbsttätige Bremssystem trägt entscheidend zu den ausgezeichneten Betriebseigenschaften in allen Druckstufen bei.

Maintenance free / Keine Wartung

The Twin gun is maintenance free. This new technology designed brake system avoids the use of ball bearings, which can seize at contact with moisture, causing failure and results in downtime and expensive repairs. Instead, parts made of high-quality, durable and maintenance-free materials are used. This is a major consideration to keep in mind when choosing a big volume gun.

Das ganze Gerät ist durch die Verwendung von hochwertigen, verschleißarmen Werkstoffen, wartungsfrei. Die moderne Konstruktion verzichtet gezielt auf die Verwendung von störanfälligen Teilen, wie z.B. Kugellager und dgl., welche bei geringster Feuchtigkeit einrosten, Stillstand und hohe Reparaturkosten verursachen können. Ein wichtiger Grund mehr, sich für den Twin als Weitstrahlregner zu entscheiden.

Patents and Int'l Patents Pending

Water distribution even at low system pressure

Dynamic intermittent jet-breaker (optional): additional stream diffusion

Wasserverteilung auch bei Niederdruck

Dynamischer Intervall-Strahlstörer (Zubehör): zusätzliche Zerstäubung

Dynamic intermittent jet-breaker in operation
Dynamischer Intervall-Strahlstörer in Funktion

Quality of irrigation / Qualität der Beregnung

With the dynamic intermittent jet-breaker, it's possible to influence the gun's distribution profile and adapt it for different applications at all pressures. Generally the operation of the intermittent jet-breaker increases the stream diffusion and provides a gentler droplet size for vegetables and sensitive crops. The intermittent jet-breaker is recommended on full circle operations.

Mit dem dynamischen Intervall Strahlstörer kann man das Bild der Wasserverteilung des Regners beeinflußen und dadurch den unterschiedlichen Einsatzbedingungen in allen Druckbereichen anpassen. Allgemein bewirkt die Arbeitsweise des Intervall Störers einen erhöhten Zerstäubungsgrad und erlaubt so eine schonende Beregnung von Gemüse und empfindlichen Kulturen. Bei Kreisregnern wird der Intervall Strahlstörer als Ausrüstung empfohlen.

Drive system with a dynamic intermittent jet-breaker
Antrieb mit dynamischem Intervall Strahlstörer

Energy savings / Einsparung von Energie

The great versatility of the gun is further increased with the dynamic intermittent jet-breaker. Depending on the crop, it allows operation at lower pressures, still achieving outstanding irrigation results. For this purpose, one or two individually adjustable dynamic jet-breakers can be mounted on the gun's drive arm. The dynamic jet-breaker provides energy savings and reduction of system operating costs by running an irrigation system at lower pressure.

Der bereits hohe Gebrauchswert des Gerätes wird durch das System des Intervall Strahlstörers zusätzlich erhöht. Je nach Kulturart wird der Betrieb bei geringerem Betriebsdruck mit dennoch guten Ergebnissen ermöglicht. Dazu können am Regner ein oder auch zwei Intervall Störer angebracht werden, deren Arbeitsweise individuell regulierbar ist. Der Strahlstörer ermöglicht die Einsparung von Energie verbunden mit einer Reduzierung der Betriebskosten.

Adjustable trajectory angle

The system for more efficient irrigation in windy conditions

Stufenlos einstellbarer Strahlwinkel

Das System für die wirkungsvolle Beregnung bei Wind

The Vari-Angle system:
Enhances the flexibility of the operation
Das Vari-Angle System:
ein Pluspunkt für jeden Weitstrahlregner

Vari-Angle® System

Adjustable trajectory angle / Einstellbarer Strahlwinkel

The irrigation efficiency of big volume guns depends principally on existing wind conditions. The trajectory of the water stream is one of the most important factors. The lowering of the trajectory in windy conditions reduces water drift, thus significantly improving irrigation efficiency.
Also very effective for avoiding obstacles such as power lines.
Die Effizienz der Beregnung hängt in hohem Maße von den herrschenden Windverhältnissen ab. Der Strahlwinkel des Regners spielt dabei eine wesentliche Rolle. Das Absenken der Wurfparabel vermindert bei Wind die Wasserabdrift, dadurch wird die Wirksamkeit der Beregnung erheblich verbessert. Das Vari-Angle System kann auch dazu verwendet werden, um Hindernisse, wie z.B. E-Leitungen und dgl., zu unterwandern.

Trajectory angle / Strahlneigungswinkel

The available standard trajectory angles are 24° and 18°. Should you require a trajectory angle different from the standard, we suggest selecting the Vari-Angle equipped models.
Serienmäßig stehen Neigungswinkel von 24° und 18° zur Verfügung. Möchte man eine von 24° abweichende Strahlneigung einsetzen, bietet sich das Vari-Angle System hervorragend an.

Patents and Int'l Patents Pending

Twinmax

THE KOMET ADVANTAGE >
superior performance through innovative technology

Twinmax

Taper bore nozzle / Weitstrahldüse Trajectory / Strahlwinkel 24°

Pressure / Druck	Nozzle / Düse 10 mm - 0.39"			Nozzle / Düse 11 mm - 0.43"			Nozzle / Düse 12 mm - 0.47"			Nozzle / Düse 13 mm - 0.51"			Nozzle / Düse 14 mm - 0.55"			Nozzle / Düse 15 mm - 0.59"			Nozzle / Düse 16 mm - 0.63"			Nozzle / Düse 17 mm - 0.67"			Nozzle / Düse 18 mm - 0.71"			Nozzle / Düse 20 mm - 0.79"			Nozzle / Düse 22 mm - 0.87"			Nozzle / Düse 24 mm - 0.94"		
	Flow Durchfluß		Radius Radius	Flow Durchfluß		Radius Radius	Flow Durchfluß		Radius Radius	Flow Durchfluß		Radius Radius	Flow Durchfluß		Radius Radius	Flow Durchfluß		Radius Radius	Flow Durchfluß		Radius Radius	Flow Durchfluß		Radius Radius	Flow Durchfluß		Radius Radius	Flow Durchfluß		Radius Radius	Flow Durchfluß		Radius Radius	Flow Durchfluß		Radius Radius
bar	m³/h	l/s	m	m³/h	l/s	m	m³/h	l/s	m	m³/h	l/s	m	m³/h	l/s	m	m³/h	l/s	m	m³/h	l/s	m	m³/h	l/s	m	m³/h	l/s	m	m³/h	l/s	m	m³/h	l/s	m	m³/h	l/s	m
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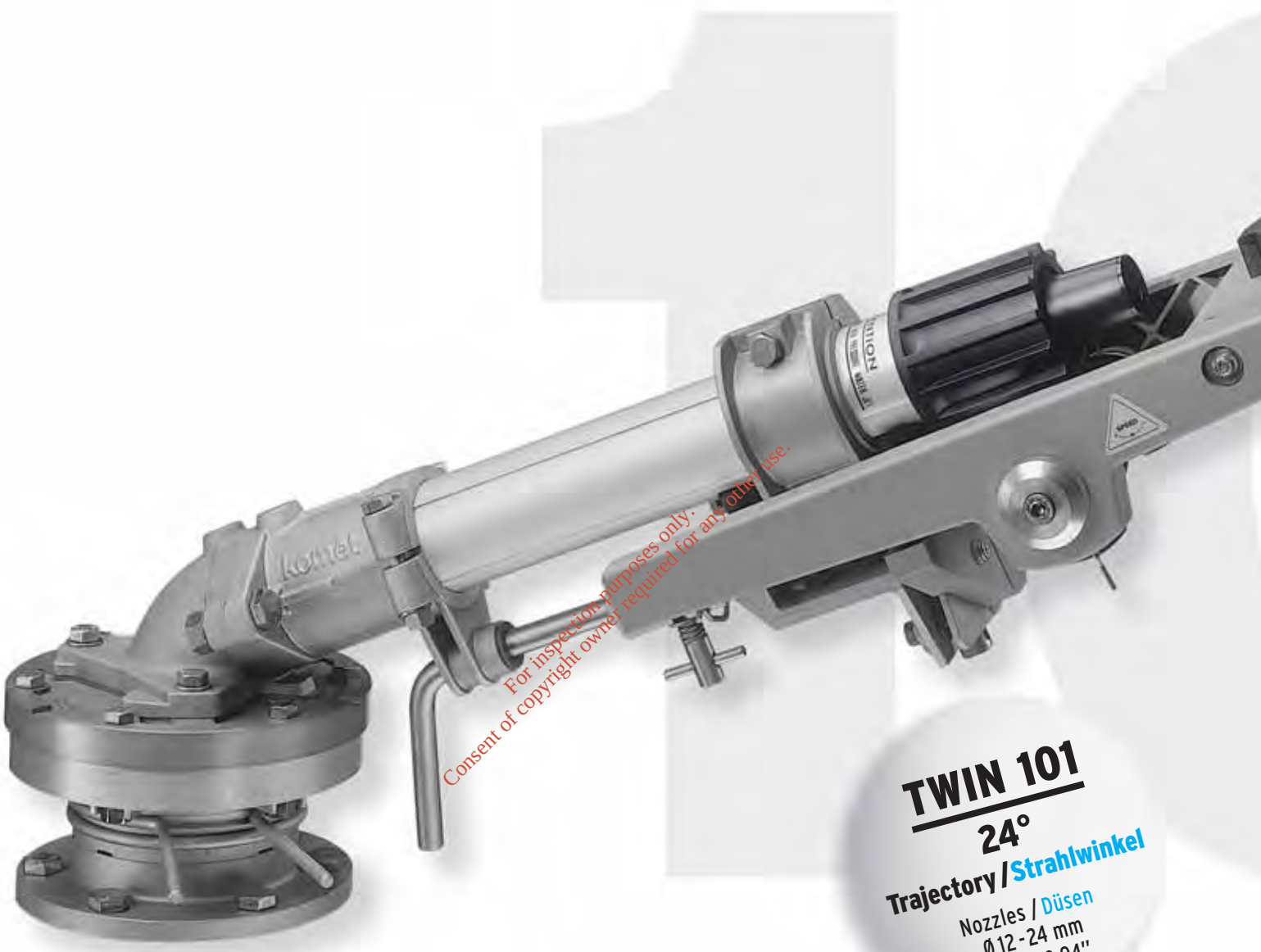
5	8,6	2,38	30,3	10,4	2,89	32,1	12,4	3,43	33,8	14,5	4,03	35,3	16,8	4,67	36,8	19,3	5,37	38,2	22,0	6,11	39,5	24,8	6,89	40,9	27,8	7,73	42,1	34,3	9,54	44,5	41,6	11,54	46,9	49,5	13,74	49,2
5,5	9,0	2,50	31,3	10,9	3,03	33,2	13,0	3,60	35,1	15,2	4,23	36,6	17,6	4,90	38,1	20,3	5,63	39,6	23,1	6,40	41,0	26,0	7,23	42,4	29,2	8,10	43,7	36,0	10,01	46,2	43,6	12,11	48,7	51,9	14,41	51,0
6	9,4	2,61	32,3	11,4	3,16	34,3	13,5	3,76	36,3	15,9	4,42	37,9	18,4	5,12	39,4	21,2	5,88	40,9	24,1	6,69	42,4	27,2	7,55	43,8	30,5	8,46	45,1	37,6	10,45	47,8	45,5	12,64	50,3	54,2	15,05	52,7
6,5	9,8	2,72	33,1	11,9	3,29	35,2	14,1	3,92	37,3	16,5	4,60	38,9	19,2	5,33	40,5	22,0	6,12	42,0	25,1	7,00	43,5	28,3	7,86	44,9	31,7	8,81	46,4	39,2	10,88	49,2	47,4	13,17	51,8	56,4	15,67	54,3

N.B. The performance data were obtained under ideal testing conditions and may be adversely affected by wind and other factors. Pressure refers to pressure at nozzle. A lowered trajectory angle improves the irrigation efficiency in windy conditions. For every 3° drop of the trajectory angle the throw is reduced by approximately 3 to 4%. Die in der Tabelle angegebenen Daten beziehen sich auf Windstille und können durch Windeinfluß oder andere Faktoren negativ beeinflußt werden. Der angegebene Betriebsdruck bezieht sich auf den Druck an der Düse. Das Absenken des Strahlwinkels erhöht die Effizienz der Beregnung bei Wind, je 3 Grad Absenkung vermindert sich die Wurfweite um ca. 3 bis 4%.

TWIN 101/PLUS



Available Models / Verfügbare Versionen

TWIN 101

Trajectory 24°
Full or part circle operation
Flange connection

Strahlwinkel 24°
Sektor -und Kreisbetrieb
Flanschanschluß

TWIN 101 Vari-Angle

Trajectory 10°-28°
Full or part circle operation
Flange connection

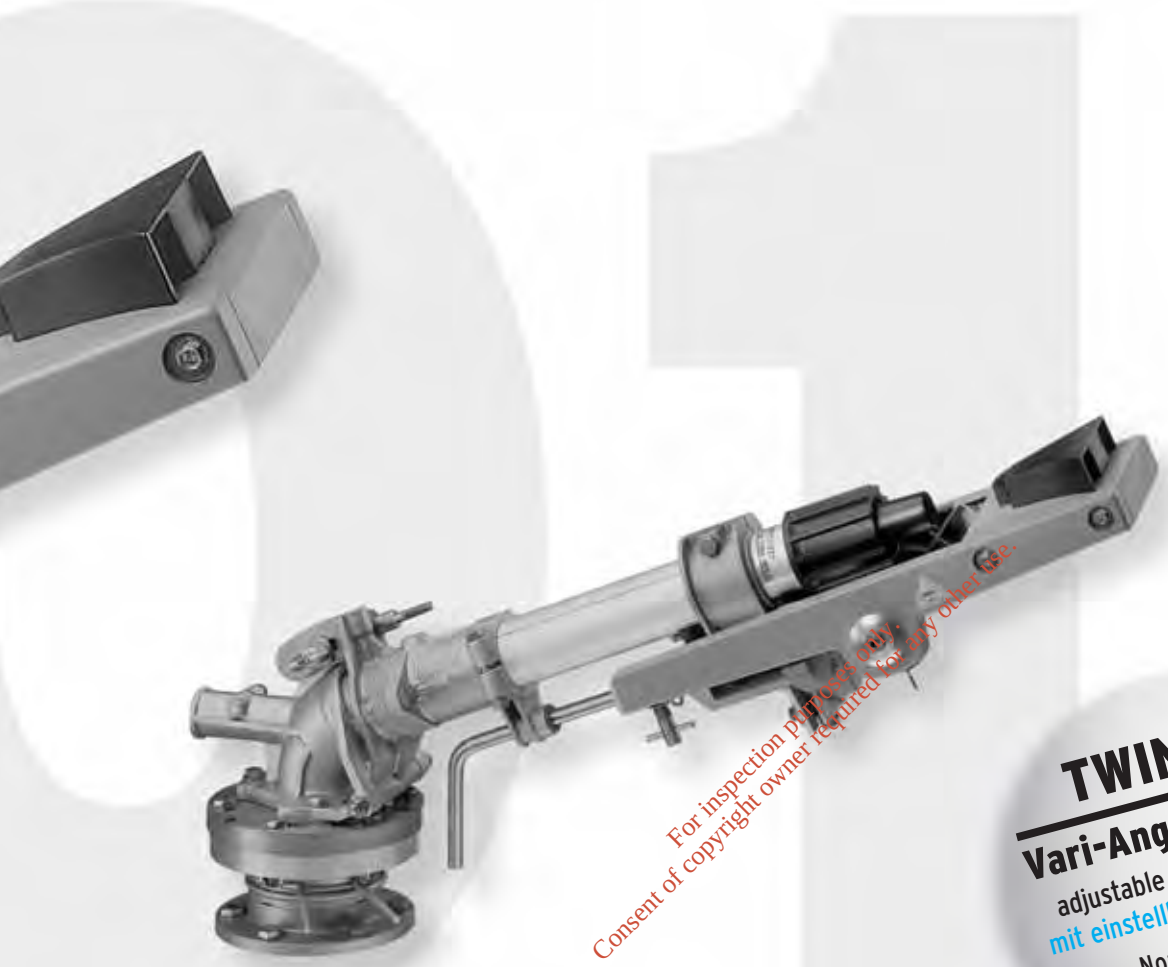
Strahlwinkel 10°-28°
Sektor -und Kreisbetrieb
Flanschanschluß

TWIN 101 Pivot

Trajectory 18°
Full or part circle operation
Thread 2" BSP or NPT

Strahlwinkel 18°
Sektor -und Kreisbetrieb
Gewindeanschluß 2" BSP oder NPT

Patents and Int'l Patents Pending



TWIN 101

Vari-Angle 10° - 28°

adjustable trajectory angle

mit einstellbarem Strahlwinkel

Nozzles / Düsen

Ø 12 - 24 mm

0.47" - 0.94"

Twin 101

Taper bore nozzle / Weitstrahldüse Trajectory / Strahlwinkel 24°

Pressure / Druck	Nozzle / Düse 12 mm - 0.47"			Nozzle / Düse 14 mm - 0.55"			Nozzle / Düse 16 mm - 0.63"			Nozzle / Düse 18 mm - 0.71"			Nozzle / Düse 20 mm - 0.79"			Nozzle / Düse 22 mm - 0.87"			Nozzle / Düse 24 mm - 0.94"		
	Flow Durchfluß		Radius Radius	Flow Durchfluß		Radius Radius	Flow Durchfluß		Radius Radius	Flow Durchfluß		Radius Radius	Flow Durchfluß		Radius Radius	Flow Durchfluß		Radius Radius	Flow Durchfluß		Radius Radius
bar	m³/h	l/s	m	m³/h	l/s	m	m³/h	l/s	m	m³/h	l/s	m	m³/h	l/s	m	m³/h	l/s	m	m³/h	l/s	m
2,0				10,6	2,96	26,0	13,9	3,86	27,9	17,6	4,89	29,7	21,7	6,04	31,5	26,3	7,30	33,1	31,3	8,69	34,7
2,5				11,9	3,31	28,3	15,5	4,32	30,4	19,7	5,47	32,4	24,3	6,75	34,3	29,4	8,17	36,1	35,0	9,72	37,8
3,0	9,6	2,66	27,9	13,0	3,62	30,3	17,0	4,73	32,6	21,6	5,99	34,7	25,6	7,39	36,7	32,2	8,95	38,7	38,3	10,65	40,5
3,5	10,4	2,87	29,5	14,1	3,91	32,1	18,4	5,11	34,5	23,3	6,47	36,8	28,7	7,99	38,9	34,8	9,66	41,0	41,4	11,50	43,0
4,0	11,1	3,07	31,1	15,1	4,18	33,8	19,7	5,46	36,3	24,9	6,91	38,7	30,7	8,54	41,0	37,2	10,33	43,1	44,3	12,29	45,2
4,5	11,7	3,26	32,5	16,0	4,44	35,3	20,9	5,80	38,0	26,4	7,33	40,5	32,6	9,05	42,8	39,4	10,96	45,1	46,9	13,04	47,3
5,0	12,4	3,44	33,8	16,8	4,68	36,8	22,0	6,11	39,5	27,8	7,73	42,1	34,4	9,54	44,6	41,6	11,55	46,9	49,5	13,74	49,2
5,5	13,0	3,60	35,1	17,7	4,91	38,1	23,1	6,41	41,0	29,2	8,11	43,7	36,0	10,01	46,2	43,6	12,11	48,7	51,9	14,42	51,0
6,0	13,6	3,76	36,3	18,4	5,12	39,4	24,1	6,69	42,4	30,5	8,47	45,1	37,6	10,46	47,8	45,5	12,65	50,3	54,2	15,06	52,7
6,5	14,1	3,92	37,4	19,2	5,33	40,6	25,1	6,96	43,6	31,7	8,81	46,5	39,2	10,88	49,3	47,4	13,17	51,9	56,4	15,67	54,4

N.B. The performance data were obtained under ideal testing conditions and may be adversely affected by wind and other factors. Pressure refers to pressure at nozzle. A lowered trajectory angle improves the irrigation efficiency in windy conditions. For every 3° drop of the trajectory angle the throw is reduced by approximately 3 to 4%. Die in der Tabelle angegebenen Daten beziehen sich auf Windstille und können durch Windeinfluß oder andere Faktoren negativ beeinflußt werden. Der angegebene Betriebsdruck bezieht sich auf den Druck an der Düse. Das Absenken des Strahlwinkels erhöht die Effizienz der Beregnung bei Wind, je 3 Grad Absenkung vermindert sich die Wurfweite um ca. 3 bis 4%.

TWIN 140/PLUS

TWIN 140
24°
Trajectory / Strahlwinkel
Nozzles / Düsen
Ø 16 - 30 mm
0.63" - 1.18"

Available Models
Verfügbare Versionen

TWIN 140

Trajectory 24°
Full or part circle operation
Flange connection

Strahlwinkel 24°
Sektor -und Kreisbetrieb
Flanschanschluß

TWIN 140 Vari-Angle

Trajectory 10°-28°
Full or part circle operation
Flange connection

Strahlwinkel 10°-28°
Sektor -und Kreisbetrieb
Flanschanschluß

Patents and Int'l Patents Pending

TWIN 140

Vari-Angle 10° - 28°

adjustable trajectory angle

mit einstellbarem Strahlwinkel

Nozzles / Düsen

Ø 16 - 30 mm

0.63" - 1.18"

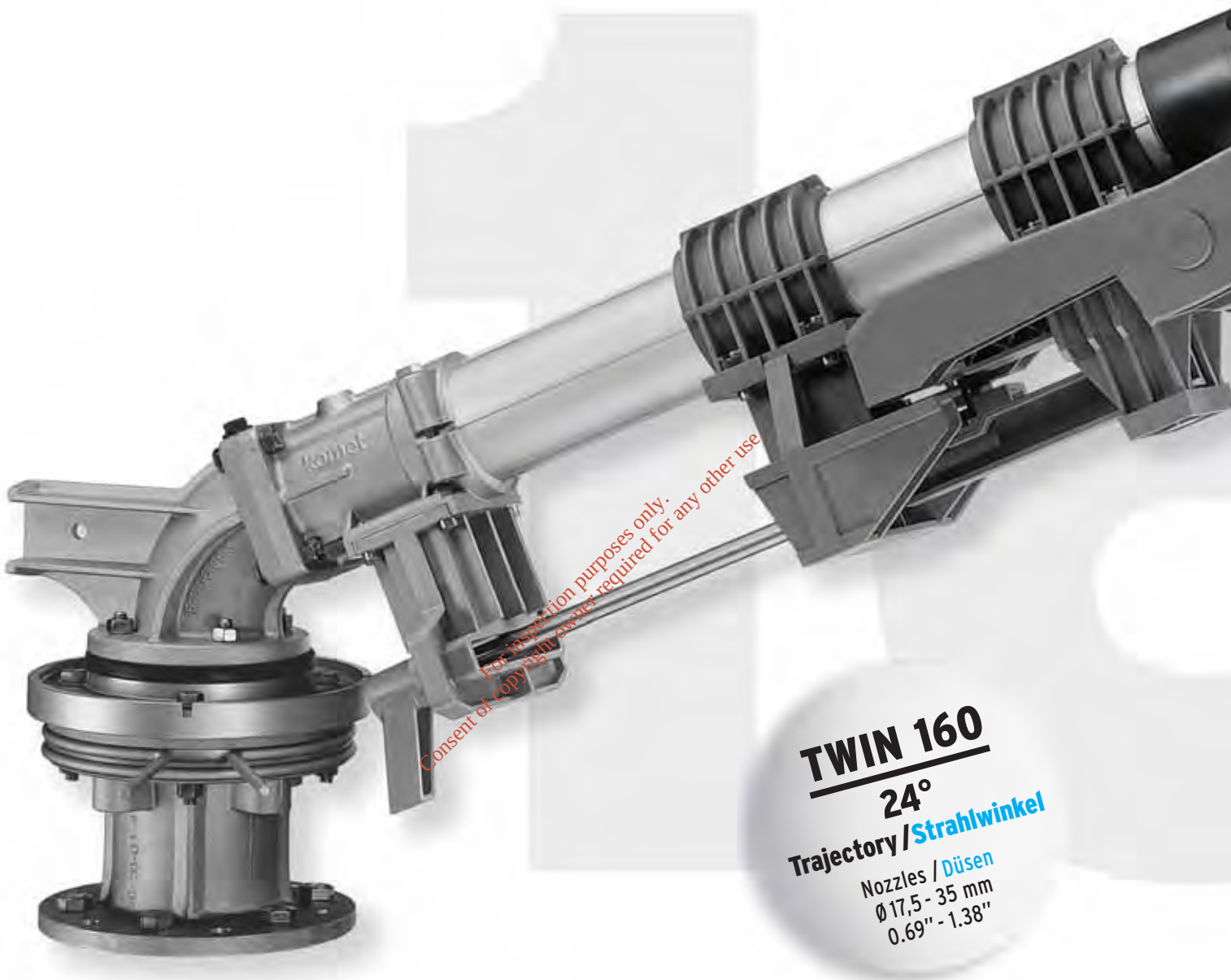
Twin 140

Taper bore nozzle / Weitstrahldüse Trajectory / Strahlwinkel 24°

Pressure / Druck	Nozzle / Düse 16 mm - 0.63"			Nozzle / Düse 18 mm - 0.71"			Nozzle / Düse 20 mm - 0.79"			Nozzle / Düse 22 mm - 0.87"			Nozzle / Düse 24 mm - 0.94"			Nozzle / Düse 26 mm - 1.02"			Nozzle / Düse 28 mm - 1.10"			Nozzle / Düse 30 mm - 1.18"		
	Flow / Durchfluß		Radius / Radius	Flow / Durchfluß		Radius / Radius	Flow / Durchfluß		Radius / Radius	Flow / Durchfluß		Radius / Radius	Flow / Durchfluß		Radius / Radius	Flow / Durchfluß		Radius / Radius	Flow / Durchfluß		Radius / Radius	Flow / Durchfluß		Radius / Radius
bar	m³/h	l/s	m	m³/h	l/s	m	m³/h	l/s	m	m³/h	l/s	m	m³/h	l/s	m	m³/h	l/s	m	m³/h	l/s	m	m³/h	l/s	m
2,0	13,9	3,86	27,9	17,6	4,89	29,7	21,7	6,04	31,5	26,3	7,30	33,1	31,3	8,69	34,7	36,7	10,20	36,3	42,6	11,83	37,7	48,9	13,58	39,2
2,5	15,5	4,32	30,4	19,7	5,47	32,4	24,3	6,75	34,3	29,4	8,17	36,1	35,0	9,72	37,8	41,1	11,41	39,5	47,6	13,23	41,1	54,7	15,19	42,6
3,0	17,0	4,73	32,6	21,6	5,99	34,7	25,6	7,39	36,7	32,2	8,95	38,7	38,3	10,65	40,5	45,0	12,49	42,3	52,2	14,49	44,0	59,9	16,63	45,7
3,5	18,4	5,11	34,5	23,3	6,47	36,8	28,7	7,99	38,9	34,8	9,66	41,0	41,4	11,50	43,0	48,6	13,50	44,9	56,3	15,65	46,7	64,7	17,97	48,5
4,0	19,7	5,46	36,3	24,9	6,91	38,7	30,7	8,54	41,0	37,2	10,33	43,1	44,3	12,29	45,2	51,9	14,43	47,2	60,2	16,73	49,1	69,1	19,21	51,0
4,5	20,9	5,80	38,0	26,4	7,33	40,5	32,6	9,05	42,8	39,4	10,96	45,1	46,9	13,04	47,3	55,1	15,30	49,4	63,9	17,75	51,4	73,3	20,37	53,3
5,0	22,0	6,11	39,5	27,8	7,73	42,1	34,4	9,54	44,6	41,6	11,55	46,9	49,5	13,74	49,2	58,1	16,13	51,4	67,3	18,71	53,5	77,3	21,48	55,5
5,5	23,1	6,41	41,0	29,2	8,11	43,7	36,0	10,01	46,2	43,6	12,11	48,7	51,9	14,42	51,0	60,9	16,92	53,3	70,6	19,62	55,4	81,1	22,52	57,5
6,0	24,1	6,69	42,4	30,5	8,47	45,1	37,6	10,46	47,8	45,5	12,65	50,3	54,2	15,06	52,7	63,6	17,61	55,1	73,8	20,49	57,3	84,7	23,52	59,5
6,5	25,1	6,96	43,6	31,7	8,81	46,5	39,2	10,88	49,3	47,4	13,17	51,9	56,4	15,67	54,4	66,2	18,39	56,8	76,8	21,33	59,1	88,1	24,49	61,3
7,0	26,0	7,23	44,9	32,9	9,15	47,9	40,7	11,29	50,7	49,2	13,66	53,3	58,5	16,26	55,9	68,7	19,09	58,4	79,7	22,13	60,8	91,5	25,41	63,1

N.B. The performance data were obtained under ideal testing conditions and may be adversely affected by wind and other factors. Pressure refers to pressure at nozzle. A lowered trajectory angle improves the irrigation efficiency in windy conditions. For every 3° drop of the trajectory angle the throw is reduced by approximately 3 to 4%. Die in der Tabelle angegebenen Daten beziehen sich auf Windstille und können durch Windeinfluß oder andere Faktoren negativ beeinflußt werden. Der angegebene Betriebsdruck bezieht sich auf den Druck an der Düse. Das Absenken des Strahlwinkels erhöht die Effizienz der Beregnung bei Wind, je 3 Grad Absenkung vermindert sich die Wurfweite um ca. 3 bis 4%.

TWIN 160/PRO



TWIN 160
24°
Trajectory / Strahlwinkel
Nozzles / Düsen
Ø 17,5 - 35 mm
0.69" - 1.38"

Available Models
Verfügbare Versionen

TWIN 160

Trajectory 24°
Full or part circle operation
Flange connection

Strahlwinkel 24°
Sektor -und Kreisbetrieb
Flanschanschluß

TWIN 160 Vari-Angle

Trajectory 16°-28°
Full or part circle operation
Flange connection

Strahlwinkel 16°-28°
Sektor -und Kreisbetrieb
Flanschanschluß

Patents and Int'l Patents Pending

TWIN 160

Vari-Angle 16° - 28°

adjustable trajectory angle
mit einstellbarem Strahlwinkel

Nozzles / Düsen
Ø17,5 - 35 mm
0.69" - 1.38"

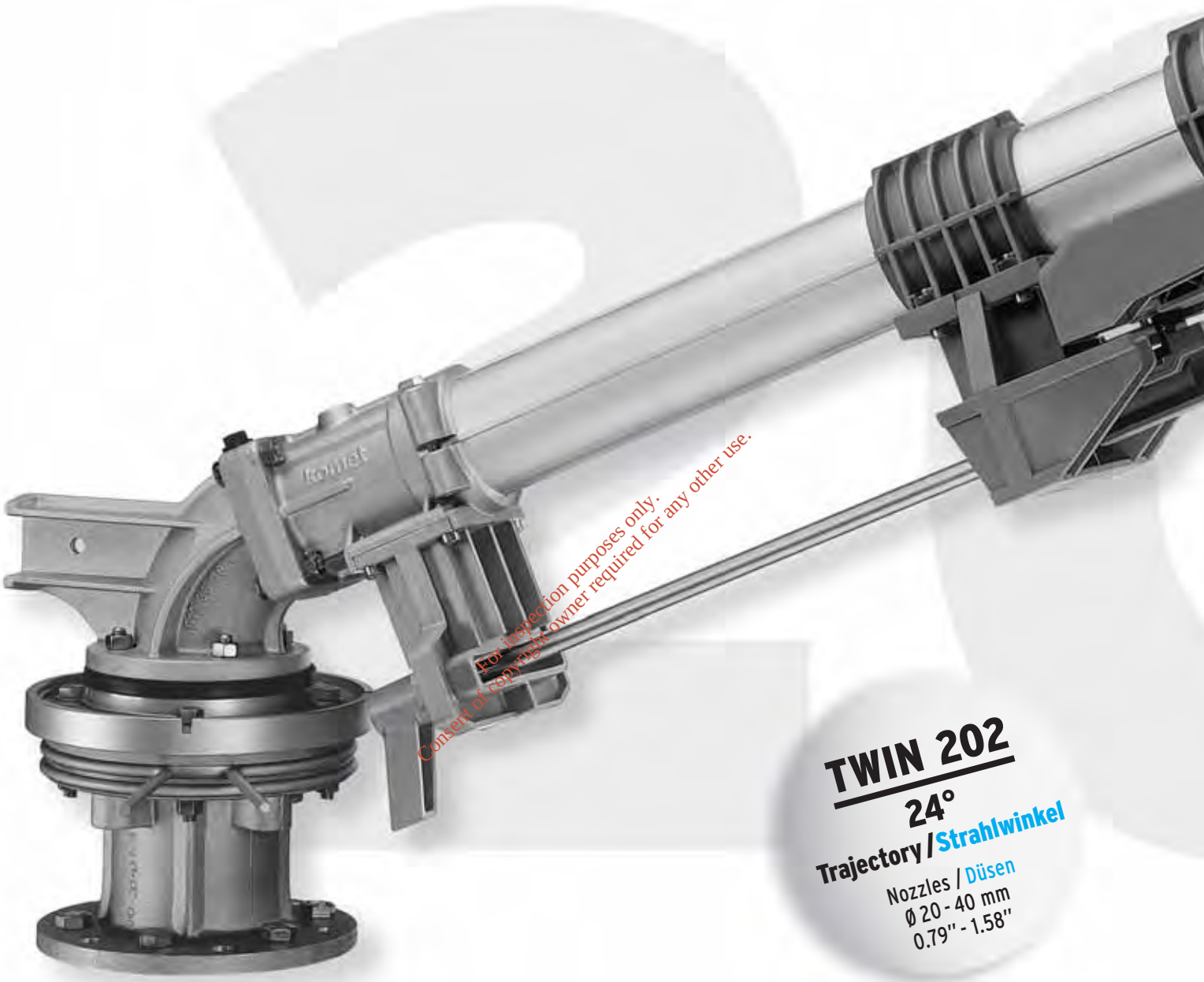
Twin 160

Taper bore nozzle / Weitstrahldüse Trajectory / Strahlwinkel 24°

Pressure / Druck	Nozzle / Düse 17,5 mm - 0.69"			Nozzle / Düse 20 mm - 0.79"			Nozzle / Düse 22,5 mm - 0.89"			Nozzle / Düse 25 mm - 0.98"			Nozzle / Düse 27,5 mm - 1.08"			Nozzle / Düse 30 mm - 1.18"			Nozzle / Düse 32,5 mm - 1.28"			Nozzle / Düse 35 mm - 1.38"		
	Flow Durchfluß		Radius Radius	Flow Durchfluß		Radius Radius	Flow Durchfluß		Radius Radius	Flow Durchfluß		Radius Radius	Flow Durchfluß		Radius Radius	Flow Durchfluß		Radius Radius	Flow Durchfluß		Radius Radius	Flow Durchfluß		Radius Radius
bar	m³/h	l/s	m	m³/h	l/s	m	m³/h	l/s	m	m³/h	l/s	m	m³/h	l/s	m	m³/h	l/s	m	m³/h	l/s	m	m³/h	l/s	m
3,0	20,38	5,66	35,8	26,07	7,24	37,2	32,99	9,16	38,9	40,73	11,31	41,5	49,28	13,69	43,5	58,65	16,29	45,7	68,83	19,12	47,5	79,83	22,17	49,5
3,5	22,01	6,11	39,5	28,16	7,82	41,2	35,63	9,90	43,8	43,99	12,22	46,5	53,32	14,81	48,7	63,35	17,59	51,3	74,35	20,65	53,6	86,22	23,95	56,0
4,0	23,53	6,53	42,5	30,10	8,36	44,2	38,09	10,58	47,3	47,03	13,06	49,9	56,90	15,80	52,5	67,72	18,81	55,2	79,48	22,08	57,9	92,18	25,60	60,2
4,5	24,96	6,93	44,2	31,98	8,87	46,0	40,41	11,22	49,4	49,38	13,85	52,4	60,36	16,76	55,2	71,83	19,95	57,8	84,30	23,42	60,5	97,77	27,16	62,8
5,0	26,31	7,30	45,4	33,65	9,36	47,5	42,59	11,83	51,0	52,58	14,60	54,0	63,62	17,67	57,0	75,72	21,03	60,0	88,86	24,68	62,5	103,06	28,63	64,9
5,5	27,59	7,66	46,4	35,29	9,80	49,0	44,67	12,41	52,5	55,15	15,32	55,4	66,73	18,53	58,5	79,41	22,06	61,5	93,20	25,88	63,9	108,09	30,02	66,3
6,0	28,82	8,00	47,2	36,86	10,24	50,0	46,66	12,96	53,4	57,60	16,00	56,5	69,69	19,36	59,7	82,90	23,05	62,5	97,34	27,04	65,0	112,89	31,36	67,3
6,5	29,99	8,33	47,5	38,37	10,66	50,5	48,56	13,49	54,0	59,95	16,65	57,4	72,54	20,15	60,7	86,33	23,98	63,3	101,32	28,14	65,7	117,50	32,64	68,0
7,0	31,13	8,64	48,0	39,82	11,06	51,1	50,39	14,00	54,6	62,21	17,28	57,9	75,28	20,91	61,3	89,59	24,88	63,9	105,14	29,20	66,2	121,94	33,87	68,5

N.B. The performance data were obtained under ideal testing conditions and may be adversely affected by wind and other factors. Pressure refers to pressure at nozzle. A lowered trajectory angle improves the irrigation efficiency in windy conditions. For every 3° drop of the trajectory angle the throw is reduced by approximately 3 to 4%. Die in der Tabelle angegebenen Daten beziehen sich auf Windstille und können durch Windeinfluß oder andere Faktoren negativ beeinflußt werden. Der angegebene Betriebsdruck bezieht sich auf den Druck an der Düse. Das Absenken des Strahlwinkels erhöht die Effizienz der Beregnung bei Wind, je 3 Grad Absenkung vermindert sich die Wurfweite um ca. 3 bis 4%.

TWIN 202/PRO



TWIN 202
24°
Trajectory / Strahlwinkel
Nozzles / Düsen
Ø 20 - 40 mm
0.79" - 1.58"

Available Models
Verfügbare Versionen

TWIN 202

Trajectory 24°
Full or part circle operation
Flange connection

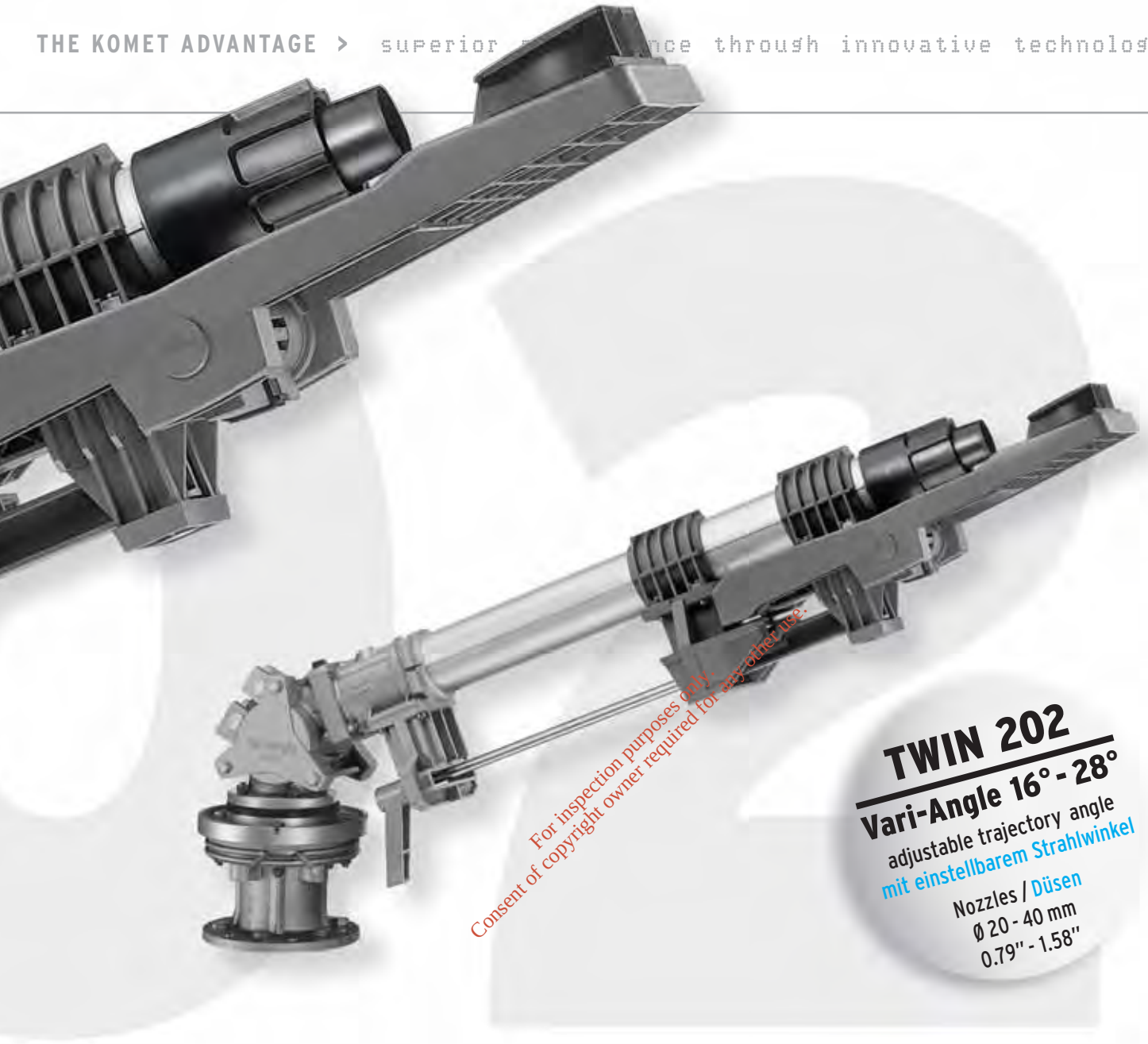
Strahlwinkel 24°
Sektor -und Kreisbetrieb
Flanschanschluß

TWIN 202 Vari-Angle

Trajectory 16°-28°
Full or part circle operation
Flange connection

Strahlwinkel 16°-28°
Sektor -und Kreisbetrieb
Flanschanschluß

Patents and Int'l Patents Pending



TWIN 202

Vari-Angle 16° - 28°

adjustable trajectory angle
mit einstellbarem Strahlwinkel

Nozzles / Düsen
Ø 20 - 40 mm
0.79" - 1.58"

Twin 202

Taper bore nozzle / Weitstrahldüse Trajectory / Strahlwinkel 24°

Pressure / Druck	Nozzle / Düse 20 mm - 0.79"			Nozzle / Düse 22,5 mm - 0.89"			Nozzle / Düse 25 mm - 0.98"			Nozzle / Düse 27,5 mm - 1.08"			Nozzle / Düse 30 mm - 1.18"			Nozzle / Düse 32,5 mm - 1.28"			Nozzle / Düse 35 mm - 1.38"			Nozzle / Düse 37,5 mm - 1.48"			Nozzle / Düse 40 mm - 1.58"		
	Flow Durchfluß		Radius Radius	Flow Durchfluß		Radius Radius	Flow Durchfluß		Radius Radius	Flow Durchfluß		Radius Radius	Flow Durchfluß		Radius Radius	Flow Durchfluß		Radius Radius	Flow Durchfluß		Radius Radius	Flow Durchfluß		Radius Radius	Flow Durchfluß		Radius Radius
bar	m³/h	l/s	m	m³/h	l/s	m	m³/h	l/s	m	m³/h	l/s	m	m³/h	l/s	m	m³/h	l/s	m	m³/h	l/ss	m	m³/h	l/s	m	m³/h	l/s	m
3,0	26,07	7,24	37,2	32,99	9,16	38,9	40,73	11,31	41,5	49,28	13,69	43,5	58,65	16,29	45,7	68,83	19,12	47,5	79,83	22,17	49,5	91,64	25,46	50,7	104,27	28,96	52,3
3,5	28,16	7,82	41,4	35,63	9,90	43,8	43,99	12,22	46,5	53,32	14,81	48,7	63,35	17,59	51,3	74,35	20,65	53,6	86,22	23,95	56,0	98,98	27,50	57,8	112,27	31,28	59,5
4,0	30,10	8,36	44,2	38,09	10,58	47,3	47,03	13,06	49,9	56,90	15,80	52,5	67,72	18,81	55,2	79,48	22,08	57,9	92,18	25,60	60,2	105,82	29,39	62,1	120,40	33,44	64,2
4,5	31,98	8,87	46,0	40,41	11,22	49,4	49,38	13,85	52,4	60,36	16,76	55,2	71,83	19,95	57,8	84,30	23,42	60,5	97,77	27,16	62,8	112,24	31,18	64,9	127,70	35,47	67,0
5,0	33,65	9,36	47,5	42,59	11,83	51,0	52,58	14,60	54,0	63,62	17,67	57,0	75,72	21,03	60,0	88,86	24,68	62,5	103,06	28,63	64,9	118,31	32,86	66,8	134,61	37,39	68,6
5,5	35,29	9,80	49,0	44,67	12,41	52,5	55,15	15,32	55,4	66,73	18,53	58,5	79,41	22,06	61,5	93,20	25,88	63,9	108,09	30,02	66,3	124,08	34,47	68,3	141,18	39,22	69,7
6,0	36,86	10,24	50,0	46,66	12,96	53,4	57,60	16,00	56,5	69,69	19,36	59,7	82,90	23,05	62,5	97,34	27,04	65,0	112,89	31,36	67,3	129,60	36,00	69,2	147,46	40,96	70,5
6,5	38,37	10,66	50,5	48,56	13,49	54,0	59,95	16,65	57,4	72,54	20,15	60,7	86,33	23,98	63,3	101,32	28,14	65,7	117,50	32,64	68,0	134,89	37,47	69,9	153,48	42,63	71,2
7,0	39,82	11,06	51,1	50,39	14,00	54,6	62,21	17,28	57,9	75,28	20,91	61,3	89,59	24,88	63,9	105,14	29,20	66,2	121,94	33,87	68,5	139,98	38,88	70,5	159,27	44,24	71,8

N.B. The performance data were obtained under ideal testing conditions and may be adversely affected by wind and other factors. Pressure refers to pressure at nozzle. A lowered trajectory angle improves the irrigation efficiency in windy conditions. For every 3° drop of the trajectory angle the throw is reduced by approximately 3 to 4%. Die in der Tabelle angegebenen Daten beziehen sich auf Windstille und können durch Windeinfluß oder andere Faktoren negativ beeinflußt werden. Der angegebene Betriebsdruck bezieht sich auf den Druck an der Düse. Das Absenken des Strahlwinkels erhöht die Effizienz der Beregnung bei Wind, je 3 Grad Absenkung vermindert sich die Wurfweite um ca. 3 bis 4%.

PERFOMANCE DATA - US. UNITS

Twin max taper bore nozzle, 24º trajectory

PSI	Nozzle 0.39"		Nozzle 0.43"		Nozzle 0.47"		Nozzle 0.51"		Nozzle 0.55"		Nozzle 0.59"		Nozzle 0.63"		Nozzle 0.67"		Nozzle 0.71"		Nozzle 0.79"		Nozzle 0.87"		Nozzle 0.94"	
	GPM	DIA.	GPM	DIA.	GPM	DIA.	GPM	DIA.	GPM	DIA.	GPM	DIA.	GPM	DIA.	GPM	DIA.	GPM	DIA.	GPM	DIA.	GPM	DIA.	GPM	DIA.
25	–	–	–	–	32	148'	37	156'	43	163'	50	170'	57	177'	64	185'	72	191'	89	202'	107	213'	128	223'
30	24	148'	29	156'	35	162'	41	171'	48	180'	55	187'	62	193'	70	201'	79	207'	97	221'	118	231'	140	243'
35	26	156'	32	165'	38	173'	44	183'	51	191'	59	199'	67	205'	76	214'	85	221'	105	237'	127	244'	151	256'
40	28	163'	34	174'	40	182'	47	193'	55	201'	63	209'	72	216'	81	225'	91	233'	112	247'	136	255'	162	268'
45	30	170'	36	180'	43	190'	50	200'	58	209'	67	218'	76	225'	86	233'	96	242'	119	257'	144	265'	171	279'
50	31	177'	38	188'	45	197'	53	207'	62	213'	71	225'	80	232'	91	242'	102	250'	126	266'	152	274'	181	290'
55	33	183'	40	195'	47	204'	56	214'	65	221'	74	232'	84	240'	95	249'	107	258'	132	274'	159	285'	190	300'
60	34	191'	42	202'	50	212'	58	221'	67	229'	77	240'	88	247'	99	256'	111	266'	138	282'	166	292'	198	309'
65	36	198'	43	208'	52	218'	60	228'	70	236'	81	247'	92	254'	103	264'	116	273'	143	290'	173	300'	206	318'
70	37	205'	45	215'	53	225'	63	235'	73	244'	84	254'	95	262'	107	271'	120	280'	148	297'	180	307'	214	323'
80	40	216'	48	227'	57	237'	67	248'	78	257'	89	266'	102	276'	115	285'	129	294'	159	309'	192	318'	229	343'
90	42	227'	51	238'	61	248'	71	259'	83	269'	95	278'	108	289'	122	296'	136	308'	168	319'	204	331'	242	355'
100	44	235'	54	246'	64	257'	75	269'	87	280'	100	289'	114	300'	128	309'	144	320'	178	330'	215	341'	256	364'
110	47	243'	56	255'	67	265'	79	279'	91	290'	105	300'	119	310'	135	319'	151	331'	186	338'	225	350'	268	371'

Twin 101 taper bore nozzle, 24º trajectory

PSI	Nozzle 0.47"		Nozzle 0.55"		Nozzle 0.63"		Nozzle 0.71"		Nozzle 0.79"		Nozzle 0.87"		Nozzle 0.94"	
	GPM	DIA.	GPM	DIA.	GPM	DIA.	GPM	DIA.	GPM	DIA.	GPM	DIA.	GPM	DIA
30	-	-	48	187'	62	201'	79	217'	97	232'	118	247'	140	260'
40	40	183'	55	203'	72	220'	91	234'	112	250'	136	265'	162	279'
50	45	197'	62	215'	80	232'	102	250'	125	267'	152	283'	181	300'
60	50	212'	67	230'	88	247'	111	266'	138	282'	167	298'	198	315'
70	54	225'	73	244'	95	262'	120	280'	149	297'	180	314'	214	323'
80	57	237'	78	257'	102	276'	129	294'	159	312'	192	329'	229	344'
90	61	248'	83	269'	108	289'	137	308'	169	326'	204	343'	243	359'
100	64	257'	87	280'	114	300'	144	320'	178	339'	215	357'	256	374'
110	67	265'	91	290'	119	310'	151	331'	186	351'	225	369'	268	388'

Twin 140 taper bore nozzle, 24º trajectory

PSI	Nozzle 0.63"		Nozzle 0.71"		Nozzle 0.79"		Nozzle 0.87"		Nozzle 0.94"		Nozzle 1.02"		Nozzle 1.10"		Nozzle 1.18"	
	GPM	DIA.	GPM	DIA.	GPM	DIA.	GPM	DIA.	GPM	DIA.	GPM	DIA.	GPM	DIA.	GPM	DIA.
30	62	201'	79	217'	97	232'	118	247'	140	260'	164	275'	191	286'	219	300'
40	72	220'	91	234'	112	250'	136	265'	162	279'	190	293'	220	307'	253	318'
50	80	232'	102	250'	125	267'	152	283'	181	300'	212	315'	246	330'	283	343'
60	88	247'	111	266'	138	282'	167	298'	198	315'	233	331'	270	347'	310	360'
70	95	262'	120	280'	149	297'	180	314'	214	323'	251	347'	291	362'	334	376'
80	102	276'	129	294'	159	312'	192	329'	229	344'	269	361'	311	376'	358	391'
90	108	289'	137	308'	169	326'	204	343'	243	359'	285	376'	330	392'	379	407'
100	114	300'	144	320'	178	339'	215	357'	256	374'	300	390'	348	407'	400	422'
110	119	310'	151	331'	186	351'	225	369'	268	388'	315	404'	365	421'	419	437'
120	125	318'	158	341'	195	362'	235	380'	280	400'	329	416'	381	432'	437	448'

Twin 160 taper bore nozzle, 24º trajectory

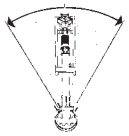
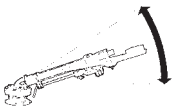
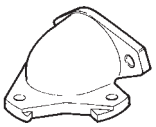
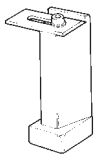
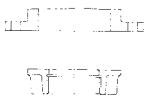
PSI	Nozzle 0.69"		Nozzle 0.79"		Nozzle 0.89"		Nozzle 0.98"		Nozzle 1.08"		Nozzle 1.18"		Nozzle 1.28"		Nozzle 1.38"	
	GPM	DIA.	GPM	DIA.	GPM	DIA.	GPM	DIA.	GPM	DIA.	GPM	DIA.	GPM	DIA.	GPM	DIA.
40	85	221'	110	229'	139	239'	172	254'	208	268'	248	279'	291	291'	337	301'
50	95	256'	123	269'	156	284'	192	302'	233	317'	277	333'	325	348'	377	364'
60	104	283'	135	294'	171	315'	211	334'	255	350'	303	367'	356	386'	413	401'
70	113	296'	146	308'	184	332'	227	350'	275	371'	328	390'	384	407'	446	422'
80	120	305'	156	321'	197	345'	243	364'	294	384'	350	404'	411	421'	476	436'
90	128	310'	165	329'	209	352'	258	374'	312	395'	371	413'	436	429'	506	444'
100	135	314'	174	334'	220	357'	272	379'	329	401'	392	418'	459	434'	533	450'
110	141	317'	182	336'	231	359'	285	382'	345	404'	411	421'	482	438'	559	453'
120	147	318"	191	339'	241	363'	298	385'	360	407'	429	424'	503	442'	584	456'

Twin 202 taper bore nozzle, 24º trajectory

PSI	Nozzle 0.79"		Nozzle 0.89"		Nozzle 0.98"		Nozzle 1.08"		Nozzle 1.18"		Nozzle 1.28"		Nozzle 1.38"		Nozzle 1.48"		Nozzle 1.58"	
	GPM	DIA.	GPM	DIA.	GPM	DIA.	GPM	DIA.	GPM	DIA.	GPM	DIA.	GPM	DIA.	GPM	DIA.	GPM	DIA.
40	110	229'	139	239'	172	254'	208	268'	248	279'	291	291'	337	301'	387	309'	440	319'
50	123	269'	156	284'	192	302'	233	317'	277	333'	325	348'	377	364'	433	377'	492	388'
60	135	294'	171	315'	211	334'	255	350'	303	367'	356	386'	413	401'	474	414'	539	427'
70	146	308'	184	332'	227	350'	275	371'	328	390'	384	407'	446	422'	512	435'	582	447'
80	156	321'	197	345'	243	364'	294	384'	350	404'	411	421'	476	436'	547	450'	622	458'
90	165	329'	209	352'	258	374'	312	395'	371	413'	436	429'	506	444'	580	457'	660	465'
100	174	334'	220	357'	272	379'	329	401'	392	418'	459	434'	533	450'	612	461'	696	470'
110	182	336'	231	359'	285	382'	345	404'	411	421'	482	438'	559	453'	642	465'	730	473'
120	191	339'	241	363'	298	385'	360	407'	429	424'	503	442'	584	456'	670	469'	762	476'

N.B.: Performance data were obtained under ideal testing conditions and may be adversely affected by wind and other factors. Pressure refers to pressure at nozzle. For solid-set applications, it is advised to take into account the appropriate throw-reduction factor for local atmospheric conditions in order to assure overlapping and coverage of the irrigated area. Every 3° drop of the trajectory angle the throw is reduced by approximately 3 to 4%.

PRODUCT OPTIONS - PROGRAMMÜBERSICHT

		TWIN max	TWIN 101	TWIN 140	TWIN 160	TWIN 202
	Part circle gun Sektorregener	available erhältlich	available erhältlich	available erhältlich	available erhältlich	available erhältlich
	Full circle gun Kreisregner	on request auf Anfrage	available erhältlich	on request auf Anfrage	available erhältlich	on request auf Anfrage
	Vari-Angle ®	not available nicht erhältlich	adjustable trajectory angle variabler Strahlwinkel 10° - 28°	adjustable trajectory angle variabler Strahlwinkel 10° - 28°	adjustable trajectory angle variabler Strahlwinkel 16° - 28°	adjustable trajectory angle variabler Strahlwinkel 16° - 28°
	Trajectory Strahlwinkel	18°/12°	24°/18°	24°	24°	24°
	Taper bore nozzles Weitwurfdüsen	12 nozzles/Düsen Ø 10 - 24 mm 0.39" - 0.94"	7 nozzles/Düsen Ø 12 - 24 mm 0.47" - 0.94"	8 nozzles/Düsen Ø 16 - 30 mm 0.63" - 1.18"	8 nozzles/Düsen Ø 17,5 - 35 mm 0.69" - 1.38"	9 nozzles/Düsen Ø 20 - 40 mm 0.79" - 1.58"
	Dynamic intermittent jet-breaker dynamischer Intervall- Strahlstörer	1 jet-breaker 1 Störer	1 or 2 jet-breakers 1 oder 2 Störer	1 or 2 jet-breakers 1 oder 2 Störer	1 or 2 jet-breakers 1 oder 2 Störer	1 or 2 jet-breakers 1 oder 2 Störer
	Connections Anschlüsse	2" BSPF Thread 2" NPTF Thread Gewinde 2" BSP Gewinde 2" NPT	Flange * 2" BSPF Thread 2" NPTF Thread Flansch * Gewinde 2" BSP Gewinde 2" NPT	Flange * Flansch *	Flange * Flansch *	Flange * Flansch *

* Standard Flange on all models :
External Ø 154 mm, 6 holes Ø 10.5 mm on pitch circle Ø 130 mm
For mod. 160-202 additional 6 holes Ø 10.5 mm on pitch circle Ø 146 mm
External Ø 6 1/16", 6 holes Ø 13/32" on pitch circle Ø 5 1/8".
For mod. 160-202 additional 6 holes Ø 13/32" on pitch circle Ø 5,748"

* Flanschanschlüsse für alle Modelle:
Außen Ø 154 mm, 6 Bohrungen Ø 10,5 mm auf Lochkreis Ø 130 mm
Für Mod. 160-202 weitere 6 Bohrungen Ø 10,5 mm auf Lochkreis Ø 146 mm

TWIN®

TECHNICAL INNOVATION IS OUR CHALLENGE THE ADVANTAGE FOR THE USER IS OUR GOAL

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Rif. 217 ED. Z7/01 - 2

Appendix 6:

ORS Consulting Engineers (January 2014)
Environmental Noise Survey

patel tonra ltd
environmental solutions

Patel Tonra Ltd. *for*
Rehab Glassco Ltd.

Feb. 2014

Engineering a Sustainable Future

ORS Consulting Engineers / ORS Building / Marlinstown Office Park / Mullingar, Co. Westmeath / Ireland

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Environmental Noise Survey

Rehab Glassco,
Unit 4 Oberstown Industrial Park,
Caragh Road,
Naas,
Co. Kildare

January 2014

Client	Revision	Date	Compiled	Checked	Approved
Rehab Glassco	D2	27/01/2014	DH	DC	
Unit 4 Oberstown Industrial Park, Caragh Road, Naas, Co. Kildare					

Index

0 Executive Summary

An Environmental noise survey was conducted on the 16th and 17th of January 2014 at the Rehab Glassco facility at 1 noise sensitive location outside the boundary of the facility, the location of which is highlighted on the enclosed site layout drawing.

Noise arose on the site from the ingress and egress of vehicles, movement of plant about the site and process noise from the recycling plant. Other contributing sources included traffic movements on the local road, R409 and the M7 motorway. Noise arose from the adjacent site which included vehicle movements and truck engines running constant.

Noise levels were compared to those recommended limits as set out EPA document **Guidance Note for Noise: Licence Applications, Surveys and Assessments in Relation to Scheduled Activities (NG4)** which states that ambient/daily noise levels should not exceed 55dB LAeq, with evening noise levels not exceeding 50dB LAeq and night time noise levels not exceeding 45dB LAeq at noise sensitive locations.

Noise levels for Day Times at the Noise Sensitive Location are within acceptable limits as set out in NG4, however there is exceedance during the evening and night-time monitoring period which was very clearly attributable to external noise sources which are discussed further in this report.

1 Scope

ORS Environmental Consultants were commissioned by Rehab Glassco to conduct a Daytime, evening and Night-time broadband; one-third octave noise for predetermined locations in Oberstown Industrial Park, Caragh Road, Naas, Co. Kildare. All tests were carried out during day-time, evening and night-time operations at the facility. Rehab Glassco is a facility which recycles glass products.

Monitoring at NSL 1 was carried out on the 16th and 17th of January 2014, including day, evening and night-time monitoring.

2 Monitoring Locations

Environmental noise monitoring was carried out at one noise sensitive location (NSL 1). The survey was conducted when the plant was in full operation i.e. normal activities taking place, however with the drying plant only operating between the hours of 7am and 7pm. The hours of waste acceptance (the hours during which the facility accepts waste) are: Monday to Saturday (including bank holidays): 07:00 (7am) to 19:00 (7pm); Sunday: closed.

The hours of operation (the hours during which the facility is operational) are: Monday to Friday (including bank holidays): 24-hours; Saturday: 07:00 (7am) to 23:00 (11pm); Sunday: closed.

The monitoring locations are detailed below in Table 1 and presented in the attached map in Appendix B.

Table 1: Noise Monitoring Location

Monitoring Location	Description
NSL 1	This monitoring point is located to the North of the site, outside of the site next to the boundary to the nearest dwelling. The monitor was positioned facing the Rehab Glassco Facility.
	*All monitoring locations are located at least 2m from any reflective surfaces

3 Activities on Site

Activities which took place at the plant during the monitoring periods included the delivery of glass products to be recycled, running of primary machinery such as hoppers, crushers and dryers which are housed internally. Other activities on site included plant machinery (i.e. Fork-lifts & Loaders), operating around the yard.

4 Durations & Measurements of Surveying

The day-time monitoring was carried out between the daytime hours of 09:00 and 19.00 on the 16th January 2014. The evening and night-time monitoring was conducted on the 16th and 17th January 2014 between the hours of 19:00 and 23:00 for evening measurements and between 23.00 and 02.00 for night time measurements. The following measurement was carried out at each location:

- Day, evening and Night-time Broadband measurements LAeq, LA10, and LA90, over a 15 minute period as set out in "**Guidance Note for Noise: Licence Applications, Surveys and Assessments in Relation to Scheduled Activities (NG4)"** as a minimum survey duration.
- 1/3 octave band frequency analysis.

5 Weather Conditions

While every effort was made to carry out the survey in accordance with the requirements of Guidance Note for Noise: Licence Applications, Surveys and Assessments in Relation to Scheduled Activities (NG4), regarding weather conditions, it should be noted that this is not always possible.

Ideally, measurements should be taken in 'neutral' weather conditions. This means in the absence of wind and precipitation, and ideally in conditions of standard temperature and pressure. Clearly, these conditions very rarely apply. The noise monitor was fitted with a windshield throughout the survey. An average wind speed of less than 5m/sec is the preferred limit when noise measurements are being taken, with 7m/sec an upper limit. On the days in question the wind speed was within limits. In as far as possible, care was be taken to avoid measurements so close to objects as to give rise to wind-derived noises, e.g. trees, pylons, etc.

Wind speed and wind direction have the potential to affect noise propagation and hence the noise measurements. The prevailing weather conditions at the time of measurement was noted and recorded in the survey report. Prior to each monitoring period a measurement of wind strength and direction was taken using a portable anemometer. A wind speed of 1-2m/s was measured coming from Northerly direction.

6 Instrumentation & Methodology

Measurements were made using a Bruel & Kjaer 2250 integrating sound level meter (SLM) with selective 1:1 or 1:3 octave band filters. Calibration was carried out on site using a Bruel & Kjaer acoustic calibrator at 94dB (A). The meter was calibrated before and after the monitoring round. Factory calibration certificates for the SLM and the acoustic calibrator, detailing equipment serial numbers, calibration traceability and recalibration dates are presented in Appendix C of this report. A "Windshield" was also fitted to the sound meter at all stages of monitoring.

The sound level meter was mounted at 1.5m above ground level. A sample period for the noise measurements was selected to be 15 minute intervals.

7 Glossary of Terms

Ambient noise: The total encompassing sound in a given situation at a given time usually composed of sound from many sources, near and far.

Background Noise Level: The A-weighted sound pressure level of the residual noise at the assessment position that is exceeded for 90 per cent of a given time interval, T. (L_{A90}, T).

Criterion Noise Level: The long-term mean value of the noise level that must not be exceeded. This is generally stipulated in the waste permit and it may be applied to a noise source, a boundary of the activity or to noise sensitive locations in the vicinity of the facility.

1/3 Octave Band Analysis: Frequency analysis of sound such that the frequency spectrum is subdivided into bands of one–third of an octave each. An octave is taken to be a frequency interval, the upper limit of which is twice the lower limit (the unit of frequency is the Hertz, Hz).

dB (decibel): The scale in which sound pressure level is expressed. It is defined as 20 times the logarithm of the ratio between the RMS pressure of the sound field and the reference pressure of 20 micro-pascals (20 µPa).

dBA or dB(A): An 'A-weighted decibel' - a measure of the overall noise level of sound across the audible frequency range (20 Hz – 20 kHz) with A-frequency weighting (i.e. 'A'–weighting) to compensate for the varying sensitivity of the human ear to sound at different frequencies.

Facade Level: Noise levels at locations 1m from the facade of a building are described by the term *Facade Levels* and are subject to higher noise levels than those in open areas (free-field conditions) due to reflection effects.

Free-field Conditions: These are conditions in which the radiation from sound sources is unaffected by the presence of any reflecting boundaries. In practice, it is a field in which the effects of the boundaries are negligible over the frequency range of interest. In environmental noise, true free-field measurement conditions are seldom achieved and generally the microphone will be positioned at a height between 1.2 and 1.5 metres above ground level. To minimise the influence of reflections, measurements are generally made at least 3.5 metres from any reflecting surface other than the ground.

Hz (Hertz): The unit of sound frequency in cycles per second.

Impulsive Noise: A noise that is of short duration (typically less than one second), the sound pressure level of which is significantly higher than the background. In determining whether a tonal adjustment applies, reference must be made to ISO 1996-2 (1987) - Section 4.1.

Impulse Exponential – Time-Weighting: This is a time-weighting which is available on some sound level meters and it represents an arbitrary compromise in an attempt to provide a means to measure the sound level of short-duration impulsive sounds. Impulse time-weighting has a design goal exponential-time constant of 35 ms for sound signals that increase with increasing time and 1.5 seconds for sound signals that decrease with increasing time.

LAeq,T: The equivalent steady sound level in dB containing the same acoustic energy as the actual fluctuating sound level over the given period T.

LAmax: The maximum RMS, A-Weighted sound pressure level occurring within a specified time period; the time weighting fast or slow is usually specified.

Noise: Any sound, that has the potential to cause disturbance, discomfort or psychological stress to a subject exposed to it, or any sound, that could to cause actual physiological harm to a subject exposed to it, or physical damage to any structure exposed to it, is known as noise.

Noise Sensitive Location: Any dwelling house, hotel or hostel, health building, educational establishment, place of worship or entertainment, or any other facility or other area of high amenity which for its proper enjoyment requires the absence of noise at nuisance levels.

Rating level (LAr,T) : The specific noise level, plus any adjustment for the characteristic features of the noise.

Residual noise: The ambient noise remaining at a given position in a given situation when the specific source is suppressed to a degree such that it does not contribute to the ambient noise (residual noise level is measured in terms of LAeq, T).

Root Mean Square (RMS): The RMS value of a set of numbers is the square root of the average of their squares.

Sound Exposure Level (SEL or LAE): Is the measure of the A-Weighted sound energy used to describe noise events such as the passing of a train or aircraft; it is the A-weighted sound pressure level if occurring over a period of 1 second, would contain the same amount of A-weighted sound energy as the event.

Specific noise level: A component of the ambient noise which can be specifically identified by acoustical means and may be associated with a specific source. In BS 4142, there is more precise definition as follows: 'the equivalent continuous A-weighted sound pressure level at the assessment position produced by the specific noise source over a given reference time interval (LAeq, T)'.

Time-weighting: One of the averaging times (Fast, Slow or Impulse) used for the measurement of RMS sound pressure level in sound level meters.

Tonal Noise: Noise which contains a clearly audible tone, i.e. a distinguishable, discrete or continuous note (whine, hiss screech or hum etc.). In determining whether a tonal adjustment applies, reference must be made to ISO 1996-2 (1987) - Section 4.

8 Noise Measurement Data

Table 3: Daytime Monitoring Data 16th January 14			
Monitoring Location	**Time**	**$L_{Aeq,15min}$ dB(A)**	**NG4 Limit dB(A)**
NSL 1	11.39 -11.54	57	55
NSL 1	12.32 - 12.47	55	55
NSL 1	14.18 -14.33	56	55

Table 4: Evening Monitoring Data 16th January 14			
Monitoring Location	**Time**	**$L_{Aeq,15min}$ dB(A)**	**NG4 Limit dB(A)**
NSL 1	20.24-20.39	55	50

Table 5: Night Monitoring Data 17th January 14			
Monitoring Location	**Time**	**$L_{Aeq,15min}$ dB(A)**	**NG4 Limit dB(A)**
NSL 1	00.11-00.26	56	45
NSL 1	00.28-00.43	55	45

		Table 6: 1/3 Octave Band Analysis (12.50Hz – 400.00Hz)										16th January (Day)			
Monitoring Location	**12.50 Hz**	**16.00 Hz**	**20.00 Hz**	**25.00 Hz**	**31.50 Hz**	**40.00 Hz**	**50.00 Hz**	**63.00 Hz**	**80.00 Hz**	**100.00 Hz**	**125.00 Hz**	**160.00 Hz**	**200.00 Hz**	**250.00 Hz**	**315.00 Hz**	**400.00 Hz**
NSL 1 11.39 -11.54	-2	24	12	16	28	25	29	31	31	31	30	31	31	33	34	37
NSL 1 12.32 - 12.47	-3	22	11	16	29	28	29	32	33	30	31	31	31	32	33	36
NSL 1 14.18 -14.33	-2	22	12	16	30	26	29	30	30	30	33	34	31	32	33	36

		Table 6: 1/3 Octave Band Analysis (500.00Hz – 16000.00Hz)										16th January (Day)			
Monitoring Location	**500.00 Hz**	**630.00 Hz**	**800.00 Hz**	**1000.00 Hz**	**1250.00 Hz**	**1600.00 Hz**	**2000.00 Hz**	**2500.00 Hz**	**3150.00 Hz**	**4000.00 Hz**	**5000.00 Hz**	**6300.00 Hz**	**8000.00 Hz**	**10000.00 Hz**	**12500.00 Hz**	**16000.00 Hz**
NSL 1 11.39 -11.54	42	47	50	50	49	47	43	41	39	34	30	28	22	11	6	4
NSL 1 12.32 - 12.47	40	44	48	48	47	45	40	38	36	32	28	25	21	11	7	4
NSL 1 14.18 -14.33	41	46	49	50	48	45	42	39	37	33	28	24	20	10	6	4

		Table 7: 1/3 Octave Band Analysis (12.50Hz – 400.00Hz)										16th January (Evening)			
Monitoring Location	**12.50 Hz**	**16.00 Hz**	**20.00 Hz**	**25.00 Hz**	**31.50 Hz**	**40.00 Hz**	**50.00 Hz**	**63.00 Hz**	**80.00 Hz**	**100.00 Hz**	**125.00 Hz**	**160.00 Hz**	**200.00 Hz**	**250.00 Hz**	**315.00 Hz**	**400.00 Hz**
NSL 1 20.24-20.39	-7	18	7	8	21	21	26	39	29	28	32	30	30	30	32	34
		Table 7: 1/3 Octave Band Analysis (500.00Hz – 16000.00Hz)										16th January (Evening)			
Monitoring Location	**500.00 Hz**	**630.00 Hz**	**800.00 Hz**	**1000.00 Hz**	**1250.00 Hz**	**1600.00 Hz**	**2000.00 Hz**	**2500.00 Hz**	**3150.00 Hz**	**4000.00 Hz**	**5000.00 Hz**	**6300.00 Hz**	**8000.00 Hz**	**10000.00 Hz**	**12500.00 Hz**	**16000.00 Hz**
NSL 1 20.24-20.39	39	45	49	49	47	46	40	37	30	24	20	18	14	11	7	4

		Table 8: 1/3 Octave Band Analysis (12.50Hz – 400.00Hz)										17th January (Night)			
Monitoring Location	**12.50 Hz**	**16.00 Hz**	**20.00 Hz**	**25.00 Hz**	**31.50 Hz**	**40.00 Hz**	**50.00 Hz**	**63.00 Hz**	**80.00 Hz**	**100.00 Hz**	**125.00 Hz**	**160.00 Hz**	**200.00 Hz**	**250.00 Hz**	**315.00 Hz**	**400.00 Hz**
NSL 1 00.11-00.26	-3	22	11	9	26	23	28	40	30	29	32	30	31	31	32	35
NSL 1 00.28-00.43	-4	22	11	8	24	24	26	34	27	30	34	34	35	33	33	35

		Table 8: 1/3 Octave Band Analysis (500.00Hz – 16000.00Hz)											17th January (Night)			
Monitoring Location	**500.00 Hz**	**630.00 Hz**	**800.00 Hz**	**1000.00 Hz**	**1250.00 Hz**	**1600.00 Hz**	**2000.00 Hz**	**2500.00 Hz**	**3150.00 Hz**	**4000.00 Hz**	**5000.00 Hz**	**6300.00 Hz**	**8000.00 Hz**	**10000.00 Hz**	**12500.00 Hz**	**16000.00 Hz**
NSL 1 00.11-00.26	40	46	50	50	48	47	42	38	34	30	24	19	12	7	4	2
NSL 1 00.28-00.43	36	43	48	51	48	45	41	35	31	26	22	17	12	7	4	3

9 Interferences

Below is a comprehensive breakdown of all the noise interference and sources that occurred at NSL 1 during each monitoring period.

Noise Sources/Interferences – NSL	
Date	
16th January 2014 11.39 -11.54	• Lorries reversing and Tipping Glass within the Rehab Compound. • Traffic noise from M7 was quite prominent • Truck movements at nearby facility • Birdsong • Light Rain
16th January 2014 12.32 - 12.47	• Birdsong • A number of lorries were noted to enter the adjacent site and were left idling for long periods. • Road noise from the nearby R409 to the East, Local road to the North of the Site and the M7
16th January 2014 14.18 -14.33	• Road noise from the nearby R409 to the East • Traffic noise from M7 was quite prominent • Truck movements at nearby facility
16th January 2014 20.24-20.39	• Distant traffic noise (M7) • Vehicle movement at adjacent site (i.e. reversing, idling engines) • Light rain
17th January 2014 00.11-00.26	• Constant traffic noise (M7) • Vehicle movement at adjacent site (air brakes and reversing sirens) • Vehicle movement at adjacent site

10 Evaluation of Measurement Data

Tables 3 to 8 summarises the monitoring data for each period of noise monitoring which was carried out on site. From this monitoring the noise levels recorded ranged from 55dB (A) to 57dB (A) during the day, 55dB (A) during the evening and 55dB (A) during the night-time period.

These, in the main, are considered not to comply with the recommended Noise Level limits as set out in EPA document **Guidance Note for Noise: Licence Applications, Surveys and Assessments in Relation to Scheduled Activities (NG4) 2012.**

On review of the one-third octave band analysis tonal noise qualities were recorded at 16Hz. The 16Hz level recorded maybe attributable to the truck engines running constant on the adjacent site which was quite prominent during the monitoring period. The frequency of 16Hz in which tonal noise was detected is below 20Hz and therefore is not audible to the human ear.

11 Conclusion

As can be seen there is a significant exceedance in noise levels experienced at NSL 1.

It was noted during the monitoring period that, noise from the Rehab Glassco facility is barely audible and intermittent. Since the first monitoring round was undertaken in November 2012, Rehab Glassco have made efforts to minimise the generation of any excess noise emanating from the site through a combination of mitigation measures including revised work / operation practices and boundary screening.

Given the above results it can be concluded that any exceedance in noise limits is attributable to external influences such as the constant traffic noise associated with the R409, M7 and the adjacent 24hr Warehousing Facility and not the Rehab Glassco facility.

Appendix A – Noise Measurement Graphs

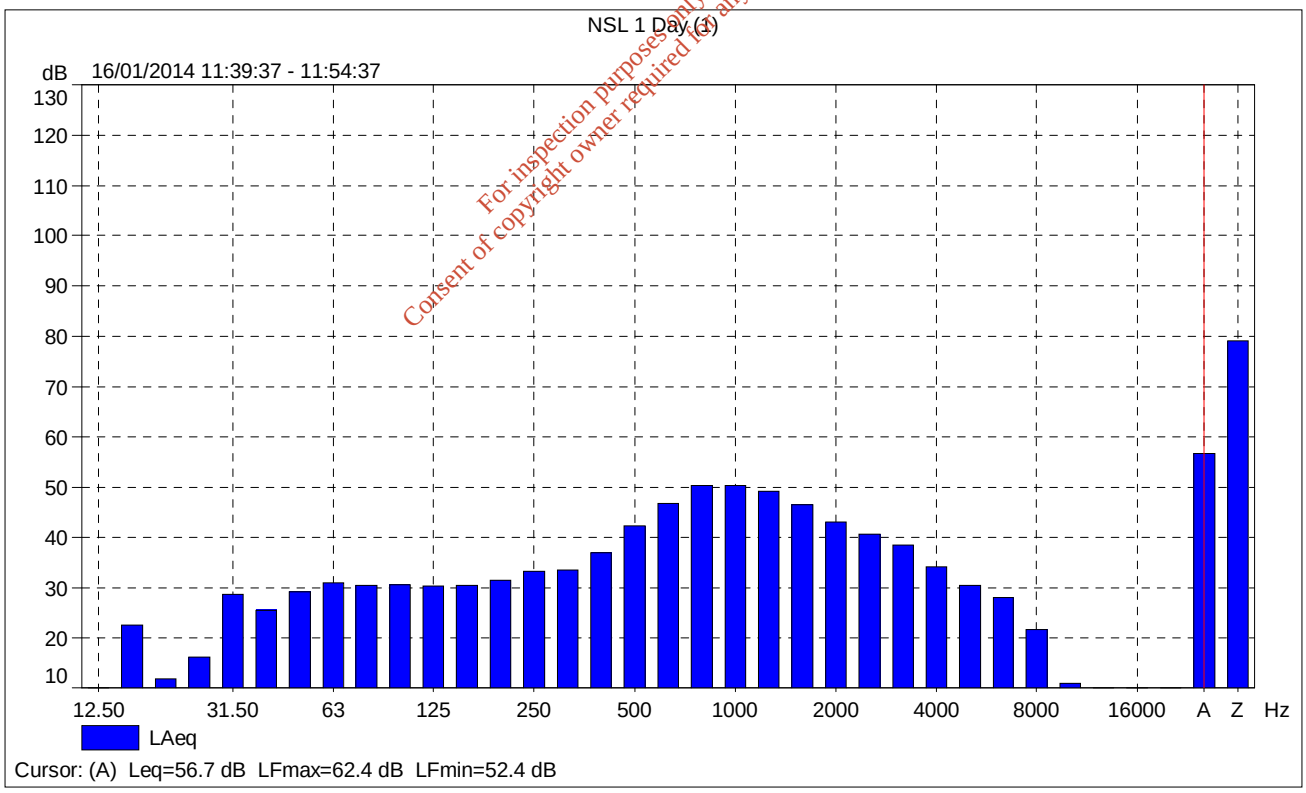
NSL 1 Day (1)

Instrument:		2250-L
Application:		BZ7132 Version 3.0.1
Start Time:		01/16/2014 11:39:37
End Time:		01/16/2014 11:54:37
Elapsed Time:		00:15:00
Bandwidth:		1/3-octave
Max Input Level:		140.63

	Time	Frequency
Broadband (excl. Peak):	FSI	AZ
Broadband Peak:		C
Spectrum:	FS	A

Instrument Serial Number:		2602719
Microphone Serial Number:		2600864
Input:		
Windscreen Correction:		None
Sound Field Correction:		Free-field

Calibration Time:		01/16/2014 11:38:15
Calibration Type:		External reference
Sensitivity:		51.9015118479729 mV/Pa



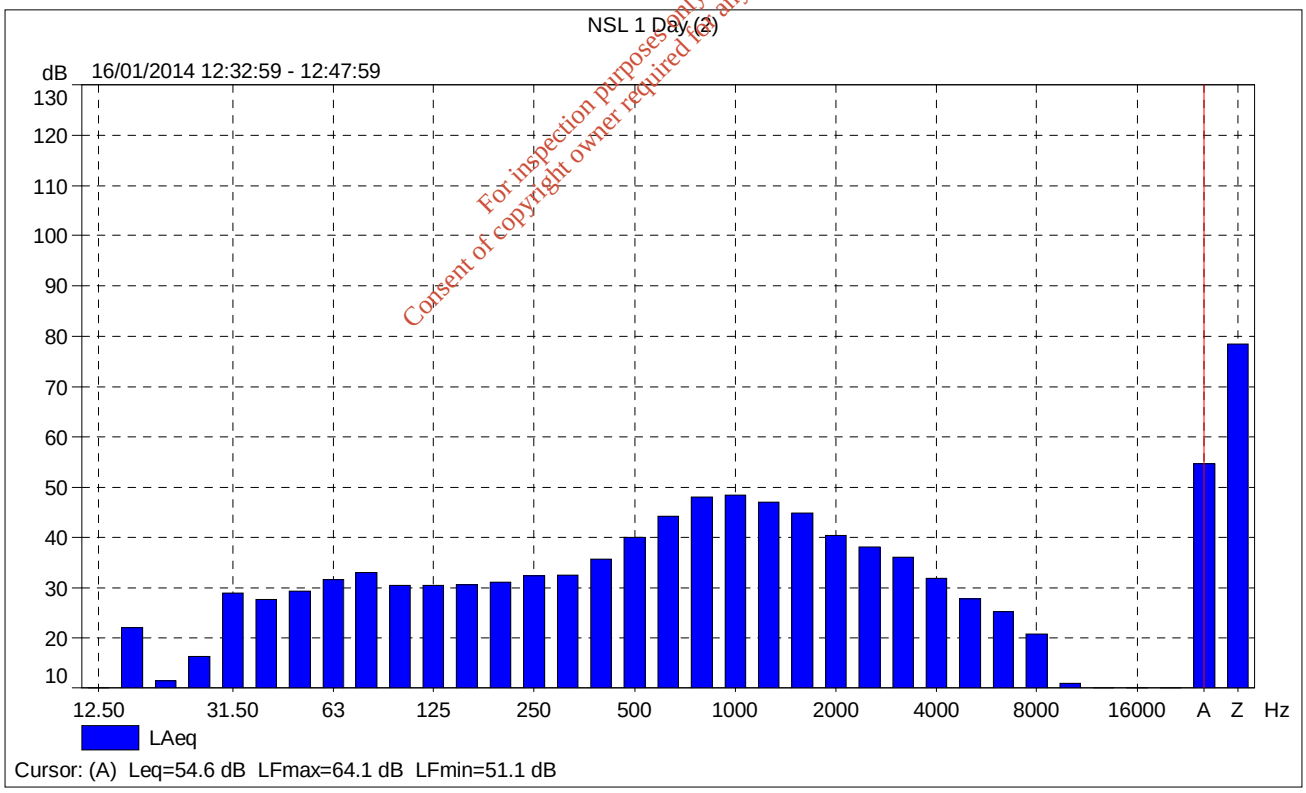
NSL 1 Day (2)

Instrument:		2250-L
Application:		BZ7132 Version 3.0.1
Start Time:		01/16/2014 12:32:59
End Time:		01/16/2014 12:47:59
Elapsed Time:		00:15:00
Bandwidth:		1/3-octave
Max Input Level:		140.63

	Time	Frequency
Broadband (excl. Peak):	FSI	AZ
Broadband Peak:		C
Spectrum:	FS	A

Instrument Serial Number:		2602719
Microphone Serial Number:		2600864
Input:		
Windscreen Correction:		None
Sound Field Correction:		Free-field

Calibration Time:		01/16/2014 11:38:15
Calibration Type:		External reference
Sensitivity:		51.9015118479729 mV/Pa



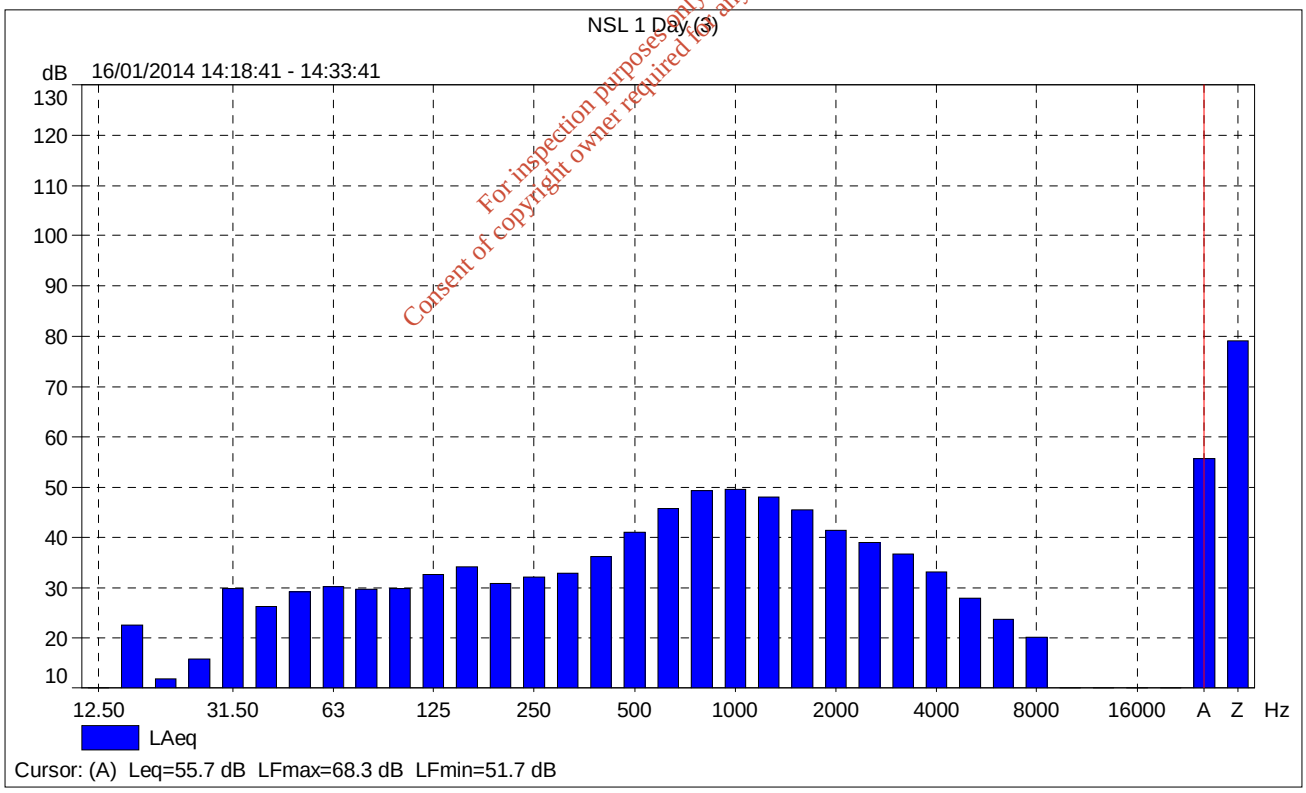
NSL 1 Day (3)

Instrument:		2250-L
Application:		BZ7132 Version 3.0.1
Start Time:		01/16/2014 14:18:41
End Time:		01/16/2014 14:33:41
Elapsed Time:		00:15:00
Bandwidth:		1/3-octave
Max Input Level:		140.63

	Time	Frequency
Broadband (excl. Peak):	FSI	AZ
Broadband Peak:		C
Spectrum:	FS	A

Instrument Serial Number:		2602719
Microphone Serial Number:		2600864
Input:		
Windscreen Correction:		UA-0237
Sound Field Correction:		Free-field

Calibration Time:		01/16/2014 11:38:15
Calibration Type:		External reference
Sensitivity:		51.9015118479729 mV/Pa



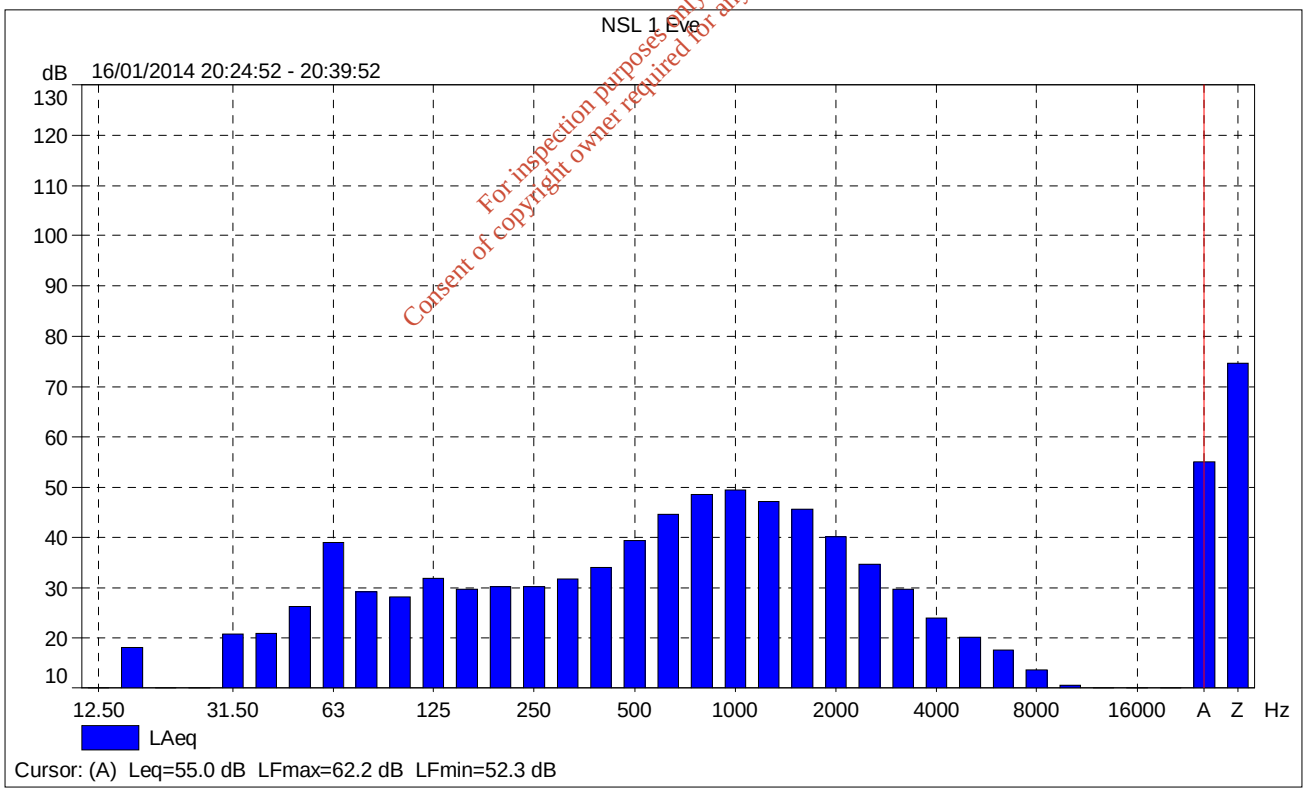
NSL 1 Eve

Instrument:		2250-L
Application:		BZ7132 Version 3.0.1
Start Time:		01/16/2014 20:24:52
End Time:		01/16/2014 20:39:52
Elapsed Time:		00:15:00
Bandwidth:		1/3-octave
Max Input Level:		140.62

	Time	Frequency
Broadband (excl. Peak):	FSI	AZ
Broadband Peak:		C
Spectrum:	FS	A

Instrument Serial Number:		2602719
Microphone Serial Number:		2600864
Input:		
Windscreen Correction:		UA-0237
Sound Field Correction:		Free-field

Calibration Time:		01/16/2014 11:38:15
Calibration Type:		External reference
Sensitivity:		51.9015118479729 mV/Pa



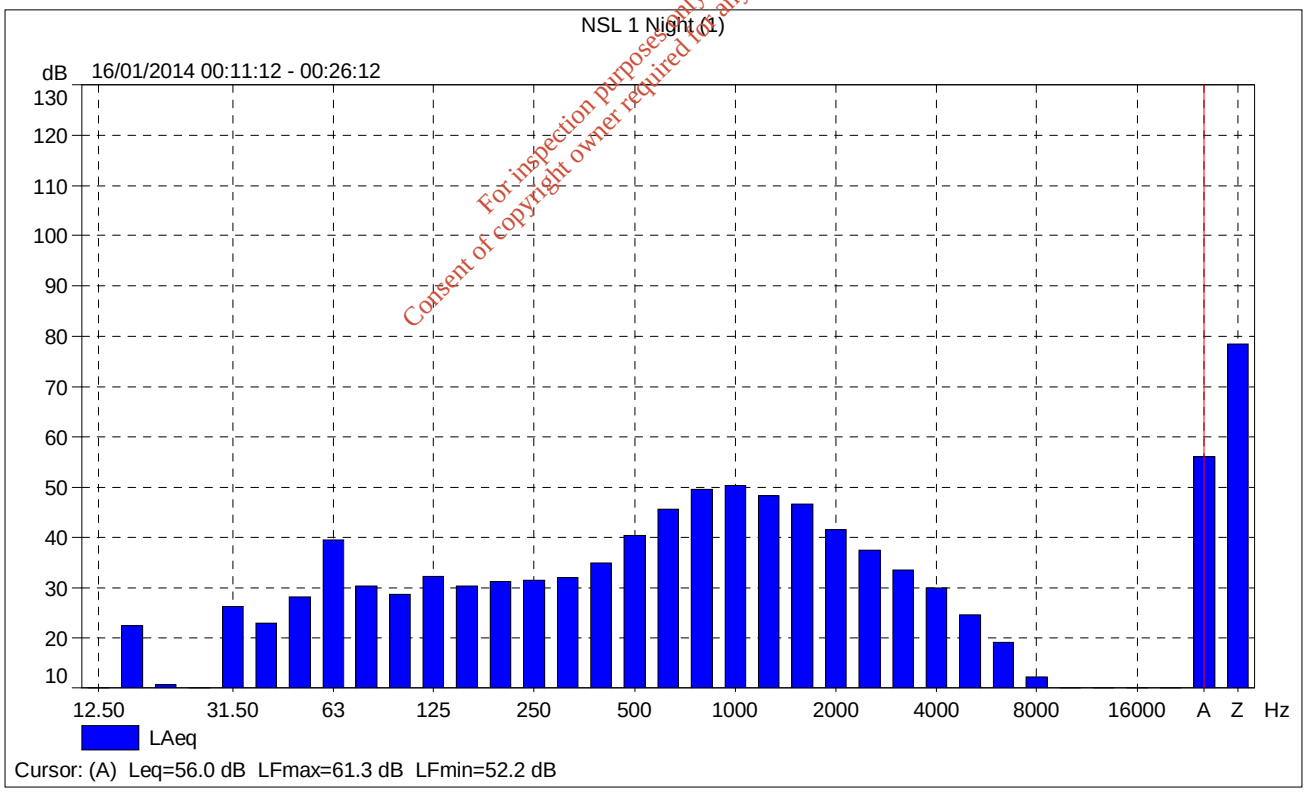
NSL 1 Night (1)

Instrument:		2250-L
Application:		BZ7132 Version 3.0.1
Start Time:		01/16/2014 00:11:12
End Time:		01/16/2014 00:26:12
Elapsed Time:		00:15:00
Bandwidth:		1/3-octave
Max Input Level:		140.62

	Time	Frequency
Broadband (excl. Peak):	FSI	AZ
Broadband Peak:		C
Spectrum:	FS	A

Instrument Serial Number:		2602719
Microphone Serial Number:		2600864
Input:		
Windscreen Correction:		UA-0237
Sound Field Correction:		Free-field

Calibration Time:		01/16/2014 11:38:15
Calibration Type:		External reference
Sensitivity:		51.9015118479729 mV/Pa



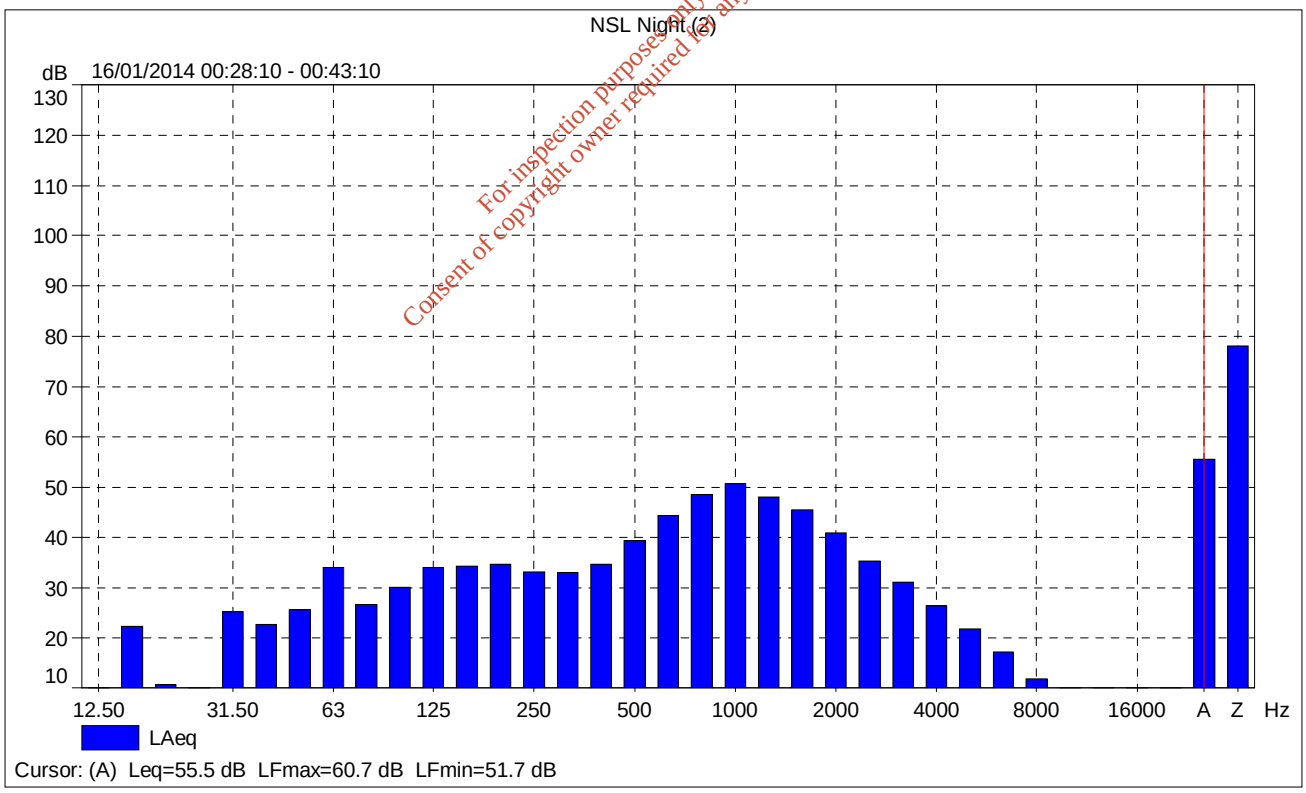
NSL Night (2)

Instrument:		2250-L
Application:		BZ7132 Version 3.0.1
Start Time:		01/16/2014 00:28:10
End Time:		01/16/2014 00:43:10
Elapsed Time:		00:15:00
Bandwidth:		1/3-octave
Max Input Level:		140.62

	Time	Frequency
Broadband (excl. Peak):	FSI	AZ
Broadband Peak:		C
Spectrum:	FS	A

Instrument Serial Number:		2602719
Microphone Serial Number:		2600864
Input:		
Windscreen Correction:		UA-0237
Sound Field Correction:		Free-field

Calibration Time:		01/16/2014 11:38:15
Calibration Type:		External reference
Sensitivity:		51.9015118479729 mV/Pa



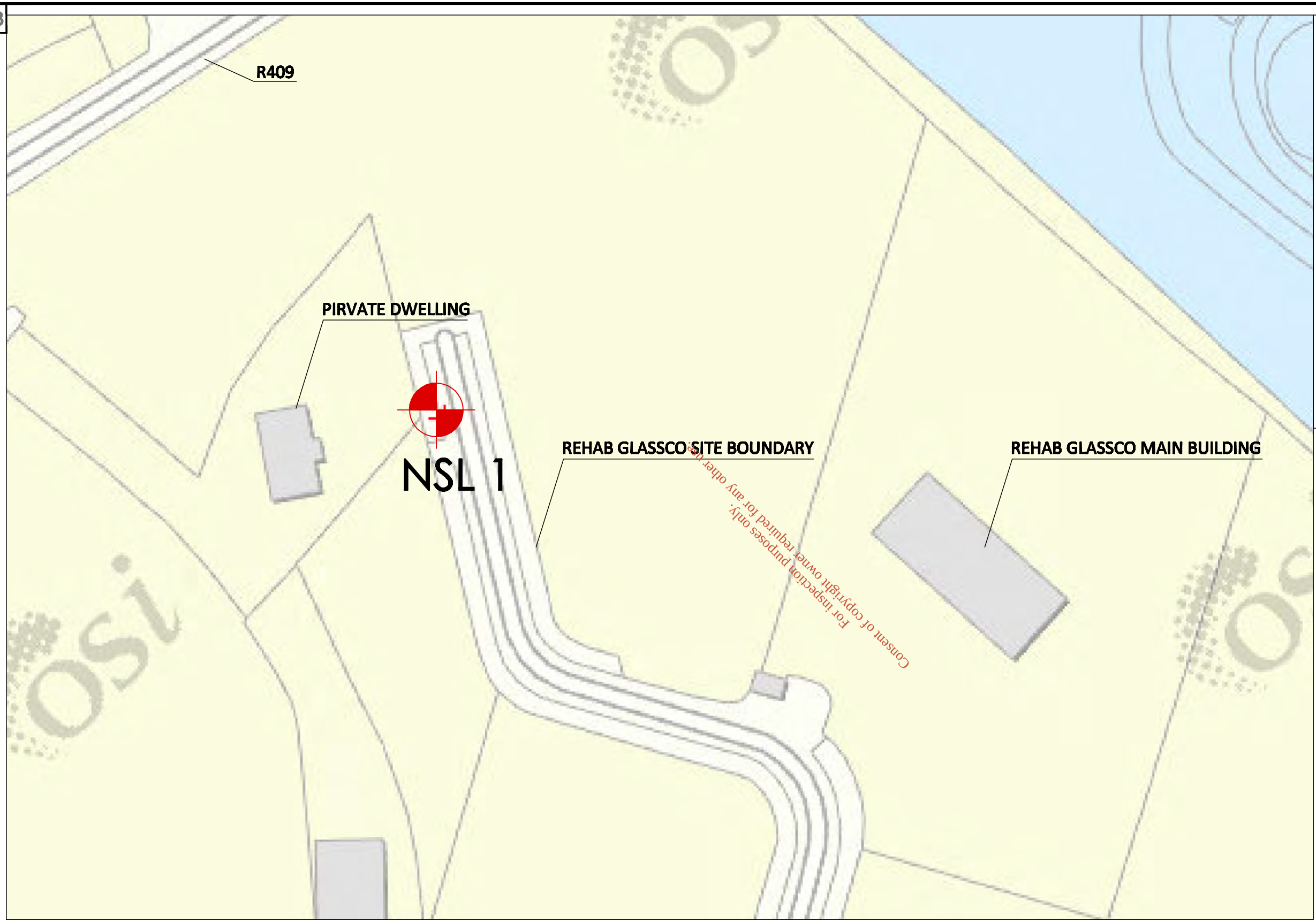
Appendix B – Noise Monitoring Locations

A3

REVISION DATE 31/05/11

REVISION 1

FORM NO FRM-010



LEGEND	
	BOUNDARY LINE
Nx	NOISE MONITORING LOCATIONS
NSL	NOISE SENSITIVE LOCATIONS
Dx	DUST MONITORING LOCATIONS
SWx	SURFACEWATER MONITORING LOCATIONS
BHx	GROUNDWATER MONITORING LOCATIONS
	EXISTING WELL/BOREHOLE
Vx	VIBRATION MONITORING LOCATIONS
Ax	AIR MONITORING LOCATIONS
	EXISTING SURFACE WATER PIPES
	EXISTING FOUL SEWER PIPES
	EXISTING WATERMAIN
	EXISTING MANHOLE
F	FOUL SEWER
S	SURFACE WATER
	EXISTING BUILDING
	PROPOSED BUILDING
	NORTH POINT

SITE LAYOUT - NTS

ISSUE

ON ORIGINAL

0 10 20 30 40 50mm

REV NO:	DATE:	REVISION NOTE:	DWN BY:	CKD BY:
D1	06/12/12	ISSUED TO CLIENT	DH	DC

SITE LOCATION

Datum: Irish Grid System: Malin Head ITM

CLIENT:	REHAB GLASSCO
PROJECT:	ENVIRONMENTAL NOISE MONITORING AT REHAB GALSSCO SITE, NAAS
TITLE:	SITE LAYOUT NOISE MONITORING LOCATIONS

DRAWN:	CHECKED:	APPROVED:	DRAWING NO:	REV:
DH	DC		101_169_201	D1
DATE: 06/12/12	SCALE: NTS			

ORS
Consulting Engineers
ORS Building, Mullingar, Co. Westmeath
T: +353 (0) 44 934 2518 F: +353 (0) 44 934 4573
E: info@ors.ie W: www.ors.ie
ISO 9001:2008 QUALITY ASSURED COMPANY

Appendix C – Calibration Certificates

Brüel & Kjær

The Calibration Laboratory
Skodsborgvej 307, DK-2850 Nærum, Denmark

ilac-MRA DANAK CAL Reg.nr. 307

CERTIFICATE OF CALIBRATION

No: CDK1307034 Page 1 of 4

CALIBRATION OF

Calibrator:	Brüel & Kjær Type 4231	No: 2605825 Id: -
½ Inch adaptor:	Brüel & Kjær Type UC-0210	
Pattern Approval:	PTB-1.61-4057176	

CUSTOMER

ORS Consulting Engineers
Marlinstown Office Park
Mullingar
Co. Westmeath, Ireland

CALIBRATION CONDITIONS

Preconditioning:	4 hours at 23°C ± 3°C
Environment conditions:	Pressure: 101.4 kPa. Humidity: 51 % RH. Temperature: 23.1 °C.

SPECIFICATIONS

The Calibrator Brüel & Kjær Type 4231 has been calibrated in accordance with the requirements as specified in IEC60942:2003 Annex B Class 1. The accreditation assures the traceability to the international units system SI.

PROCEDURE

The measurements have been performed with the assistance of Brüel & Kjær acoustic calibrator calibration application software Type 7794 (version 2.4) by using procedure P_4231_D04.

RESULTS

Calibration Mode: **Calibration as received.**

The reported expanded uncertainty is based on the standard uncertainty multiplied by a coverage factor $k = 2$ providing a level of confidence of approximately 95 %. The uncertainty evaluation has been carried out in accordance with EA-4/02 from elements originating from the standards, calibration method, effect of environmental conditions and any short time contribution from the device under calibration.

Date of calibration: 2013-09-06

Date of issue: 2013-09-06

Susanne Nygaard
Calibration Technician

Erik Bruus
Approved Signatory

Brüel & Kjær

The Calibration Laboratory
Skodsborgvej 307, DK-2850 Nærum, Denmark

1. Visual Inspection

OK.

2. Measured Values

All stated values are valid at the following environmental reference conditions:

Pressure	101.3 kPa
Temperature	23.0 °C
Relative Humidity	50.0 %

2.1 Sound Pressure Levels

The sound pressure level is measured using the sound calibration comparison method.

Nominal Level [dB]	Accept Limit Lower [dB]	Accept Limit Upper [dB]	Measured Level [dB]	Measurement Uncertainty [dB]
94.00	93.89	94.11	93.93	0.09
114.00	113.89	114.11	113.95	0.09

2.2 Frequency

Nominal Level [Hz]	Accept Limit Lower [Hz]	Accept Limit Upper [Hz]	Measured Frequency [Hz]	Measurement Uncertainty [Hz]
1000	990.10	1009.90	999.98	0.10

2.3 Total Distortion

Distortion mode: [X] TD [ ] THD

Calibration Level [dB]	Accept Limit [%]	Measured Distortion [%]	Measurement Uncertainty [%]
94	2.25	0.56	0.25
114	2.25	0.40	0.25

Note: Acceptance limits are reduced by measurement uncertainty to assure that measured value expanded by the actual expanded uncertainty does not exceed the specified limits as stated in the standard.

Brüel & Kjær

The Calibration Laboratory
Skodsborgvej 307, DK-2850 Nærum, Denmark

3. Calibration Equipment

	Instrument	Inventory No.
Sound Source, Reference	Brüel & Kjær, Type 4228	124228023
PULSE Analyzer	Brüel & Kjær, Type 3560-C	123560010
Transfer Microphone	Brüel & Kjær, Type 4192-L-001	124192027

4. Comments

As public evidence was available, from a testing organization responsible for approving the results of pattern evaluation tests, to demonstrate that the model of sound calibrator fully conformed to the requirements for pattern evaluation described in Annex A of IEC 60942:2003, the sound calibrator tested is considered to conform to all the class 1 requirements of IEC 60942:2003.

Brüel & Kjær

The Calibration Laboratory
Skodsborgvej 307, DK-2850 Nærum, Denmark

DANAK

The Danish Accreditation and Metrology Fund - DANAK - is managing the Danish accreditation scheme based on a contract with the Danish Safety Technology Authority under the Danish Ministry of Economics and Business Affairs who is responsible for the legislation on accreditation in Denmark.

The fundamental criteria for accreditation are described in DS/EN ISO/IEC 17025: "General requirements for the competence of testing and calibration laboratories", and in DS/EN ISO/IEC 15189 "Medical laboratories – Particular requirements for quality and competence" respectively. DANAK uses guidance documents to clarify the requirements in the standards, where this is considered to be necessary. These will mainly be drawn up by the "European co-operation for Accreditation (EA)" or the "International Laboratory Accreditation Co-operation (ILAC)" with a view to obtaining uniform criteria for accreditation worldwide. In addition, the Danish Safety Technology Authority issues Technical Regulations prepared by DANAK with specific requirements for accreditation that are not contained in the standards.

In order for a laboratory to be accredited it is, among other things, required:

- *that the laboratory and its personnel are free from any commercial, financial or other pressures, which might influence their impartiality;*
- *that the laboratory operates a documented management system, and has a management that ensures that the system is followed and maintained;*
- *that the laboratory has at its disposal all items of equipment, facilities and premises required for correct performance of the service that it is accredited to perform;*
- *that the laboratory has at its disposal personnel with technical competence and practical experience in performing the services that they are accredited to perform;*
- *that the laboratory has procedures for traceability and uncertainty calculations;*
- *that accredited testing, calibration or medical examination are performed in accordance with fully validated and documented methods;*
- *that accredited services are performed and reported in confidentiality with the customer and in compliance with the customer's request;*
- *that the laboratory keeps records which contain sufficient information to permit repetition of the accredited test, calibration or medical examination;*
- *that the laboratory is subject to surveillance by DANAK on a regular basis;*

Reports carrying DANAK's accreditation mark are used when reporting accredited services and show that these have been performed in accordance with the rules for accreditation.

Brüel & Kjær

The Calibration Laboratory
Skodsborgvej 307, DK-2850 Nærum, Denmark

ilac-MRA DANAK CAL Reg.nr. 307

CERTIFICATE OF CALIBRATION

No: C1107125 Page 1 of 10

CALIBRATION OF

Sound Level Meter:	Brüel & Kjær Type 2250 Light	No: 2602719	Id: -
Microphone:	Brüel & Kjær Type 4950	No: 2600864	
Preamplifier:	Brüel & Kjær Type ZC-0032	No: 6365	
Supplied Calibrator:	Brüel & Kjær Type 4231	No: 2605825	
Software version:	BZ7131 Version 3.0.1	Pattern Approval:	PENDING
Instruction manual:	BE-1774-11		

CUSTOMER

ORS Consulting Engineers
Marlinstown Office Park
Mullingar
Co. Westmeath, Ireland

CALIBRATION CONDITIONS

Preconditioning: 4 hours at 23°C ± 3°C

Environment conditions: *See actual values in **Environmental conditions** sections.*

SPECIFICATIONS

The Sound Level Meter Brüel & Kjær Type 2250 Light has been calibrated in accordance with the requirements as specified in IEC61672-1:2002 class 1. Procedures from IEC 61672-3:2006 were used to perform the periodic tests.

PROCEDURE

The measurements have been performed with the assistance of Brüel & Kjær Sound Level Meter Calibration System 3630 with application software type 7763 (version 4.5 - DB: 4.50) by using procedure 2250-L-4950.

RESULTS

Calibration Mode: **Calibration as received.**

The reported expanded uncertainty is based on the standard uncertainty multiplied by a coverage factor $k = 2$ providing a level of confidence of approximately 95 %. The uncertainty evaluation has been carried out in accordance with EA-4/02 from elements originating from the standards, calibration method, effect of environmental conditions and any short time contribution from the device under calibration.

Date of calibration: 2011-09-08

Steen Vodstrup Andersen
Calibration Technician

Date of issue: 2011-09-08

Nils Johansen
Approved Signatory

Brüel & Kjær

The Calibration Laboratory
Skodsborgvej 307, DK-2850 Nærum, Denmark

1. Calibration Note

n/a

2. Summary

4.1. Preliminary inspection	Passed
4.2. Environmental conditions, Prior to calibration	Passed
4.3. Reference information	Passed
4.4. Indication at the calibration check frequency	Passed
4.5. Self-generated noise, Microphone installed	Passed
4.6. Acoustical signal tests of a frequency weighting, C weighting	Passed
4.7. Self-generated noise, Electrical	Passed
4.8. Electrical signal tests of frequency weightings, A weighting	Passed
4.9. Electrical signal tests of frequency weightings, C weighting	Passed
4.10. Electrical signal tests of frequency weightings, Z weighting	Passed
4.11. Frequency and time weightings at 1 kHz	Passed
4.12. Level linearity on the reference level range, Upper	Passed
4.13. Level linearity on the reference level range, Lower	Passed
4.14. Toneburst response, Time-weighting Fast	Passed
4.15. Toneburst response, Time-weighting Slow	Passed
4.16. Toneburst response, LAE	Passed
4.17. Peak C sound level, 8 kHz	Passed
4.18. Peak C sound level, 500 Hz	Passed
4.19. Overload indication	Passed
4.20. Environmental conditions, Following calibration	Passed

The sound level meter submitted for periodic testing successfully completed the class 1 tests of IEC 61672-3:2006, for the environmental conditions under which the tests were performed.
However, no general statement or conclusion can be made about conformance of the sound level meter to the full requirements of IEC 61672-1:2002 because evidence was not publicly available, from an independent testing organization responsible pattern approvals, to demonstrate that the model of sound level meter fully conformed to the requirements in IEC 61672-1:2002 and because the periodic test of IEC 61672-3:2006 cover only a limited subset of the specifications in IEC 61672-1:2002.

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3. Instruments

	Instrument	Inventory No.
Generator	Brüel & Kjær, Type 3560	123560014
AmplifierDivider	Brüel & Kjær, Type 3111	123111004
Calibrator	Brüel & Kjær, Type 4226	124226018
Adaptor	Brüel & Kjær, Type WA-0302-B 15 pF	150503009
Voltmeter	Agilent, Type 34970A	142101028

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4. Measurements

4.1. Preliminary inspection

Visually inspect instrument, and operate all relevant controls. (section 5)

Routine Passed

4.2. Environmental conditions, Prior to calibration

Actual environmental conditions prior to calibration. (section 7)

	Measured	
	[Deg / kPa / %RH]	
Air temperature	22.30	
Air pressure	99.57	
Relative humidity	53.00	

4.3. Reference information

Information about reference range, level and channel. (section 19.h + 19.m)

	Value	
	[dB]	
Reference sound pressure level	94	
Reference level range	140	
Channel number	1	

4.4. Indication at the calibration check frequency

Measure and adjust sound level meter using the supplied calibrator. (section 9 + 19.m)

	Measured	Uncertainty	
	[dB / Hz]	[dB / Hz]	
Initial indication (supplied calibrator)	93.89	0.14	
Calibration check frequency (supplied calibrator)	1000.00	1.00	
Adjusted indication (supplied calibrator)	93.85	0.14	

4.5. Self-generated noise, Microphone installed

Self-generated noise measured with microphone submitted for periodic testing. Averaging time is 30 seconds. An anechoic chamber is used to isolate environmental noise. (section 10.1)

	Max	Measured	Deviation	Uncertainty	
	[dB]	[dB]	[dB]	[dB]	
A weighted	17.40	16.16	-1.24	1.00	
Monitor Level	20.40	11.40	-9.00	1.00	

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4.6. Acoustical signal tests of a frequency weighting, C weighting

Frequency weightings measured acoustically with a calibrated multi-frequency sound calibrator. Averaging time is 10 seconds, and the result is the average of 2 measurements. (section 11)

	Coupler Pressure Lc	Mic. Correction C4226	Body Influence	Expected	Measured	Corr. Measured	Accept - Limit	Accept + Limit	Deviation	Uncertainty
	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]
1000Hz, Ref. (1st)	94.30	0.15	-0.09	94.24	94.18	94.18	-1.1	1.1	-0.06	0.20
1000Hz, Ref. (2nd)	94.30	0.15	-0.09	94.24	94.18	94.18	-1.1	1.1	-0.06	0.20
1000Hz, Ref. (Average)	94.30	0.15	-0.09	94.24	94.18	94.18	-1.1	1.1	-0.06	0.20
125.89Hz (1st)	94.28	0.00	0.00	94.11	94.25	94.25	-1.5	1.5	0.14	0.20
125.89Hz (2nd)	94.28	0.00	0.00	94.11	94.25	94.25	-1.5	1.5	0.14	0.20
125.89Hz (Average)	94.28	0.00	0.00	94.11	94.25	94.25	-1.5	1.5	0.14	0.20
3981.1Hz (1st)	94.23	1.15	-0.06	92.37	92.17	92.17	-1.6	1.6	-0.20	0.30
3981.1Hz (2nd)	94.23	1.15	-0.06	92.37	92.18	92.18	-1.6	1.6	-0.19	0.30
3981.1Hz (Average)	94.23	1.15	-0.06	92.37	92.18	92.18	-1.6	1.6	-0.19	0.30
7943.3Hz (1st)	93.98	3.85	-0.17	87.33	86.98	86.98	-3.1	2.1	-0.35	0.40
7943.3Hz (2nd)	93.98	3.85	-0.17	87.33	86.99	86.99	-3.1	2.1	-0.34	0.40
7943.3Hz (Average)	93.98	3.85	-0.17	87.33	86.98	86.98	-3.1	2.1	-0.35	0.40

4.7. Self-generated noise, Electrical

Self-generated noise measured in most sensitive range, with electrical substitution for microphone, according to manufactures specifications.

Exceedance of the measured level above the corresponding level given in the instruction manual does not, by itself, mean that the performance of the sound level meter is no longer acceptable for many practical applications. (section 10.2)

	Max	Measured	Uncertainty
	[dB]	[dB]	[dB]
A weighted	13.70	12.86	0.30
C weighted	15.00	13.37	0.30
Z weighted	20.40	18.91	0.30

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4.8. Electrical signal tests of frequency weightings, A weighting

Frequency response measured with electrical signal relative to level at 1 kHz in reference range. (section 12)

	Input Level	Expected	Measured	Acoustical Resp.	Body Influence	Corr. Measured	Accept - Limit	Accept + Limit	Deviation	Uncertainty
	[dBV]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]
1000Hz, Ref.	-24.68	95.00	95.00	-0.04	-0.09	94.87	-1.1	1.1	-0.13	0.12
63.096Hz	1.52	95.00	95.01	0.21	0.00	95.22	-1.5	1.5	0.22	0.12
125.89Hz	-8.58	95.00	95.01	0.10	0.00	95.11	-1.5	1.5	0.11	0.12
251.19Hz	-16.08	95.00	94.97	0.01	0.06	95.04	-1.4	1.4	0.04	0.12
501.19Hz	-21.48	95.00	94.97	-0.03	0.22	95.16	-1.4	1.4	0.16	0.12
1995.3Hz	-25.88	95.00	95.00	-0.04	-0.01	94.95	-1.6	1.6	-0.05	0.12
3981.1Hz	-25.68	95.00	94.91	-0.02	-0.06	94.83	-1.6	1.6	-0.17	0.12
7943.3Hz	-23.58	95.00	94.69	0.02	-0.17	94.54	-3.1	2.1	-0.46	0.12
15849Hz	-18.08	95.00	95.59	0.06	-0.01	95.64	-17.0	3.5	0.64	0.12

4.9. Electrical signal tests of frequency weightings, C weighting

Frequency response measured with electrical signal relative to level at 1 kHz in reference range. (section 12)

	Input Level	Expected	Measured	Acoustical Resp.	Body Influence	Corr. Measured	Accept - Limit	Accept + Limit	Deviation	Uncertainty
	[dBV]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]
1000Hz, Ref.	-24.68	95.00	95.00	-0.04	-0.09	94.87	-1.1	1.1	-0.13	0.12
63.096Hz	-23.88	95.00	94.97	0.21	0.00	95.18	-1.5	1.5	0.18	0.12
125.89Hz	-24.48	95.00	95.03	0.10	0.00	95.13	-1.5	1.5	0.13	0.12
251.19Hz	-24.68	95.00	95.00	0.01	0.06	95.07	-1.4	1.4	0.07	0.12
501.19Hz	-24.68	95.00	95.04	-0.03	0.22	95.23	-1.4	1.4	0.23	0.12
1995.3Hz	-24.48	95.00	95.03	-0.04	-0.01	94.98	-1.6	1.6	-0.02	0.12
3981.1Hz	-23.88	95.00	94.92	-0.02	-0.06	94.84	-1.6	1.6	-0.16	0.12
7943.3Hz	-21.68	95.00	94.69	0.02	-0.17	94.54	-3.1	2.1	-0.46	0.12
15849Hz	-16.18	95.00	95.56	0.06	-0.01	95.61	-17.0	3.5	0.61	0.12

4.10. Electrical signal tests of frequency weightings, Z weighting

Frequency response measured with electrical signal relative to level at 1 kHz in reference range. (section 12)

	Input Level	Expected	Measured	Acoustical Resp.	Body Influence	Corr. Measured	Accept - Limit	Accept + Limit	Deviation	Uncertainty
	[dBV]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]
1000Hz, Ref.	-24.68	95.00	95.00	-0.04	-0.09	94.87	-1.1	1.1	-0.13	0.12
63.096Hz	-24.68	95.00	94.98	0.21	0.00	95.19	-1.5	1.5	0.19	0.12
125.89Hz	-24.68	95.00	95.00	0.10	0.00	95.10	-1.5	1.5	0.10	0.12
251.19Hz	-24.68	95.00	95.00	0.01	0.06	95.07	-1.4	1.4	0.07	0.12
501.19Hz	-24.68	95.00	95.00	-0.03	0.22	95.19	-1.4	1.4	0.19	0.12
1995.3Hz	-24.68	95.00	95.00	-0.04	-0.01	94.95	-1.6	1.6	-0.05	0.12
3981.1Hz	-24.68	95.00	94.94	-0.02	-0.06	94.86	-1.6	1.6	-0.14	0.12
7943.3Hz	-24.68	95.00	94.70	0.02	-0.17	94.55	-3.1	2.1	-0.45	0.12
15849Hz	-24.68	95.00	95.62	0.06	-0.01	95.67	-17.0	3.5	0.67	0.12

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4.11. Frequency and time weightings at 1 kHz

Frequency and time weighting measured at 1 kHz with electrical signal in reference range. Measured relative to A-weighted and Fast response. (section 13)

	Expected	Measured	Accept - Limit	Accept + Limit	Deviation	Uncertainty
	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]
LAF, Ref.	94.00	94.00	-0.4	0.4	0.00	0.12
LCF	94.00	94.00	-0.4	0.4	0.00	0.12
LZF	94.00	94.00	-0.4	0.4	0.00	0.12
LAS	94.00	93.99	-0.4	0.4	-0.01	0.12
LAeq	94.00	93.99	-0.4	0.4	-0.01	0.12

4.12. Level linearity on the reference level range, Upper

Level linearity in reference range, measured at 8 kHz until overload. (section 14)

	Expected	Measured	Accept - Limit	Accept + Limit	Deviation	Uncertainty
	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]
94 dB	94.00	94.00	-1.1	1.1	0.00	0.12
99 dB	99.00	99.00	-1.1	1.1	0.00	0.12
104 dB	104.00	104.00	-1.1	1.1	0.00	0.12
109 dB	109.00	109.01	-1.1	1.1	0.01	0.12
114 dB	114.00	114.02	-1.1	1.1	0.02	0.12
119 dB	119.00	119.02	-1.1	1.1	0.02	0.12
124 dB	124.00	124.02	-1.1	1.1	0.02	0.12
129 dB	129.00	129.03	-1.1	1.1	0.03	0.12
134 dB	134.00	134.02	-1.1	1.1	0.02	0.12
135 dB	135.00	135.02	-1.1	1.1	0.02	0.12
136 dB	136.00	136.02	-1.1	1.1	0.02	0.12
137 dB	137.00	137.02	-1.1	1.1	0.02	0.12
138 dB	138.00	138.02	-1.1	1.1	0.02	0.12
139 dB	139.00	139.02	-1.1	1.1	0.02	0.12

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4.13. Level linearity on the reference level range, Lower

Level linearity in reference range, measured at 8 kHz down to lower limit, or until underrange. (section 14)

	Expected	Measured	Accept - Limit	Accept + Limit	Deviation	Uncertainty
	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]
94 dB	94.00	94.00	-1.1	1.1	0.00	0.12
89 dB	89.00	88.99	-1.1	1.1	-0.01	0.12
84 dB	84.00	84.00	-1.1	1.1	0.00	0.12
79 dB	79.00	78.99	-1.1	1.1	-0.01	0.12
74 dB	74.00	73.99	-1.1	1.1	-0.01	0.12
69 dB	69.00	68.99	-1.1	1.1	-0.01	0.12
64 dB	64.00	63.98	-1.1	1.1	-0.02	0.12
59 dB	59.00	58.98	-1.1	1.1	-0.02	0.12
54 dB	54.00	53.99	-1.1	1.1	-0.01	0.12
49 dB	49.00	48.99	-1.1	1.1	-0.01	0.12
44 dB	44.00	44.00	-1.1	1.1	0.00	0.12
39 dB	39.00	39.02	-1.1	1.1	0.02	0.30
34 dB	34.00	34.04	-1.1	1.1	0.04	0.30
29 dB	29.00	29.11	-1.1	1.1	0.11	0.30
28 dB	28.00	28.17	-1.1	1.1	0.17	0.30
27 dB	27.00	27.19	-1.1	1.1	0.19	0.30
26 dB	26.00	26.24	-1.1	1.1	0.24	0.30
25 dB	25.00	25.29	-1.1	1.1	0.29	0.30

4.14. Toneburst response, Time-weighting Fast

Response to 4 kHz toneburst measured in reference range, relative to continuous signal. (section 16)

	Expected	Measured	Accept - Limit	Accept + Limit	Deviation	Uncertainty
	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]
Continuous, Ref.	138.00	138.00	-0.8	0.8	0.00	0.11
200 ms Burst	137.00	136.99	-0.8	0.8	-0.01	0.11
2 ms Burst	120.00	119.93	-1.8	1.3	-0.07	0.11
0.25 ms Burst	111.00	110.87	-3.3	1.3	-0.13	0.11

4.15. Toneburst response, Time-weighting Slow

Response to 4 kHz toneburst measured in reference range, relative to continuous signal. (section 16)

	Expected	Measured	Accept - Limit	Accept + Limit	Deviation	Uncertainty
	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]
Continuous, Ref.	138.00	138.01	-0.8	0.8	0.01	0.11
200 ms Burst	130.61	130.58	-0.8	0.8	-0.03	0.11
2 ms Burst	111.01	110.97	-3.3	1.3	-0.04	0.11

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4.16. Toneburst response, LAE

Response to 4 kHz toneburst measured in reference range, relative to continuous signal. (section 16)

	Expected	Measured	Accept - Limit	Accept + Limit	Deviation	Uncertainty
	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]
Continuous, Ref.	138.00	138.00	-0.8	0.8	0.00	0.11
200 ms Burst	131.00	130.98	-0.8	0.8	-0.02	0.11
2 ms Burst	111.00	110.96	-1.8	1.3	-0.04	0.11
0.25 ms Burst	102.00	101.86	-3.3	1.3	-0.14	0.11

4.17. Peak C sound level, 8 kHz

Peak-response to a 8 kHz single- cycle sine measured in least-sensitive range, relative to continuous signal. (section 17)

	Expected	Measured	Accept - Limit	Accept + Limit	Deviation	Uncertainty
	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]
Continuous, Ref.	135.00	135.00	-0.4	0.4	0.00	0.11
Single Sine	138.40	138.64	-2.4	2.4	0.24	0.40

4.18. Peak C sound level, 500 Hz

Peak-response to a 500 Hz half-cycle sine measured in least-sensitive range, relative to continuous signal. (section 17)

	Expected	Measured	Accept - Limit	Accept + Limit	Deviation	Uncertainty
	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]
Continuous, Ref.	135.00	135.00	-0.4	0.4	0.00	0.11
Half-sine, Positive	137.40	137.11	-1.4	1.4	-0.29	0.40
Half-sine, Negative	137.40	137.11	-1.4	1.4	-0.29	0.40

4.19. Overload indication

Overload indication in the least sensitive range determined with a 4 kHz positive/negative half-cycle signal. (section 18)

	Measured	Accept - Limit	Accept + Limit	Deviation	Uncertainty
	[dB]	[dB]	[dB]	[dB]	[dB]
Continuous	140.00	-0.4	0.4	0.00	0.20
Half-sine, Positive	141.10	-10.0	10.0	1.10	0.20
Half-sine, Negative	141.20	-10.0	10.0	1.20	0.20
Difference	141.20	-1.8	1.8	0.10	0.30

4.20. Environmental conditions, Following calibration

Actual environmental conditions following calibration. (section 7)

	Measured
	[Deg / kPa / %RH]
Air temperature	22.90
Air pressure	99.50
Relative humidity	51.00

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DANAK

The Danish Accreditation and Metrology Fund - DANAK - is managing the Danish accreditation scheme based on a contract with the Danish Safety Technology Authority under the Danish Ministry of Economics and Business Affairs who is responsible for the legislation on accreditation in Denmark.

The fundamental criteria for accreditation are described in DS/EN ISO/IEC 17025: "General requirements for the competence of testing and calibration laboratories", and in DS/EN ISO/IEC 15189 "Medical laboratories – Particular requirements for quality and competence" respectively. DANAK uses guidance documents to clarify the requirements in the standards, where this is considered to be necessary. These will mainly be drawn up by the "European co-operation for Accreditation (EA)" or the "International Laboratory Accreditation Co-operation (ILAC)" with a view to obtaining uniform criteria for accreditation worldwide. In addition, the Danish Safety Technology Authority issues Technical Regulations prepared by DANAK with specific requirements for accreditation that are not contained in the standards.

In order for a laboratory to be accredited it is, among other things, required:

- *that the laboratory and its personnel are free from any commercial, financial or other pressures, which might influence their impartiality;*
- *that the laboratory operates a documented management system, and has a management that ensures that the system is followed and maintained;*
- *that the laboratory has at its disposal all items of equipment, facilities and premises required for correct performance of the service that it is accredited to perform;*
- *that the laboratory has at its disposal personnel with technical competence and practical experience in performing the services that they are accredited to perform;*
- *that the laboratory has procedures for traceability and uncertainty calculations;*
- *that accredited testing, calibration or medical examination are performed in accordance with fully validated and documented methods;*
- *that accredited services are performed and reported in confidentiality with the customer and in compliance with the customer's request;*
- *that the laboratory keeps records which contain sufficient information to permit repetition of the accredited test, calibration or medical examination;*
- *that the laboratory is subject to surveillance by DANAK on a regular basis;*
- *that the laboratory shall take out an insurance, which covers liability in connection with the performance of accredited services.*

Reports carrying DANAK's accreditation mark are used when reporting accredited services and show that these have been performed in accordance with the rules for accreditation.

Appendix 7:

ORS Consulting Engineers (February 2014)
Environmental Noise Survey

patel tonra ltd
environmental solutions

Patel Tonra Ltd. *for*
Rehab Glassco Ltd.

Feb. 2014

Engineering a Sustainable Future

ORS Consulting Engineers / ORS Building / Marlinstown Office Park / Mullingar, Co. Westmeath / Ireland

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Environmental Noise Survey

Rehab Glassco,
Unit 4 Oberstown Industrial Park,
Caragh Road,
Naas,
Co. Kildare

February 2014

Client	Revision	Date	Compiled	Checked	Approved
Rehab Glassco	D1	21/02/2014	DH	DC	
Unit 4 Oberstown Industrial Park, Caragh Road, Naas, Co. Kildare					

Index

0 Executive Summary

An Environmental noise survey was conducted on the 20th and 21st of February 2014 at the Rehab Glassco facility at 1 noise sensitive location outside the boundary of the facility, the location of which is highlighted on the enclosed site layout drawing.

Results from a previous noise monitoring period, carried out in January 2014 were seen to exceed recommended levels with some tonal noise present. It was concluded that some of this exceedance could be attributed to external noise sources that were out of the control of the client. In an attempt to conclusively indentify these external noise sources an additional period of noise monitoring was conducted when all operations at the Rehab Glassco plant were stopped.

Noise levels were compared to those recommended limits as set out EPA document **Guidance Note for Noise: Licence Applications, Surveys and Assessments in Relation to Scheduled Activities (NG4)** which states that ambient/daily noise levels should not exceed 55dB LAeq, with evening noise levels not exceeding 50dB LAeq and night time noise levels not exceeding 45dB LAeq at noise sensitive locations.

Noise levels at the Noise Sensitive Location are outside acceptable limits as set out in NG4. As the Rehab Glassco Plant was not in operation during this period of monitoring this exceedance can clearly be attributable to external noise sources which are discussed further in this report.

1 Scope

ORS Environmental Consultants were commissioned by Rehab Glassco to conduct a Daytime, evening and Night-time broadband; one-third octave noise for predetermined locations in Oberstown Industrial Park, Caragh Road, Naas, Co. Kildare. Rehab Glassco is a facility which recycles glass products.

Monitoring at NSL 1 was carried out on the 20th of February 2014, including day, evening and night-time monitoring.

2 Monitoring Locations

Environmental noise monitoring was carried out at one noise sensitive location (NSL 1). The survey was conducted when operations at the plant were stopped. The hours of waste acceptance (the hours during which the facility accepts waste) are: Monday to Saturday (including bank holidays): 07:00 (7am) to 19:00 (7pm); Sunday: closed.

The hours of operation (the hours during which the facility is operational) are: Monday to Friday (including bank holidays): 24-hours; Saturday: 07:00 (7am) to 23:00 (11pm); Sunday: closed.

The monitoring locations are detailed below in Table 1 and presented in the attached map in Appendix B.

Table 1: Noise Monitoring Location

Monitoring Location	Description
NSL 1	This monitoring point is located to the North of the site, outside of the site next to the boundary to the nearest dwelling. The monitor was positioned facing the Rehab Glassco Facility.
	*All monitoring locations are located at least 2m from any reflective surfaces

3 Activities on Site

No activities took place at the site during the monitoring periods.

4 Durations & Measurements of Surveying

The day-time monitoring was carried out between the daytime hours of 09:00 and 19.00 on the 20th February 2014. The evening and night-time monitoring was conducted on the 20th February 2014 between the hours of 19:00 and 23:00 for evening measurements and between 23.00 and 00.00 for night time measurements. The following measurement was carried out at each location:

- Day, evening and Night-time Broadband measurements LAeq, LA10, and LA90, over a 15 minute period as set out in "**Guidance Note for Noise: Licence Applications, Surveys and Assessments in Relation to Scheduled Activities (NG4)"** as a minimum survey duration.
- 1/3 octave band frequency analysis.

5 Weather Conditions

While every effort was made to carry out the survey in accordance with the requirements of Guidance Note for Noise: Licence Applications, Surveys and Assessments in Relation to Scheduled Activities (NG4), regarding weather conditions, it should be noted that this is not always possible.

Ideally, measurements should be taken in 'neutral' weather conditions. This means in the absence of wind and precipitation, and ideally in conditions of standard temperature and pressure. Clearly, these conditions very rarely apply. The noise monitor was fitted with a windshield throughout the survey. An average wind speed of less than 5m/sec is the preferred limit when noise measurements are being taken, with 7m/sec an upper limit. On the days in question the wind speed was within limits. In as far as

possible, care was be taken to avoid measurements so close to objects as to give rise to wind-derived noises, e.g. trees, pylons, etc.

Wind speed and wind direction have the potential to affect noise propagation and hence the noise measurements. The prevailing weather conditions at the time of measurement was noted and recorded in the survey report. Prior to each monitoring period a measurement of wind strength and direction was taken using a portable anemometer. A wind speed of 1-2m/s was measured coming from Northerly direction.

6 Instrumentation & Methodology

Measurements were made using a Bruel & Kjaer 2250 integrating sound level meter (SLM) with selective 1:1 or 1:3 octave band filters. Calibration was carried out on site using a Bruel & Kjaer acoustic calibrator at 94dB (A). The meter was calibrated before and after the monitoring round. Factory calibration certificates for the SLM and the acoustic calibrator, detailing equipment serial numbers, calibration traceability and recalibration dates are presented in Appendix C of this report. A "Windshield" was also fitted to the sound meter at all stages of monitoring.

The sound level meter was mounted at 1.5m above ground level. A sample period for the noise measurements was selected to be 15 minute intervals.

7 Glossary of Terms

Ambient noise: The total encompassing sound in a given situation at a given time usually composed of sound from many sources, near and far.

Background Noise Level: The A-weighted sound pressure level of the residual noise at the assessment position that is exceeded for 90 per cent of a given time interval, T. (L_{A90}, T).

Criterion Noise Level: The long-term mean value of the noise level that must not be exceeded. This is generally stipulated in the waste permit and it may be applied to a noise source, a boundary of the activity or to noise sensitive locations in the vicinity of the facility.

1/3 Octave Band Analysis: Frequency analysis of sound such that the frequency spectrum is subdivided into bands of one–third of an octave each. An octave is taken to be a frequency interval, the upper limit of which is twice the lower limit (the unit of frequency is the Hertz, Hz).

dB (decibel): The scale in which sound pressure level is expressed. It is defined as 20 times the logarithm of the ratio between the RMS pressure of the sound field and the reference pressure of 20 micro-pascals (20 µPa).

dBA or dB(A): An 'A-weighted decibel' - a measure of the overall noise level of sound across the audible frequency range (20 Hz – 20 kHz) with A-frequency weighting (i.e. 'A'–weighting) to compensate for the varying sensitivity of the human ear to sound at different frequencies.

Facade Level: Noise levels at locations 1m from the facade of a building are described by the term *Facade Levels* and are subject to higher noise levels than those in open areas (free-field conditions) due to reflection effects.

Free-field Conditions: These are conditions in which the radiation from sound sources is unaffected by the presence of any reflecting boundaries. In practice, it is a field in which the effects of the boundaries are negligible over the frequency range of interest. In environmental noise, true free-field measurement conditions are seldom achieved and generally the microphone will be positioned at a height between 1.2 and 1.5 metres above ground level. To minimise the influence of reflections, measurements are generally made at least 3.5 metres from any reflecting surface other than the ground.

Hz (Hertz): The unit of sound frequency in cycles per second.

Impulsive Noise: A noise that is of short duration (typically less than one second), the sound pressure level of which is significantly higher than the background. In determining whether a tonal adjustment applies, reference must be made to ISO 1996-2 (1987) - Section 4.1.

Impulse Exponential – Time-Weighting: This is a time-weighting which is available on some sound level meters and it represents an arbitrary compromise in an attempt to provide a means to measure the sound level of short-duration impulsive sounds. Impulse time-weighting has a design goal exponential-time constant of 35 ms for sound signals that increase with increasing time and 1.5 seconds for sound signals that decrease with increasing time.

LAeq,T: The equivalent steady sound level in dB containing the same acoustic energy as the actual fluctuating sound level over the given period, T.

LAmax: The maximum RMS, A-Weighted sound pressure level occurring within a specified time period; the time weighting fast or slow is usually specified.

Noise: Any sound, that has the potential to cause disturbance, discomfort or psychological stress to a subject exposed to it, or any sound, that could to cause actual physiological harm to a subject exposed to it, or physical damage to any structure exposed to it, is known as noise.

Noise Sensitive Location: Any dwelling house, hotel or hostel, health building, educational establishment, place of worship or entertainment, or any other facility or other area of high amenity which for its proper enjoyment requires the absence of noise at nuisance levels.

Rating level (LAr,T) : The specific noise level, plus any adjustment for the characteristic features of the noise.

Residual noise: The ambient noise remaining at a given position in a given situation when the specific source is suppressed to a degree such that it does not contribute to the ambient noise (residual noise level is measured in terms of LAeq, T).

Root Mean Square (RMS): The RMS value of a set of numbers is the square root of the average of their squares.

Sound Exposure Level (SEL or LAE): Is the measure of the A-Weighted sound energy used to describe noise events such as the passing of a train or aircraft; it is the A-weighted sound pressure level if occurring over a period of 1 second, would contain the same amount of A-weighted sound energy as the event.

Specific noise level: A component of the ambient noise which can be specifically identified by acoustical means and may be associated with a specific source. In BS 4142, there is more precise definition as

follows: 'the equivalent continuous A-weighted sound pressure level at the assessment position produced by the specific noise source over a given reference time interval (LAeq, T)'.

Time-weighting: One of the averaging times (Fast, Slow or Impulse) used for the measurement of RMS sound pressure level in sound level meters.

Tonal Noise: Noise which contains a clearly audible tone, i.e. a distinguishable, discrete or continuous note (whine, hiss screech or hum etc.). In determining whether a tonal adjustment applies, reference must be made to ISO 1996-2 (1987) - Section 4.

8 Noise Measurement Data

Table 3: Daytime Monitoring Data 20th February 14			
Monitoring Location	**Time**	**$L_{Aeq,15min}$ dB(A)**	**NG4 Limit dB(A)**
NSL 1	15.43 -15.58	56	55
NSL 1	16.01 - 16.16	56	55
NSL 1	18.39 -18.54	55	55

Table 4: Evening Monitoring Data 20th February 14			
Monitoring Location	**Time**	**$L_{Aeq,15min}$ dB(A)**	**NG4 Limit dB(A)**
NSL 1	19.15-19.0	56	50

Table 5: Night Monitoring Data 20th February 14			
Monitoring Location	**Time**	**$L_{Aeq,15min}$ dB(A)**	**NG4 Limit dB(A)**
NSL 1	23.05-23.20	53	45
NSL 1	23.32-23.47	53	45

		Table 6: 1/3 Octave Band Analysis (12.50Hz – 400.00Hz)										20th February (Day)			
Monitoring Location	**12.50 Hz**	**16.00 Hz**	**20.00 Hz**	**25.00 Hz**	**31.50 Hz**	**40.00 Hz**	**50.00 Hz**	**63.00 Hz**	**80.00 Hz**	**100.00 Hz**	**125.00 Hz**	**160.00 Hz**	**200.00 Hz**	**250.00 Hz**	**315.00 Hz**	**400.00 Hz**
NSL 1 15.43-15.58	-5	20	9	10	30	23	29	26	26	28	29	30	31	33	37	43
NSL 1 16.01 – 6.16	2	7	10	14	16	20	24	29	29	30	33	35	35	35	37	39
NSL 1 18.39 -18.54	-9	-3	3	8	13	21	22	26	27	34	33	32	36	35	33	38

		Table 6: 1/3 Octave Band Analysis (500.00Hz – 16000.00Hz)										20th February (Day)			
Monitoring Location	**500.00 Hz**	**630.00 Hz**	**800.00 Hz**	**1000.00 Hz**	**1250.00 Hz**	**1600.00 Hz**	**2000.00 Hz**	**2500.00 Hz**	**3150.00 Hz**	**4000.00 Hz**	**5000.00 Hz**	**6300.00 Hz**	**8000.00 Hz**	**10000.00 Hz**	**12500.00 Hz**	**16000.00 Hz**
NSL 1 15.43-15.58	46	47	44	41	39	37	33	30	27	25	21	16	12	11	6	4
NSL 1 16.01 – 6.16	45	46	49	50	47	45	43	38	36	28	29	28	25	22	16	8
NSL 1 18.39 -18.54	41	46	48	50	48	42	41	35	33	30	26	24	22	18	12	6

		Table 7: 1/3 Octave Band Analysis (12.50Hz – 400.00Hz)											20th February (Evening)			
Monitoring Location	**12.50 Hz**	**16.00 Hz**	**20.00 Hz**	**25.00 Hz**	**31.50 Hz**	**40.00 Hz**	**50.00 Hz**	**63.00 Hz**	**80.00 Hz**	**100.00 Hz**	**125.00 Hz**	**160.00 Hz**	**200.00 Hz**	**250.00 Hz**	**315.00 Hz**	**400.00 Hz**
NSL 1 19.15-19.30	-11	-4	1	10	13	21	23	27	29	28	29	32	30	33	35	40
		Table 7: 1/3 Octave Band Analysis (500.00Hz – 16000.00Hz)											20th February			
Monitoring Location	**500.00 Hz**	**630.00 Hz**	**800.00 Hz**	**1000.00 Hz**	**1250.00 Hz**	**1600.00 Hz**	**2000.00 Hz**	**2500.00 Hz**	**3150.00 Hz**	**4000.00 Hz**	**5000.00 Hz**	**6300.00 Hz**	**8000.00 Hz**	**10000.00 Hz**	**12500.00 Hz**	**16000.00 Hz**
NSL 1 19.15-19.30	43	47	49	50	48	46	40	37	33	28	25	21	17	11	8	6

		Table 8: 1/3 Octave Band Analysis (12.50Hz – 400.00Hz)											20th February (Night)			
Monitoring Location	**12.50 Hz**	**16.00 Hz**	**20.00 Hz**	**25.00 Hz**	**31.50 Hz**	**40.00 Hz**	**50.00 Hz**	**63.00 Hz**	**80.00 Hz**	**100.00 Hz**	**125.00 Hz**	**160.00 Hz**	**200.00 Hz**	**250.00 Hz**	**315.00 Hz**	**400.00 Hz**
NSL 1 23.05 –23.20	-5	21	9	10	18	30	23	28	27	27	28	30	31	31	32	37
NSL 1 23.32-23.47	-4	22	10	7	21	22	22	29	27	28	28	30	32	33	33	37

		Table 8: 1/3 Octave Band Analysis (500.00Hz – 16000.00Hz)										20th February (Night)			
Monitoring Location	**500.00 Hz**	**630.00 Hz**	**800.00 Hz**	**1000.00 Hz**	**1250.00 Hz**	**1600.00 Hz**	**2000.00 Hz**	**2500.00 Hz**	**3150.00 Hz**	**4000.00 Hz**	**5000.00 Hz**	**6300.00 Hz**	**8000.00 Hz**	**10000.00 Hz**	**12500.00 Hz**	**16000.00 Hz**
NSL 1 23.05 – 23.20	41	43	45	45	44	41	39	38	34	30	27	25	21	17	13	6
NSL 1 23.32-23.47	43	45	45	44	45	42	39	32	27	24	19	14	9	5	3	1

9 Interferences

Below is a comprehensive breakdown of all the noise interference and sources that occurred at NSL 1 during each monitoring period.

Noise Sources/Interferences – NSL	
Date	
20th February 2014 Day time	• Traffic noise from M7 was quite prominent • Truck movements at nearby facility • Birdsong • Light Rain • Trees rustling in wind
20th February 2014 Evening	• Birdsong • A number of Lorries were noted to enter the neighbouring warehousing facility and were left idling for long periods. • Road noise from the nearby R409 to the East, Local road to the North of the Site and the M7 • Tractor passing on R409
20th February 2014 Night Time	• Road noise from the nearby R409 to the East • Traffic noise from M7 was quite prominent • Truck movements at nearby facility • Light rain

10 Evaluation of Measurement Data

Tables 3 to 8 summarises the monitoring data for each period of noise monitoring which was carried out on site. From this monitoring the noise levels recorded ranged from 55dB (A) to 57dB (A) during the day, 56dB (A) during the evening and 53dB (A) during the night-time period.

These, in the main, are considered not to comply with the recommended Noise Level limits as set out in EPA document **Guidance Note for Noise: Licence Applications, Surveys and Assessments in Relation to Scheduled Activities (NG4) 2012.**

On review of the one-third octave band analysis tonal noise qualities were recorded at 16Hz. The 16Hz level recorded maybe attributable to the truck engines running constant on the adjacent site which was quite prominent during the monitoring period. The frequency of 16Hz in which tonal noise was detected is below 20Hz and therefore is not audible to the human ear.

11 Conclusion

Detailed below in tabular format is the noise levels recorded both when the site was fully operational and when the site was shut down. The data highlighted in blue are an average of the readings when the facility is fully operational and the other data is representative of the latest survey when the facility was shut down.

Location	Day dB(L_{Aeq})		Evening dB(L_{Aeq})		Night dB (L_{Aeq})	
Date of Monitoring	20th Feb	16th Jan	20th Feb	16th Jan	20th Feb	16th Jan
NSL	56	**56**	55	**55**	53	**55**
Typical Limits						
	55		50		45	

As can be seen there is no significant reduction in noise levels at the noise sensitive location during each time period when the Rehab Glassco site was not in operation.

It is noted that there is a slight reduction in noise levels during night time period of 2dB. However this difference is not deemed to be significant and would not be attributable to operations at the Rehab Glassco Site. it is also noted that at the time of the 55dB reading an increase of truck movements was noted within the neighbouring warehousing facility site.

Given the above results it can be concluded that any exceedance in noise limits is attributable to external influences such as the constant traffic noise associated with the R409, M7 and the adjacent 24hr Warehousing Facility and not the Rehab Glassco facility.

Appendix A – Noise Measurement Graphs

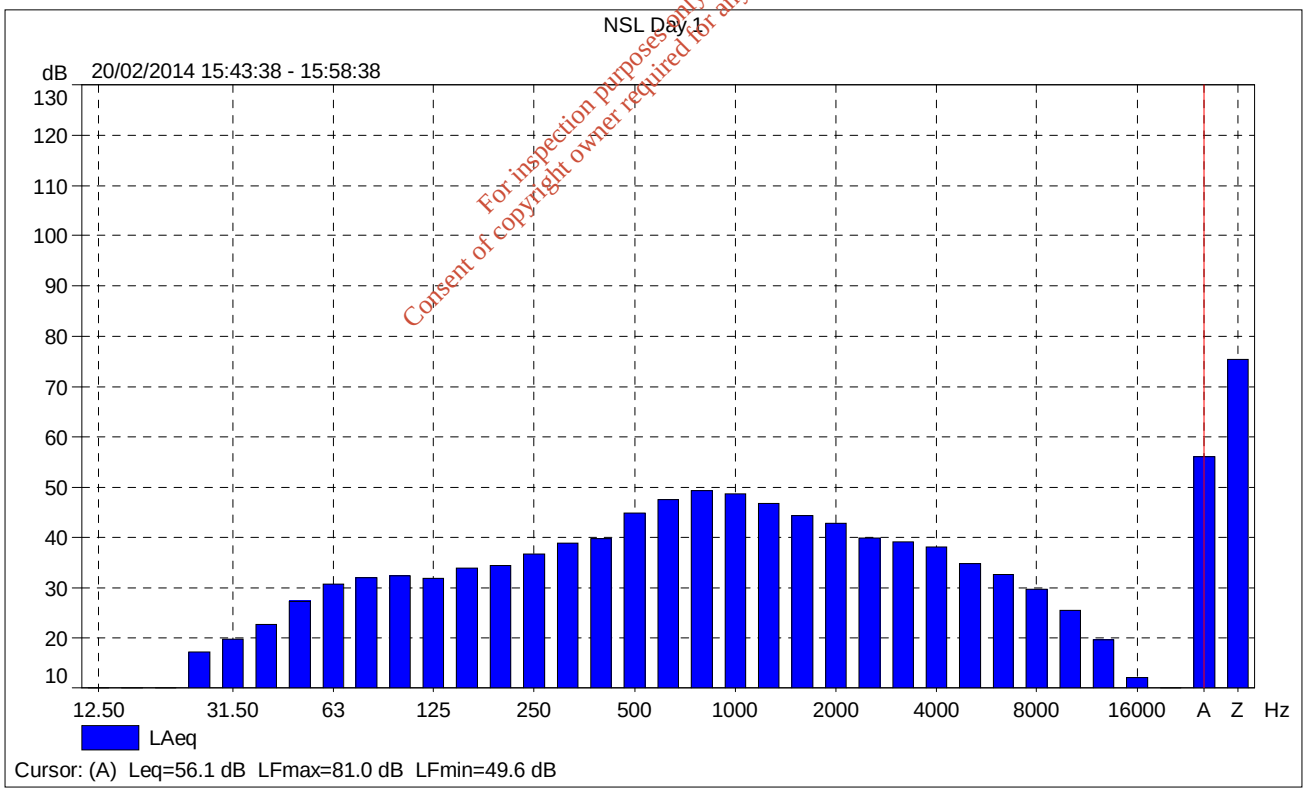
NSL Day 1

Instrument:		2250-L
Application:		BZ7132 Version 3.0.1
Start Time:		02/20/2014 15:43:38
End Time:		02/20/2014 15:58:38
Elapsed Time:		00:15:00
Bandwidth:		1/3-octave
Max Input Level:		140.72

	Time	Frequency
Broadband (excl. Peak):	FSI	AZ
Broadband Peak:		C
Spectrum:	FS	A

Instrument Serial Number:		2602719
Microphone Serial Number:		2600864
Input:		
Windscreen Correction:		UA-0237
Sound Field Correction:		Free-field

Calibration Time:		02/20/2014 15:39:07
Calibration Type:		External reference
Sensitivity:		51.3830631971359 mV/Pa



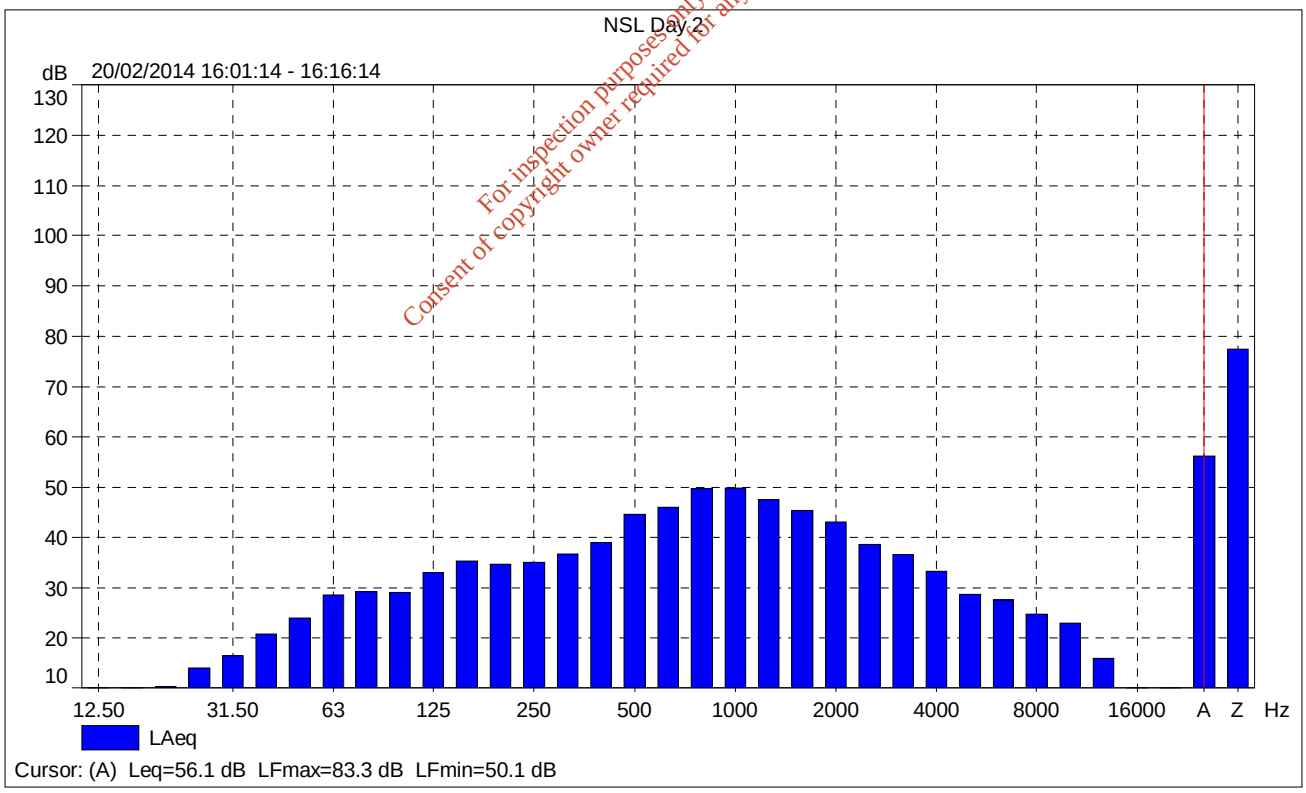
NSL Day 2

Instrument:		2250-L
Application:		BZ7132 Version 3.0.1
Start Time:		02/20/2014 16:01:14
End Time:		02/20/2014 16:16:14
Elapsed Time:		00:15:00
Bandwidth:		1/3-octave
Max Input Level:		140.72

	Time	Frequency
Broadband (excl. Peak):	FSI	AZ
Broadband Peak:		C
Spectrum:	FS	A

Instrument Serial Number:		2602719
Microphone Serial Number:		2600864
Input:		
Windscreen Correction:		UA-0237
Sound Field Correction:		Free-field

Calibration Time:		02/20/2014 15:39:07
Calibration Type:		External reference
Sensitivity:		51.3830631971359 mV/Pa



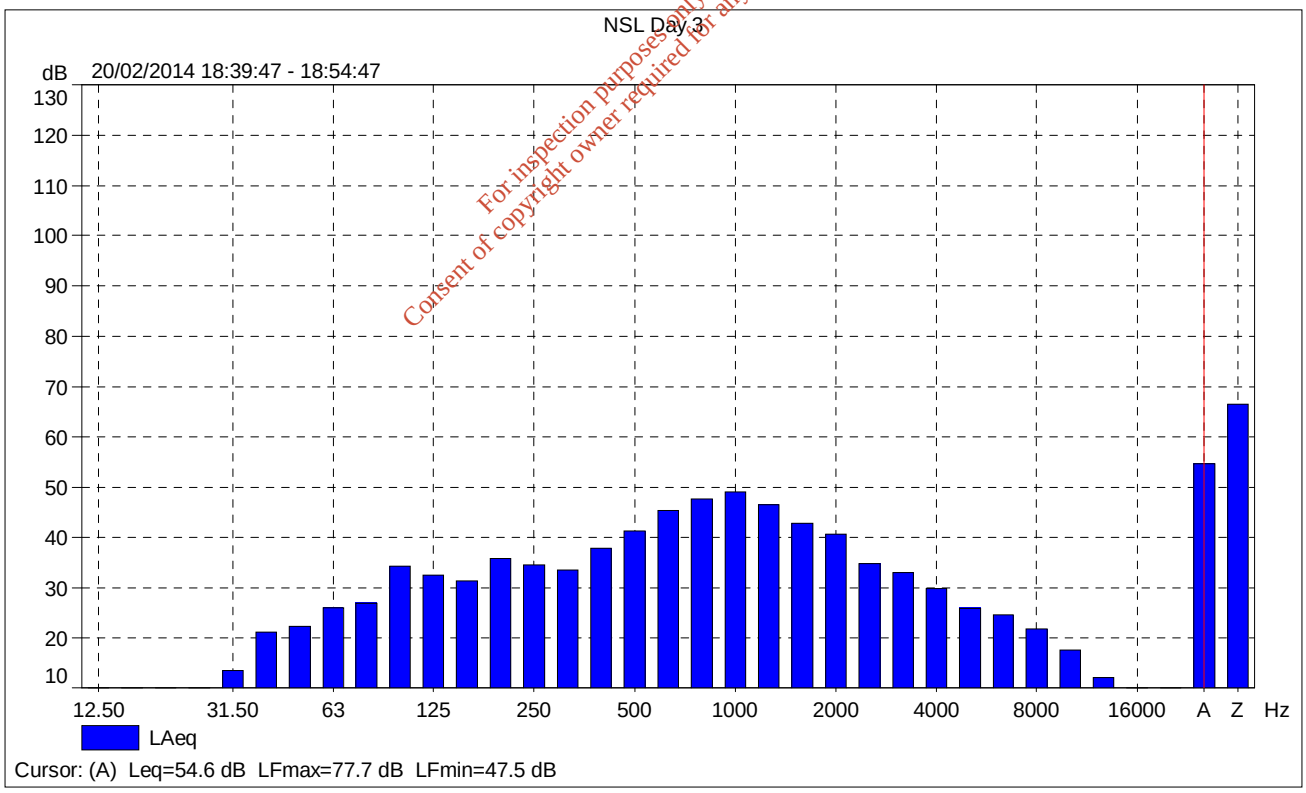
NSL Day 3

Instrument:		2250-L
Application:		BZ7132 Version 3.0.1
Start Time:		02/20/2014 18:39:47
End Time:		02/20/2014 18:54:47
Elapsed Time:		00:15:00
Bandwidth:		1/3-octave
Max Input Level:		140.71

	Time	Frequency
Broadband (excl. Peak):	FSI	AZ
Broadband Peak:		C
Spectrum:	FS	A

Instrument Serial Number:		2602719
Microphone Serial Number:		2600864
Input:		
Windscreen Correction:		UA-0237
Sound Field Correction:		Free-field

Calibration Time:		02/20/2014 15:39:07
Calibration Type:		External reference
Sensitivity:		51.3830631971359 mV/Pa



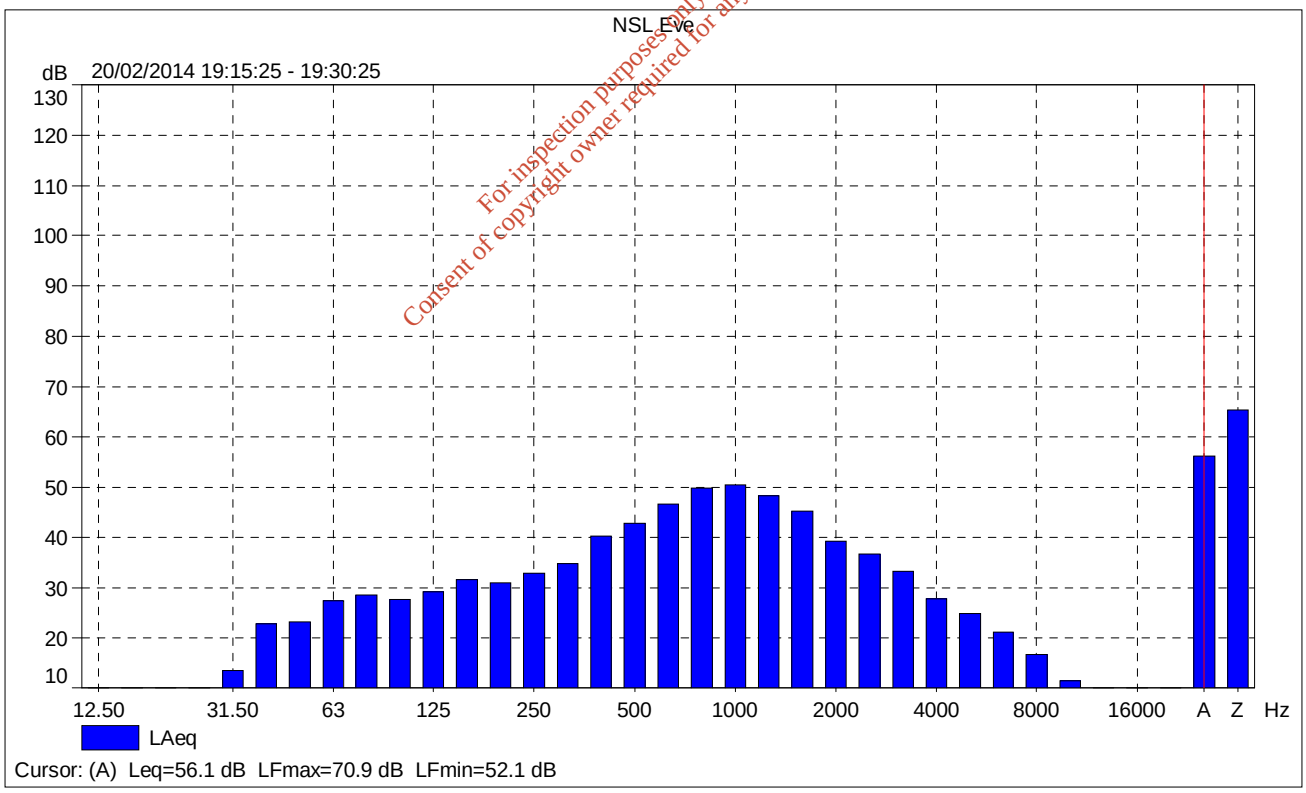
NSL Eve

Instrument:		2250-L
Application:		BZ7132 Version 3.0.1
Start Time:		02/20/2014 19:15:25
End Time:		02/20/2014 19:30:25
Elapsed Time:		00:15:00
Bandwidth:		1/3-octave
Max Input Level:		140.71

	Time	Frequency
Broadband (excl. Peak):	FSI	AZ
Broadband Peak:		C
Spectrum:	FS	A

Instrument Serial Number:		2602719
Microphone Serial Number:		2600864
Input:		
Windscreen Correction:		UA-0237
Sound Field Correction:		Free-field

Calibration Time:		02/20/2014 15:39:07
Calibration Type:		External reference
Sensitivity:		51.3830631971359 mV/Pa



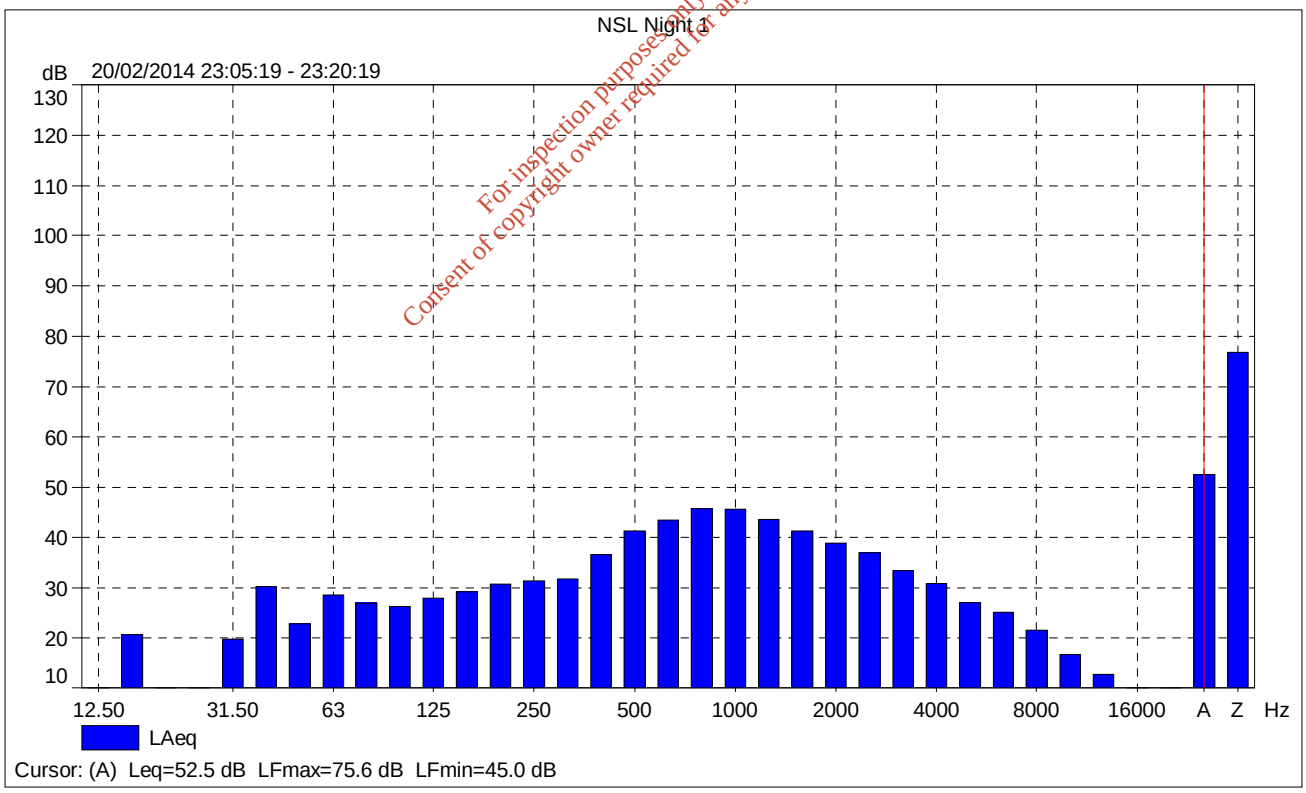
NSL Night 1

Instrument:		2250-L
Application:		BZ7132 Version 3.0.1
Start Time:		02/20/2014 23:05:19
End Time:		02/20/2014 23:20:19
Elapsed Time:		00:15:00
Bandwidth:		1/3-octave
Max Input Level:		140.71

	Time	Frequency
Broadband (excl. Peak):	FSI	AZ
Broadband Peak:		C
Spectrum:	FS	A

Instrument Serial Number:		2602719
Microphone Serial Number:		2600864
Input:		
Windscreen Correction:		None
Sound Field Correction:		Free-field

Calibration Time:		02/20/2014 15:39:07
Calibration Type:		External reference
Sensitivity:		51.3830631971359 mV/Pa



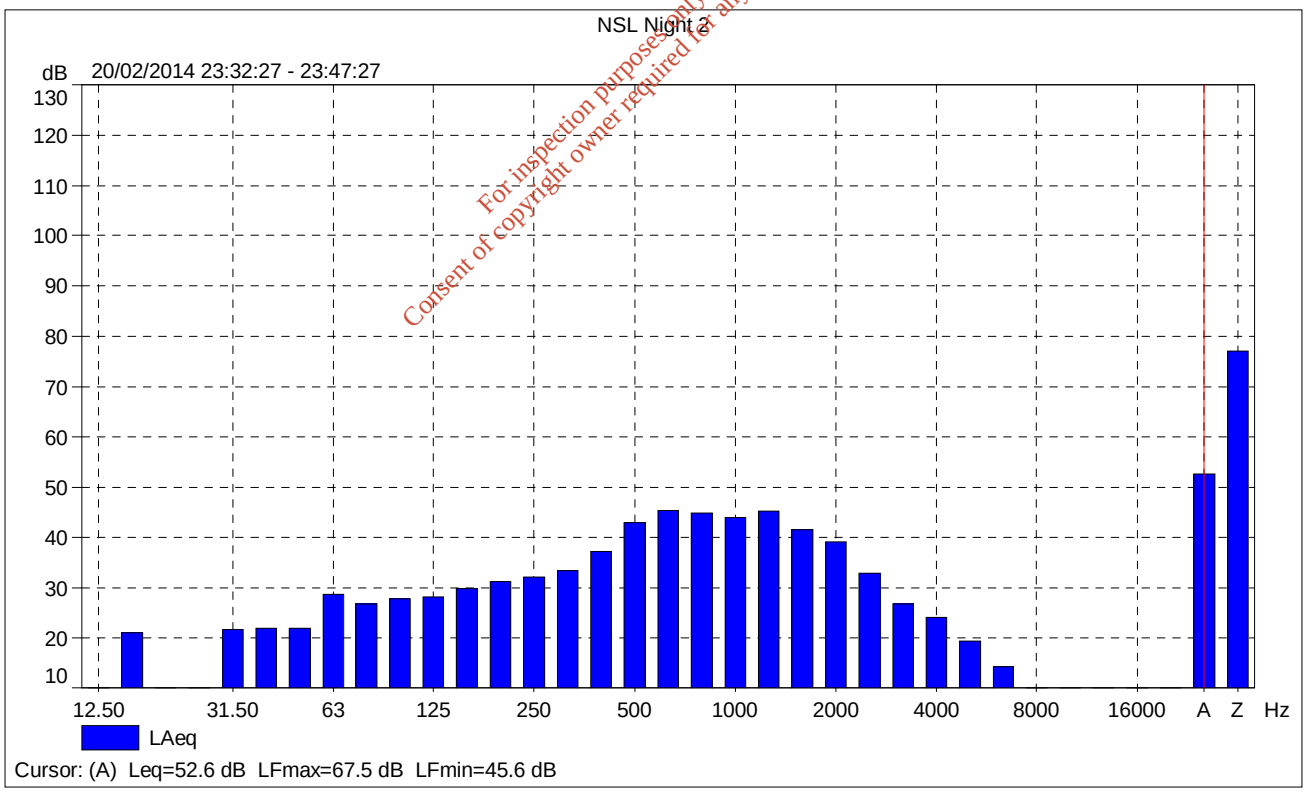
NSL Night 2

Instrument:		2250-L
Application:		BZ7132 Version 3.0.1
Start Time:		02/20/2014 23:32:27
End Time:		02/20/2014 23:47:27
Elapsed Time:		00:15:00
Bandwidth:		1/3-octave
Max Input Level:		140.71

	Time	Frequency
Broadband (excl. Peak):	FSI	AZ
Broadband Peak:		C
Spectrum:	FS	A

Instrument Serial Number:		2602719
Microphone Serial Number:		2600864
Input:		
Windscreen Correction:		None
Sound Field Correction:		Free-field

Calibration Time:		02/20/2014 15:39:07
Calibration Type:		External reference
Sensitivity:		51.3830631971359 mV/Pa



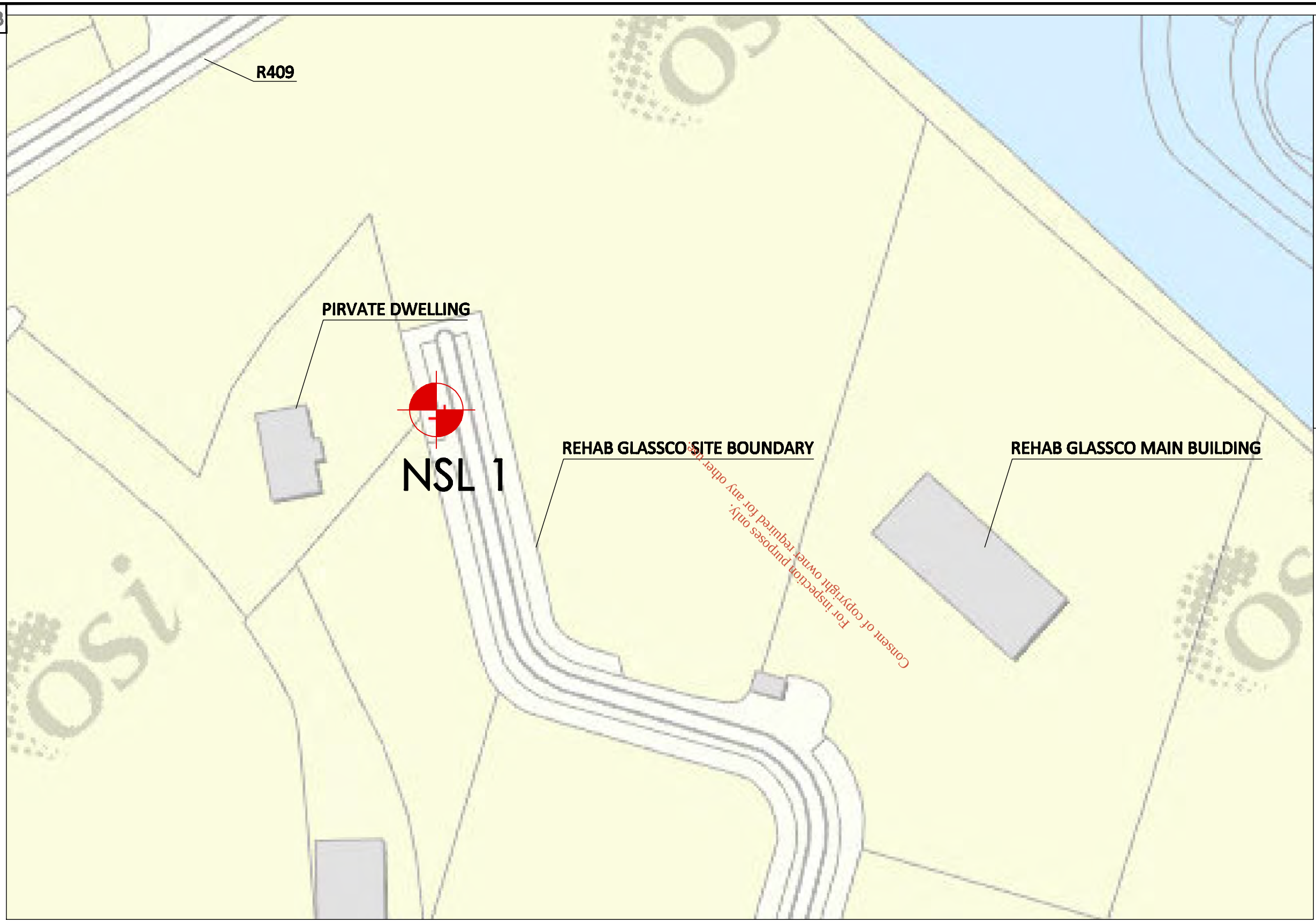
Appendix B – Noise Monitoring Locations

A3

REVISION DATE 31/05/11

REVISION 1

FORM NO FRM-010



SITE LAYOUT - NTS

ISSUE

ON ORIGINAL

0 10 20 30 40 50mm

REV NO:	DATE:	REVISION NOTE:	DWN BY:	CKD BY:
D1	06/12/12	ISSUED TO CLIENT	DH	DC

SITE LOCATION

Datum: Irish Grid System: Malin Head ITM

CLIENT:	REHAB GLASSCO
PROJECT:	ENVIRONMENTAL NOISE MONITORING AT REHAB GALSSCO SITE, NAAS
TITLE:	SITE LAYOUT NOISE MONITORING LOCATIONS

DRAWN:	CHECKED:	APPROVED:	DRAWING NO:	REV:
DH	DC		101_169_201	D1
DATE: 06/12/12	SCALE: NTS			

ORS
Consulting Engineers
ORS Building, Mullingar, Co. Westmeath
T: +353 (0) 44 934 2518 F: +353 (0) 44 934 4573
E: info@ors.ie W: www.ors.ie
ISO 9001:2008 QUALITY ASSURED COMPANY

Appendix C – Calibration Certificates

Brüel & Kjær

The Calibration Laboratory
Skodsborgvej 307, DK-2850 Nærum, Denmark

ilac-MRA DANAK CAL Reg.nr. 307

CERTIFICATE OF CALIBRATION

No: C1107125 Page 1 of 10

CALIBRATION OF

Sound Level Meter:	Brüel & Kjær Type 2250 Light	No: 2602719	Id: -
Microphone:	Brüel & Kjær Type 4950	No: 2600864	
Preamplifier:	Brüel & Kjær Type ZC-0032	No: 6365	
Supplied Calibrator:	Brüel & Kjær Type 4231	No: 2605825	
Software version:	BZ7131 Version 3.0.1	Pattern Approval:	PENDING
Instruction manual:	BE-1774-11		

CUSTOMER

ORS Consulting Engineers
Marlinstown Office Park
Mullingar
Co. Westmeath, Ireland

CALIBRATION CONDITIONS

Preconditioning: 4 hours at 23°C ± 3°C

Environment conditions: *See actual values in **Environmental conditions** sections.*

SPECIFICATIONS

The Sound Level Meter Brüel & Kjær Type 2250 Light has been calibrated in accordance with the requirements as specified in IEC61672-1:2002 class 1. Procedures from IEC 61672-3:2006 were used to perform the periodic tests.

PROCEDURE

The measurements have been performed with the assistance of Brüel & Kjær Sound Level Meter Calibration System 3630 with application software type 7763 (version 4.5 - DB: 4.50) by using procedure 2250-L-4950.

RESULTS

Calibration Mode: **Calibration as received.**

The reported expanded uncertainty is based on the standard uncertainty multiplied by a coverage factor $k = 2$ providing a level of confidence of approximately 95 %. The uncertainty evaluation has been carried out in accordance with EA-4/02 from elements originating from the standards, calibration method, effect of environmental conditions and any short time contribution from the device under calibration.

Date of calibration: 2011-09-08

Date of issue: 2011-09-08

Steen Vodstrup Andersen
Calibration Technician

Nils Johansen
Approved Signatory

Brüel & Kjær

The Calibration Laboratory
Skodsborgvej 307, DK-2850 Nærum, Denmark

1. Calibration Note

n/a

2. Summary

4.1. Preliminary inspection	Passed
4.2. Environmental conditions, Prior to calibration	Passed
4.3. Reference information	Passed
4.4. Indication at the calibration check frequency	Passed
4.5. Self-generated noise, Microphone installed	Passed
4.6. Acoustical signal tests of a frequency weighting, C weighting	Passed
4.7. Self-generated noise, Electrical	Passed
4.8. Electrical signal tests of frequency weightings, A weighting	Passed
4.9. Electrical signal tests of frequency weightings, C weighting	Passed
4.10. Electrical signal tests of frequency weightings, Z weighting	Passed
4.11. Frequency and time weightings at 1 kHz	Passed
4.12. Level linearity on the reference level range, Upper	Passed
4.13. Level linearity on the reference level range, Lower	Passed
4.14. Toneburst response, Time-weighting Fast	Passed
4.15. Toneburst response, Time-weighting Slow	Passed
4.16. Toneburst response, LAE	Passed
4.17. Peak C sound level, 8 kHz	Passed
4.18. Peak C sound level, 500 Hz	Passed
4.19. Overload indication	Passed
4.20. Environmental conditions, Following calibration	Passed

The sound level meter submitted for periodic testing successfully completed the class 1 tests of IEC 61672-3:2006, for the environmental conditions under which the tests were performed.
However, no general statement or conclusion can be made about conformance of the sound level meter to the full requirements of IEC 61672-1:2002 because evidence was not publicly available, from an independent testing organization responsible pattern approvals, to demonstrate that the model of sound level meter fully conformed to the requirements in IEC 61672-1:2002 and because the periodic test of IEC 61672-3:2006 cover only a limited subset of the specifications in IEC 61672-1:2002.

Brüel & Kjær

The Calibration Laboratory
Skodsborgvej 307, DK-2850 Nærum, Denmark

3. Instruments

	Instrument	Inventory No.
Generator	Brüel & Kjær, Type 3560	123560014
AmplifierDivider	Brüel & Kjær, Type 3111	123111004
Calibrator	Brüel & Kjær, Type 4226	124226018
Adaptor	Brüel & Kjær, Type WA-0302-B 15 pF	150503009
Voltmeter	Agilent, Type 34970A	142101028

Brüel & Kjær

The Calibration Laboratory
Skodsborgvej 307, DK-2850 Nærum, Denmark

4. Measurements

4.1. Preliminary inspection

Visually inspect instrument, and operate all relevant controls. (section 5)

Routine Passed

4.2. Environmental conditions, Prior to calibration

Actual environmental conditions prior to calibration. (section 7)

	Measured	
	[Deg / kPa / %RH]	
Air temperature	22.30	
Air pressure	99.57	
Relative humidity	53.00	

4.3. Reference information

Information about reference range, level and channel. (section 19.h + 19.m)

	Value	
	[dB]	
Reference sound pressure level	94	
Reference level range	140	
Channel number	1	

4.4. Indication at the calibration check frequency

Measure and adjust sound level meter using the supplied calibrator. (section 9 + 19.m)

	Measured	Uncertainty	
	[dB / Hz]	[dB / Hz]	
Initial indication (supplied calibrator)	93.89	0.14	
Calibration check frequency (supplied calibrator)	1000.00	1.00	
Adjusted indication (supplied calibrator)	93.85	0.14	

4.5. Self-generated noise, Microphone installed

Self-generated noise measured with microphone submitted for periodic testing. Averaging time is 30 seconds. An anechoic chamber is used to isolate environmental noise. (section 10.1)

	Max	Measured	Deviation	Uncertainty	
	[dB]	[dB]	[dB]	[dB]	
A weighted	17.40	16.16	-1.24	1.00	
Monitor Level	20.40	11.40	-9.00	1.00	

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4.6. Acoustical signal tests of a frequency weighting, C weighting

Frequency weightings measured acoustically with a calibrated multi-frequency sound calibrator. Averaging time is 10 seconds, and the result is the average of 2 measurements. (section 11)

	Coupler Pressure Lc	Mic. Correction C4226	Body Influence	Expected	Measured	Corr. Measured	Accept - Limit	Accept + Limit	Deviation	Uncertainty
	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]
1000Hz, Ref. (1st)	94.30	0.15	-0.09	94.24	94.18	94.18	-1.1	1.1	-0.06	0.20
1000Hz, Ref. (2nd)	94.30	0.15	-0.09	94.24	94.18	94.18	-1.1	1.1	-0.06	0.20
1000Hz, Ref. (Average)	94.30	0.15	-0.09	94.24	94.18	94.18	-1.1	1.1	-0.06	0.20
125.89Hz (1st)	94.28	0.00	0.00	94.11	94.25	94.25	-1.5	1.5	0.14	0.20
125.89Hz (2nd)	94.28	0.00	0.00	94.11	94.25	94.25	-1.5	1.5	0.14	0.20
125.89Hz (Average)	94.28	0.00	0.00	94.11	94.25	94.25	-1.5	1.5	0.14	0.20
3981.1Hz (1st)	94.23	1.15	-0.06	92.37	92.17	92.17	-1.6	1.6	-0.20	0.30
3981.1Hz (2nd)	94.23	1.15	-0.06	92.37	92.18	92.18	-1.6	1.6	-0.19	0.30
3981.1Hz (Average)	94.23	1.15	-0.06	92.37	92.18	92.18	-1.6	1.6	-0.19	0.30
7943.3Hz (1st)	93.98	3.85	-0.17	87.33	86.98	86.98	-3.1	2.1	-0.35	0.40
7943.3Hz (2nd)	93.98	3.85	-0.17	87.33	86.99	86.99	-3.1	2.1	-0.34	0.40
7943.3Hz (Average)	93.98	3.85	-0.17	87.33	86.98	86.98	-3.1	2.1	-0.35	0.40

4.7. Self-generated noise, Electrical

Self-generated noise measured in most sensitive range, with electrical substitution for microphone, according to manufactures specifications.

Exceedance of the measured level above the corresponding level given in the instruction manual does not, by itself, mean that the performance of the sound level meter is no longer acceptable for many practical applications. (section 10.2)

	Max	Measured	Uncertainty
	[dB]	[dB]	[dB]
A weighted	13.70	12.86	0.30
C weighted	15.00	13.37	0.30
Z weighted	20.40	18.91	0.30

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4.8. Electrical signal tests of frequency weightings, A weighting

Frequency response measured with electrical signal relative to level at 1 kHz in reference range. (section 12)

	Input Level	Expected	Measured	Acoustical Resp.	Body Influence	Corr. Measured	Accept - Limit	Accept + Limit	Deviation	Uncertainty
	[dBV]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]
1000Hz, Ref.	-24.68	95.00	95.00	-0.04	-0.09	94.87	-1.1	1.1	-0.13	0.12
63.096Hz	1.52	95.00	95.01	0.21	0.00	95.22	-1.5	1.5	0.22	0.12
125.89Hz	-8.58	95.00	95.01	0.10	0.00	95.11	-1.5	1.5	0.11	0.12
251.19Hz	-16.08	95.00	94.97	0.01	0.06	95.04	-1.4	1.4	0.04	0.12
501.19Hz	-21.48	95.00	94.97	-0.03	0.22	95.16	-1.4	1.4	0.16	0.12
1995.3Hz	-25.88	95.00	95.00	-0.04	-0.01	94.95	-1.6	1.6	-0.05	0.12
3981.1Hz	-25.68	95.00	94.91	-0.02	-0.06	94.83	-1.6	1.6	-0.17	0.12
7943.3Hz	-23.58	95.00	94.69	0.02	-0.17	94.54	-3.1	2.1	-0.46	0.12
15849Hz	-18.08	95.00	95.59	0.06	-0.01	95.64	-17.0	3.5	0.64	0.12

4.9. Electrical signal tests of frequency weightings, C weighting

Frequency response measured with electrical signal relative to level at 1 kHz in reference range. (section 12)

	Input Level	Expected	Measured	Acoustical Resp.	Body Influence	Corr. Measured	Accept - Limit	Accept + Limit	Deviation	Uncertainty
	[dBV]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]
1000Hz, Ref.	-24.68	95.00	95.00	-0.04	-0.09	94.87	-1.1	1.1	-0.13	0.12
63.096Hz	-23.88	95.00	94.97	0.21	0.00	95.18	-1.5	1.5	0.18	0.12
125.89Hz	-24.48	95.00	95.03	0.10	0.00	95.13	-1.5	1.5	0.13	0.12
251.19Hz	-24.68	95.00	95.00	0.01	0.06	95.07	-1.4	1.4	0.07	0.12
501.19Hz	-24.68	95.00	95.04	-0.03	0.22	95.23	-1.4	1.4	0.23	0.12
1995.3Hz	-24.48	95.00	95.03	-0.04	-0.01	94.98	-1.6	1.6	-0.02	0.12
3981.1Hz	-23.88	95.00	94.92	-0.02	-0.06	94.84	-1.6	1.6	-0.16	0.12
7943.3Hz	-21.68	95.00	94.69	0.02	-0.17	94.54	-3.1	2.1	-0.46	0.12
15849Hz	-16.18	95.00	95.56	0.06	-0.01	95.61	-17.0	3.5	0.61	0.12

4.10. Electrical signal tests of frequency weightings, Z weighting

Frequency response measured with electrical signal relative to level at 1 kHz in reference range. (section 12)

	Input Level	Expected	Measured	Acoustical Resp.	Body Influence	Corr. Measured	Accept - Limit	Accept + Limit	Deviation	Uncertainty
	[dBV]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]
1000Hz, Ref.	-24.68	95.00	95.00	-0.04	-0.09	94.87	-1.1	1.1	-0.13	0.12
63.096Hz	-24.68	95.00	94.98	0.21	0.00	95.19	-1.5	1.5	0.19	0.12
125.89Hz	-24.68	95.00	95.00	0.10	0.00	95.10	-1.5	1.5	0.10	0.12
251.19Hz	-24.68	95.00	95.00	0.01	0.06	95.07	-1.4	1.4	0.07	0.12
501.19Hz	-24.68	95.00	95.00	-0.03	0.22	95.19	-1.4	1.4	0.19	0.12
1995.3Hz	-24.68	95.00	95.00	-0.04	-0.01	94.95	-1.6	1.6	-0.05	0.12
3981.1Hz	-24.68	95.00	94.94	-0.02	-0.06	94.86	-1.6	1.6	-0.14	0.12
7943.3Hz	-24.68	95.00	94.70	0.02	-0.17	94.55	-3.1	2.1	-0.45	0.12
15849Hz	-24.68	95.00	95.62	0.06	-0.01	95.67	-17.0	3.5	0.67	0.12

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4.11. Frequency and time weightings at 1 kHz

Frequency and time weighting measured at 1 kHz with electrical signal in reference range. Measured relative to A-weighted and Fast response. (section 13)

	Expected	Measured	Accept - Limit	Accept + Limit	Deviation	Uncertainty
	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]
LAF, Ref.	94.00	94.00	-0.4	0.4	0.00	0.12
LCF	94.00	94.00	-0.4	0.4	0.00	0.12
LZF	94.00	94.00	-0.4	0.4	0.00	0.12
LAS	94.00	93.99	-0.4	0.4	-0.01	0.12
LAeq	94.00	93.99	-0.4	0.4	-0.01	0.12

4.12. Level linearity on the reference level range, Upper

Level linearity in reference range, measured at 8 kHz until overload. (section 14)

	Expected	Measured	Accept - Limit	Accept + Limit	Deviation	Uncertainty
	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]
94 dB	94.00	94.00	-1.1	1.1	0.00	0.12
99 dB	99.00	99.00	-1.1	1.1	0.00	0.12
104 dB	104.00	104.00	-1.1	1.1	0.00	0.12
109 dB	109.00	109.01	-1.1	1.1	0.01	0.12
114 dB	114.00	114.02	-1.1	1.1	0.02	0.12
119 dB	119.00	119.02	-1.1	1.1	0.02	0.12
124 dB	124.00	124.02	-1.1	1.1	0.02	0.12
129 dB	129.00	129.03	-1.1	1.1	0.03	0.12
134 dB	134.00	134.02	-1.1	1.1	0.02	0.12
135 dB	135.00	135.02	-1.1	1.1	0.02	0.12
136 dB	136.00	136.02	-1.1	1.1	0.02	0.12
137 dB	137.00	137.02	-1.1	1.1	0.02	0.12
138 dB	138.00	138.02	-1.1	1.1	0.02	0.12
139 dB	139.00	139.02	-1.1	1.1	0.02	0.12

4.13. Level linearity on the reference level range, Lower

Level linearity in reference range, measured at 8 kHz down to lower limit, or until underrange. (section 14)

	Expected	Measured	Accept - Limit	Accept + Limit	Deviation	Uncertainty
	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]
94 dB	94.00	94.00	-1.1	1.1	0.00	0.12
89 dB	89.00	88.99	-1.1	1.1	-0.01	0.12
84 dB	84.00	84.00	-1.1	1.1	0.00	0.12
79 dB	79.00	78.99	-1.1	1.1	-0.01	0.12
74 dB	74.00	73.99	-1.1	1.1	-0.01	0.12
69 dB	69.00	68.99	-1.1	1.1	-0.01	0.12
64 dB	64.00	63.98	-1.1	1.1	-0.02	0.12
59 dB	59.00	58.98	-1.1	1.1	-0.02	0.12
54 dB	54.00	53.99	-1.1	1.1	-0.01	0.12
49 dB	49.00	48.99	-1.1	1.1	-0.01	0.12
44 dB	44.00	44.00	-1.1	1.1	0.00	0.12
39 dB	39.00	39.02	-1.1	1.1	0.02	0.30
34 dB	34.00	34.04	-1.1	1.1	0.04	0.30
29 dB	29.00	29.11	-1.1	1.1	0.11	0.30
28 dB	28.00	28.17	-1.1	1.1	0.17	0.30
27 dB	27.00	27.19	-1.1	1.1	0.19	0.30
26 dB	26.00	26.24	-1.1	1.1	0.24	0.30
25 dB	25.00	25.29	-1.1	1.1	0.29	0.30

4.14. Toneburst response, Time-weighting Fast

Response to 4 kHz toneburst measured in reference range, relative to continuous signal. (section 16)

	Expected	Measured	Accept - Limit	Accept + Limit	Deviation	Uncertainty
	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]
Continuous, Ref.	138.00	138.00	-0.8	0.8	0.00	0.11
200 ms Burst	137.00	136.99	-0.8	0.8	-0.01	0.11
2 ms Burst	120.00	119.93	-1.8	1.3	-0.07	0.11
0.25 ms Burst	111.00	110.87	-3.3	1.3	-0.13	0.11

4.15. Toneburst response, Time-weighting Slow

Response to 4 kHz toneburst measured in reference range, relative to continuous signal. (section 16)

	Expected	Measured	Accept - Limit	Accept + Limit	Deviation	Uncertainty
	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]
Continuous, Ref.	138.00	138.01	-0.8	0.8	0.01	0.11
200 ms Burst	130.61	130.58	-0.8	0.8	-0.03	0.11
2 ms Burst	111.01	110.97	-3.3	1.3	-0.04	0.11

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4.16. Toneburst response, LAE

Response to 4 kHz toneburst measured in reference range, relative to continuous signal. (section 16)

	Expected	Measured	Accept - Limit	Accept + Limit	Deviation	Uncertainty
	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]
Continuous, Ref.	138.00	138.00	-0.8	0.8	0.00	0.11
200 ms Burst	131.00	130.98	-0.8	0.8	-0.02	0.11
2 ms Burst	111.00	110.96	-1.8	1.3	-0.04	0.11
0.25 ms Burst	102.00	101.86	-3.3	1.3	-0.14	0.11

4.17. Peak C sound level, 8 kHz

Peak-response to a 8 kHz single- cycle sine measured in least-sensitive range, relative to continuous signal. (section 17)

	Expected	Measured	Accept - Limit	Accept + Limit	Deviation	Uncertainty
	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]
Continuous, Ref.	135.00	135.00	-0.4	0.4	0.00	0.11
Single Sine	138.40	138.64	-2.4	2.4	0.24	0.40

4.18. Peak C sound level, 500 Hz

Peak-response to a 500 Hz half-cycle sine measured in least-sensitive range, relative to continuous signal. (section 17)

	Expected	Measured	Accept - Limit	Accept + Limit	Deviation	Uncertainty
	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]
Continuous, Ref.	135.00	135.00	-0.4	0.4	0.00	0.11
Half-sine, Positive	137.40	137.11	-1.4	1.4	-0.29	0.40
Half-sine, Negative	137.40	137.11	-1.4	1.4	-0.29	0.40

4.19. Overload indication

Overload indication in the least sensitive range determined with a 4 kHz positive/negative half-cycle signal. (section 18)

	Measured	Accept - Limit	Accept + Limit	Deviation	Uncertainty
	[dB]	[dB]	[dB]	[dB]	[dB]
Continuous	140.00	-0.4	0.4	0.00	0.20
Half-sine, Positive	141.10	-10.0	10.0	1.10	0.20
Half-sine, Negative	141.20	-10.0	10.0	1.20	0.20
Difference	141.20	-1.8	1.8	0.10	0.30

4.20. Environmental conditions, Following calibration

Actual environmental conditions following calibration. (section 7)

	Measured
	[Deg / kPa / %RH]
Air temperature	22.90
Air pressure	99.50
Relative humidity	51.00

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DANAK

The Danish Accreditation and Metrology Fund - DANAK - is managing the Danish accreditation scheme based on a contract with the Danish Safety Technology Authority under the Danish Ministry of Economics and Business Affairs who is responsible for the legislation on accreditation in Denmark.

The fundamental criteria for accreditation are described in DS/EN ISO/IEC 17025: "General requirements for the competence of testing and calibration laboratories", and in DS/EN ISO/IEC 15189 "Medical laboratories – Particular requirements for quality and competence" respectively. DANAK uses guidance documents to clarify the requirements in the standards, where this is considered to be necessary. These will mainly be drawn up by the "European co-operation for Accreditation (EA)" or the "International Laboratory Accreditation Co-operation (ILAC)" with a view to obtaining uniform criteria for accreditation worldwide. In addition, the Danish Safety Technology Authority issues Technical Regulations prepared by DANAK with specific requirements for accreditation that are not contained in the standards.

In order for a laboratory to be accredited it is, among other things, required:

- *that the laboratory and its personnel are free from any commercial, financial or other pressures, which might influence their impartiality;*
- *that the laboratory operates a documented management system, and has a management that ensures that the system is followed and maintained;*
- *that the laboratory has at its disposal all items of equipment, facilities and premises required for correct performance of the service that it is accredited to perform;*
- *that the laboratory has at its disposal personnel with technical competence and practical experience in performing the services that they are accredited to perform;*
- *that the laboratory has procedures for traceability and uncertainty calculations;*
- *that accredited testing, calibration or medical examination are performed in accordance with fully validated and documented methods;*
- *that accredited services are performed and reported in confidentiality with the customer and in compliance with the customer's request;*
- *that the laboratory keeps records which contain sufficient information to permit repetition of the accredited test, calibration or medical examination;*
- *that the laboratory is subject to surveillance by DANAK on a regular basis;*
- *that the laboratory shall take out an insurance, which covers liability in connection with the performance of accredited services.*

Reports carrying DANAK's accreditation mark are used when reporting accredited services and show that these have been performed in accordance with the rules for accreditation.

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ilac-MRA DANAK CAL Reg.nr. 307

CERTIFICATE OF CALIBRATION

No: CDK1307034 Page 1 of 4

CALIBRATION OF

Calibrator:	Brüel & Kjær Type 4231	No: 2605825 Id: -
½ Inch adaptor:	Brüel & Kjær Type UC-0210	
Pattern Approval:	PTB-1.61-4057176	

CUSTOMER

ORS Consulting Engineers
Marlinstown Office Park
Mullingar
Co. Westmeath, Ireland

CALIBRATION CONDITIONS

Preconditioning:	4 hours at 23°C ± 3°C
Environment conditions:	Pressure: 101.4 kPa. Humidity: 51 % RH. Temperature: 23.1 °C.

SPECIFICATIONS

The Calibrator Brüel & Kjær Type 4231 has been calibrated in accordance with the requirements as specified in IEC60942:2003 Annex B Class 1. The accreditation assures the traceability to the international units system SI.

PROCEDURE

The measurements have been performed with the assistance of Brüel & Kjær acoustic calibrator calibration application software Type 7794 (version 2.4) by using procedure P_4231_D04.

RESULTS

Calibration Mode: **Calibration as received.**

The reported expanded uncertainty is based on the standard uncertainty multiplied by a coverage factor $k = 2$ providing a level of confidence of approximately 95 %. The uncertainty evaluation has been carried out in accordance with EA-4/02 from elements originating from the standards, calibration method, effect of environmental conditions and any short time contribution from the device under calibration.

Date of calibration: 2013-09-06

Date of issue: 2013-09-06

Susanne Nygaard
Calibration Technician

Erik Bruus
Approved Signatory

Brüel & Kjær

The Calibration Laboratory
Skodsborgvej 307, DK-2850 Nærum, Denmark

1. Visual Inspection

OK.

2. Measured Values

All stated values are valid at the following environmental reference conditions:

Pressure	101.3 kPa
Temperature	23.0 °C
Relative Humidity	50.0 %

2.1 Sound Pressure Levels

The sound pressure level is measured using the sound calibration comparison method.

Nominal Level [dB]	Accept Limit Lower [dB]	Accept Limit Upper [dB]	Measured Level [dB]	Measurement Uncertainty [dB]
94.00	93.89	94.11	93.93	0.09
114.00	113.89	114.11	113.95	0.09

2.2 Frequency

Nominal Level [Hz]	Accept Limit Lower [Hz]	Accept Limit Upper [Hz]	Measured Frequency [Hz]	Measurement Uncertainty [Hz]
1000	990.10	1009.90	999.98	0.10

2.3 Total Distortion

Distortion mode: [X] TD [ ] THD

Calibration Level [dB]	Accept Limit [%]	Measured Distortion [%]	Measurement Uncertainty [%]
94	2.25	0.56	0.25
114	2.25	0.40	0.25

Note: Acceptance limits are reduced by measurement uncertainty to assure that measured value expanded by the actual expanded uncertainty does not exceed the specified limits as stated in the standard.

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3. Calibration Equipment

	Instrument	Inventory No.
Sound Source, Reference	Brüel & Kjær, Type 4228	124228023
PULSE Analyzer	Brüel & Kjær, Type 3560-C	123560010
Transfer Microphone	Brüel & Kjær, Type 4192-L-001	124192027

4. Comments

As public evidence was available, from a testing organization responsible for approving the results of pattern evaluation tests, to demonstrate that the model of sound calibrator fully conformed to the requirements for pattern evaluation described in Annex A of IEC 60942:2003, the sound calibrator tested is considered to conform to all the class 1 requirements of IEC 60942:2003.

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- *that the laboratory has at its disposal all items of equipment, facilities and premises required for correct performance of the service that it is accredited to perform;*
- *that the laboratory has at its disposal personnel with technical competence and practical experience in performing the services that they are accredited to perform;*
- *that the laboratory has procedures for traceability and uncertainty calculations;*
- *that accredited testing, calibration or medical examination are performed in accordance with fully validated and documented methods;*
- *that accredited services are performed and reported in confidentiality with the customer and in compliance with the customer's request;*
- *that the laboratory keeps records which contain sufficient information to permit repetition of the accredited test, calibration or medical examination;*
- *that the laboratory is subject to surveillance by DANAK on a regular basis;*

Reports carrying DANAK's accreditation mark are used when reporting accredited services and show that these have been performed in accordance with the rules for accreditation.