



**Barmm melding well interventie  
Nedmag Veendam  
TR-5 (TCI-05)**

Volgens artikel 7 Besluit algemene regels milieu mijnbouw (Barmm)

Melding bij: Ministerie van Economische Zaken en Klimaat  
Directoraat-Generaal Klimaat en Energie – Warmte en Ondergrond  
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Toldijk 17-19  
7900 AP Hoogeveen

18 november 2019

## Inleiding

Dit document is een melding conform artikel 7 lid 1 van het Besluit Algemene Regels Milieu Mijnbouw (Barmm). De melding heeft betrekking op voorgenomen werkzaamheden aan de Nedmag zoutwinningsput TR-5 (TCI-05), waarvan de wellhead zich bevindt op de locatie Wellhead Head Centre 2 (WHC-2) aan de Nedmagweg 199 te Veendam.

### Artikel 7.1.a Locatiegegevens

De voorgenomen well interventie activiteiten vinden plaats op het perceel dat kadastraal bekend staat als VDM00R 00691G0000, perceelnummer 691, in het gebied van de winningsvergunning "Veendam".

Het adres van de locatie waar de wellhead van TR-5 zich bevindt, is Nedmag Wellhead Head Centre 2 (WHC-2), Nedmagweg 199, 9641 TA Veendam.

De ligging van de mobiele installatie met bijbehorend terrein ten opzichte van de directe nabijheid van geluidsgevoelige gebouwen en geluidsgevoelige terreinen is opgenomen in onderdeel 7.1.g.

### Artikel 7.1.b Aanduiding mobiele installatie

Installatie: SpaceSaver2  
Eigenaar installatie: Balance Point Control (BPC)

### Artikel 7.1.c Beschrijving mobiele installatie

Een samenvattende beschrijving van de mobiele installatie alsmede een opgave van het motorrendement van de bij de well interventie te gebruiken power pack en generator is opgenomen in bijlage 1. De unit SpaceSaver2 is uitgerust met een elektrisch aangedreven hydraulisch power pack.

### Artikel 7.1.d Samenvatting te verrichten werkzaamheden

Nedmag B.V. heeft het voornemen om werkzaamheden uit te voeren aan de bestaande zoutwinningsput TR-5. De doelstelling is om de bestaande verbuizing uit de mantelbuis te verwijderen, waarna er een afsluiting onder in de mantelbuis geplaatst zal worden. Een samenvatting van de uit te voeren werkzaamheden is als volgt:

#### Vorbereidende fase (wireline)

1. Snijden van de 3-1/2" verbuizing en installeren van de barrières in de 3-1/2" verbuizing.

### Fase operaties met mobiele installatie van BPC

1. Drukloos maken van de winningsput met een floating mud cap.
2. Verwijderen spuitkruis en opbouwen van snubbing unit (werktoren).
3. Verwijderen van de 2-7/8" verbuizing uit de winningsput.
4. Onderzoeken van de 4-1/2" verbuizingsserie met wireline.
5. Verwijderen van de 2-7/8" ahang spool en het vervangen van de 7-1/16" boorgat afsluiters voor 13-5/8" boorgat afsluiters.
6. Verwijderen van de 3-1/2" verbuizing.
7. Verwijderen van de 4-1/2" verbuizing.
8. Onderzoek van de 10-3/4" mantelbuis met wireline.
9. Plaatsen van een mechanische ondersteuning met daar bovenop tenminste 50 m cement.
10. Installeren van de 7" suspensie buis in de winningsput.
11. Demonteren van de mobiele installatie van BPC en het terugplaatsen van het spuitkruis.

### Slot fase (wireline)

1. Verwijderen van de tijdelijke barrières in de 7" verbuizing.

### **Artikel 7.1.e 10<sup>-6</sup> Veiligheidscontour**

Een QRA is geacht niet van toepassing te zijn op deze locatie: de winningsput betreft een zout producent, waarbij alle annuli water of pekels bevatten met een druk van maximaal ca. 98 bar. Beheersmaatregelen in het geval van ongewenste uitstroming zijn beschreven in een draaiboek dat onderdeel uitmaakt van het ISO 14001 gecertificeerde Nedmag managementsysteem.

### **Artikel 7.1.f Verwachte aanvang en beëindiging werkzaamheden**

De werkzaamheden zullen naar verwachting in week 51 van 2019 aanvangen. Het einde van de werkzaamheden is gepland in week 8 van 2020. De werkzaamheden zullen in een 12-uurs operatie plaats vinden. Transport voor mobilisatie en demobilisatie zal ook alleen overdag plaatsvinden, zie 7.1.i.

### **Artikel 7.1.g Resultaten akoestisch onderzoek**

In bijlage 2 zijn de resultaten van akoestisch onderzoek naar de geluidsemissie van de te gebruiken power pack en mud pump opgenomen. Het betreft de langtijd gemiddelde geluidsemissie.

De afstand tussen het hart van de workover installatie en de meest nabijgelegen woning (Tripscompagnie 75) bedraagt voor zoutwinningsput TR-5 185 meter. In de onderstaande lucht foto van de betreffende locatie is in geel de 300 m zone aangegeven om de locatie van

TR-5. Binnen 300 m bevinden zich 2 woningen. De afstand tot de volgende meest dichtbij gelegen woning bedraagt ca. 750 m.



Van de elektrische power pack is het geluidsdruk niveau op 1 meter afstand 82 dB(A). De hoogste verwachte geluidsdruk op 185 m is 37 dB.

Van de mud pump is het geluidsdruk niveau op 2.5 meter afstand 82 dB(A), de hoogste verwachte geluidsdruk op 185 m is 45 dB.

Uitgaande van een demping van de gevel van de dichtstbij gelegen geluidsgevoelige gebouwen van 20 dB(A), bedraagt het verwachte geluidsniveau in deze gebouwen ca. 25 dB(A). Dat is ruimschoots binnen de door de Barmm gestelde norm van 40 dB(A) voor operaties gepland tussen 07:00 - 19:00 uur.

Aangezien zich binnen 300 meter van TR-5 twee woningen bevinden, zal er tijdens de workover een continue geluidsmeting geplaatst worden. Bij overschrijding van de norm zullen passende maatregelen worden genomen.

In 2017 en 2018 zijn aan winningsputten TR-4 en respectievelijk TR-3 en TR-8 werkzaamheden uitgevoerd, waarbij een combinatie van diesel gedreven en elektrisch aangedreven hydraulische powerpack is gebruikt. Hiermee is ruimschoots binnen de geluidsnormen geopereerd. Tijdens de werkzaamheden aan TR-5 wordt wederom primair gebruik gemaakt van een elektrisch aangedreven hydraulisch powerpack.

#### Artikel 7.1.h Resultaten bodemonderzoek

De uit te voeren werkzaamheden aan TR-5 vormen geen bedreiging voor de bodem. Ter plaatse is de putkelder afgewerkt met een vloeistofkerende laag en de hardstand met een

asfalt vloeistofkerende laag. Mitigerende maatregelen zijn lekbakken bij power pack en aggregaat, en de dieseltank is dubbelwandig uitgevoerd. Tevens zijn er meerdere peilbuizen op de locatie geplaatst. Bijlage 3 bevat een plattegrond waarop de peilbuizen zijn weergegeven.

#### Artikel 7.1.i Aantal transportbewegingen

Tijdens de bouw en demontage van de mobiele installatie zullen, voornamelijk overdag, tussen de 10 tot 15 transporten plaatsvinden.

Tijdens de werkzaamheden vindt het transport overwegend op werkdagen en tijdens de dag uren plaats, waarbij van 2 tot 4 voertuigen per dag uitgegaan kan worden. Alleen bij uitzondering en in noodsituaties zullen transporten 's nachts en in de weekenden plaatsvinden. In onderstaande tabel zijn de transportbewegingen samengevat:

Aantal Transportbewegingen per periode (gemiddeld)			
		Montage/Demontage	Tijdens operatie
Dag	07.00 - 19.00	10-15/10-15	2-4
Avond	19.00 - 23.00	0	0
Nacht	23.00 - 07.00	0	0

De overlast voor de omwonenden is gering omdat het bevoorradingsverkeer uitsluitend overdag plaatsvindt en het extra verkeer geen noemenswaardige bijdrage aan de eventuele verkeershinder betekent: op werkdagen is er o.a. al verkeer voor leveringen aan en productafvoer vanaf de locatie WHC-2, zoals beschreven in de vigerende omgevingsvergunning.

## **Bijlage 1: samenvattende beschrijving mobiele installatie en opgave motorrendement**

- BPC Unit Space Saver II specificities
- BPC Emission Caterpillar C15 engine
- BPC Engine Efficiency C15

	<h2 style="margin: 0;">Space Saver II</h2> <p style="margin: 0;">Service &gt; Hydraulic Workover &gt; Equipment</p>
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**HWO/Snubbing Unit > Space Saver II**



During the TR-5 operations the staircase shown on the picture will not be present

The 385k Space Saver II has been designed optimizing weight, operational performance and operator comfort. The small footprint and easy deployed skid frames makes the Space Saver ideal for the offshore environment. Live- or Dead wells, the efficiency of this unit helps to extend the live of your small mature fields.

Tubular (drill-pipe) is handled by means of 2 hydraulic cylinders (3m stroke). The use of hydraulic cylinders allows perfect control over (drill) string movements and makes it easy to use all types of down-hole tools.

- Advantages & Characteristics:**
- Small Footprint.
  - Ideal for Offshore Projects
  - Suitable for Skid frames
  - Reliable
  - Perfect Cost/Quality ratio.
  - Ergonomic



- Operational activities:**
- Handling all types of completion.
  - Offshore well redevelopment projects
  - Live / Dead well operations
  - Installation ESP
  - Packer Setting/Milling.
  - Well Clean Out.
  - Live well Fishing Operations.
  - Remedial Operations.

**Technical Data**

<b>Space Saver II</b>		
Description	Data (Field)	Data (Metric)
Pull Capacity:	385,000 lbs	175 ton
Push Capacity:	170,000 lbs	80 ton
Rotary torque:	20,000 ft. lbs	27.000 Nm
Stroke:	10 ft	3 m
Through bore:	14"	355.6 mm
Gin Pole:	2 x 3300 lbs CB Winch 1 x 11000 lbs Main Winch	2 x 1,5 ton CB Winch 1 x 5,0 ton Main Winch

***Boost your Offshore Wells – Extend the live of your small mature fields!***  
*Our Space saver concept is the ideal solution for your offshore fields*

Zone classification	II 2G c d b IIB T3
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--- Select a Model ---



# CAT® C15 ACERT™ INDUSTRIAL DIESEL ENGINE

Overview

Specifications

Benefits & Features

Standard Equipment

Ratings

Related Products

OVERVIEW

[Print Version](#)

## Cat® C15 ACERT™ Industrial Diesel Engine

The Cat® C15 ACERT™ Industrial Diesel Engine is offered in ratings ranging from 328-444 bkW (440-595 bhp) @ 1800-2100 rpm. These ratings meet China Stage II, U.S. EPA Tier 3 equivalent, and EU Stage IIIA equivalent emission standards. Industries and applications powered by C15 ACERT engines include Agriculture, Ag Tractors, Aircraft Ground Support, Bore/Drill Rigs, Chippers/Grinders, Combines/Harvesters, Compactors/Rollers, Compressors, Construction, Cranes, Crushers, Dredgers, Forestry, General Industrial, Hydraulic Power Units, Irrigation Equipment, Loaders/Forwarders, Material Handling, Mining, Mobile Earthmoving Equipment, Paving Equipment, Pumps, Shovels/Draglines, Surface Hauling Equipment and Trenchers.

Units: [US](#) | [Metric](#)

### SPECIFICATIONS

Minimum Power	328.0 bkW
Maximum Power	444.0 bkW
Emissions	China Stage II, U.S. EPA Tier 3 Equivalent, EU Stage IIIA Equivalent

### BENEFITS & FEATURES

#### Emissions

Meets China Stage II, U.S. EPA Tier 3 equivalent, EU Stage IIIA equivalent emission standards. Available using EPA (U.S.) Flexibility and EU Flexibility, and for other regulated and non-regulated areas.



## Balance Point Control BV

### Calculate Engine Efficiency

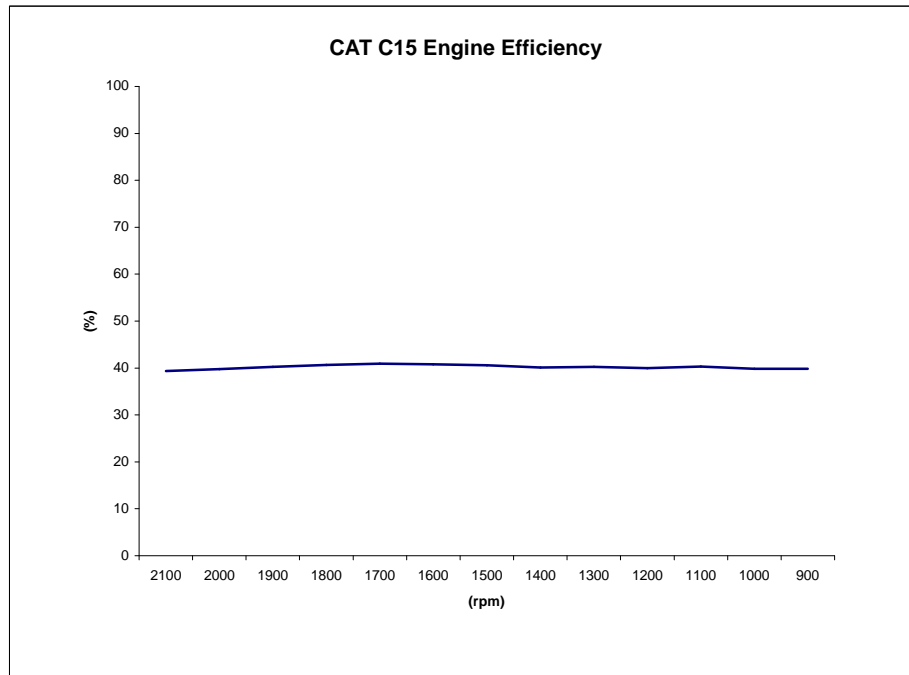
## Efficiency CAT C15 Acert Engine

The calculation below is based on information provided by Caterpillar. For exact test conditions see Caterpillar Specification Sheet. Standard reference conditions refer to SAE J1995, ISO 3046-2, ISO 2288, ISO 9249, ISO 1585, EEC 80/1269 and DIN 70020

Engine efficiency             $\eta_t =$   $\eta_t = \frac{P_e}{B_e \cdot H_0}$             (%)

Specifieke Energie Diesel     $H_0 =$             42780            (kJ/kg)

(rpm)	$P_e$ (kW)	(g/kW-hr)	(L/hr)	(Kg/L)	$B_e$ (Kg/s)	$\eta_t$ (%)
2100	373	214	95	0,839	0,022	39
2000	373	211	94	0,839	0,022	40
1900	373	209	93	0,839	0,022	40
1800	373	207	92	0,839	0,021	41
1700	367	207	90	0,839	0,021	41
1600	358	207	88	0,839	0,021	41
1500	348	208	86	0,839	0,020	41
1400	336	209	84	0,839	0,020	40
1300	301	210	75	0,839	0,017	40
1200	259	210	65	0,839	0,015	40
1100	189	210	47	0,839	0,011	40
1000	159	211	40	0,839	0,009	40
900	135	213	34	0,839	0,008	40



## **Bijlage 2: resultaten akoestisch onderzoek**

- BPC 08-24 noise report BPC mud pump
- BPC PP-32 Noise report electrical power pack

# Noise measurements at BPC mud pump unit

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Consultant	Noordelijk Akoestisch Adviesburo BV Noorderstaete 26 9402 XB Assen Postbus 339 9400 AH Assen <i>phone</i> (0592) 340630 <i>telefax</i> (0592) 340830 <i>e-mail</i> @naabv.nl
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Reference	4026/NAA/je/fw/2

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## Appendix

1	Drawing of mud pump unit
2	Summary of measurement equipment
3	Microfone positions principally defined bij ISO 3744
4	Used microfone positions
5	Calculated sound power levels

# 1 Introduction

On behalf of Balance Point Control the Noordelijk Akoestisch Adviesburo B.V. carried out noise measurements at a mud pump unit produced by them.

The goal of the measurements is to determine the noise emission of the mud pump unit. The results of the measurements can be applied as part of a study to obtain an environmental permit to operate a petrochemical drilling installation.

The noise measurements have been performed on June 9<sup>th</sup> 2010 between 17:00 and 20:00. The regarding mud pump unit was at that time located on the company terrain of Balance Point Control.

The measurements and calculations have been performed conform the international standard ISO 3744.

## 2 Base

### 2.1 Situation

The mud pump is built inside two connected sea containers on a mutual metal skid. One container contains the actual mud pump while the other contains the power pack. The power pack has three ingoing air grilles in the long vertical side and one outgoing air grille on top. The total unit is 7,04 meter long, 2,45 meters wide and 2,94 meters high. Drawings of the unit are given in appendix 1.

The measurements have been performed on a single standing mud pump unit based on a stone paved terrain. The area around the unit, was also stone paved without relevant obstacles or noise sources nearby. During measurement the pump was pumping water through a closed circuit to simulate regular operating conditions.

### 2.2 Weather conditions

During the measurements the weather conditions caused no problems. A summary of the weather conditions is given in table 1.

**Table 1: Weather conditions during the measurements**

Date	Clouds	Wind	Temperature in °C
9 <sup>th</sup> June 2010	8/8	3 m/s northeast	16-18

### 2.3 Interfering noise

During the measurements on the mud pump unit there was no disturbance of external interfering noises.

### 3 Used methods of measurement and calculation

#### 3.1 Used equipment

The equipment used for the measurements is given in appendix 2. During the measurements in the open air the microphones were always provided with a windscreen. Before and after the measurements the equipment has been calibrated. No irregularities have been found.

#### 3.2 Determining the sound power level of the mud pump

The total sound power level of the mud pump unit is determined by measurements on a hypothetical parallelepiped surface at one meter distance from a reference box as defined in ISO 3744. In this case the reference box is formed by the outer limits of the two containers. The microphone positions on the measurement surface are defined in the figures C.1 to C.8 of ISO 3744. In this case figure C.6, shown in Appendix 3, fits best. The schematic location of the actually used measurement points at 6 different paths is shown in appendix 4.

Because the microphone positions are uniformly distributed, the energetical average ( $L_{pf}$ ) of all measurement points can be calculated as follows:

$$L_{pf} = 10 \log(1/N) [\sum 10^{0,1L_{pi}}] \text{ dB(A) for } i= 1 \text{ to } N \quad (\text{formula 1})$$

$L_{pi}$  = sound pressure level measured at the i-th position  
N = number of measurements

The sound power level ( $L_w$ ) of the unit can be obtained as follows:

$$L_w = L_{pf} + 10 \log(S/S_0) \text{ dB(A)} \quad (\text{formula 2})$$

$S_0$  = reference surface of 1 m<sup>2</sup>

The area S of the measurement surface is given by the formula

$$S = 4(ab + bc + ca) \quad (\text{formula 3})$$

$$a = 0,5l_1 + d$$

$$b = 0,5l_2 + d$$

$$c = l_3 + d$$

d = measuring distance, here 1 meter

$l_1$ ,  $l_2$  and  $l_3$  are the length, width and height of the reference box

At each measurement point the period of observation was at least sixty seconds. In case of relevant back ground noise, the measurements have to be corrected.

## 4 Results of measurement and calculation

### 4.1 Total sound power level

Appendix 5 page 1 and 2 give the calculated sound power levels of the mud pump unit at the measured operating condition. After completing the measurements on the mud pump unit, the back ground noise was examined and turned out to be irrelevantly low.

The resulting sound power level is shown in table 2.

**Table 2: Sound power levels mud pump unit (L<sub>w</sub> in dB(A), ref. 1 pW)**

	Octave Band Centre Frequencies (Hz)									Total dB(A)
	31.5	63	125	250	500	1k	2k	4k	8k	
Mud pump unit	70.8	77.3	85.9	98.1	99.0	103.1	102.6	96.9	86.0	107.7

The measurement points near the air grilles are distinctively higher than average. The highest sound pressure level above the air outlet grille on top is 96.0 dB(A) while 86.0 dB(A) is average. The highest sound pressure level in front of the inlet grilles is 89.2 dB(A). The lowest sound pressure level is 73.6 dB(A).

### 4.2 Additional measurements

ISO 3744 defines three situations in which additional microphone positions are required in order to get more information about specific parts of the installation under measurement. These situations are:

- the range of sound pressure level values measured at the key microphone positions (i.e. the difference in decibels between the highest and the lowest sound pressure levels) exceeds the number of measurement points,
- the source radiates noise with a high directivity,
- the noise from a large source is radiated only from a small portion of the source, for example the openings of an otherwise enclosed machine.

Condition a) is not met because the maximum difference is 12.4 dB(A) which is a lot less than the 118 used measurement points.

Condition b) is not met either because the highest measured sound pressure levels are above the unit and the radiated noise is therefore evenly distributed in all directions. The highest sound pressure level in front of the vertical air inlets is just 3.2 dB(A) above average and therefore regarded acceptable.

Condition c) is met because the radiated sound power of the air outlet grille on top of the unit is approximately half of the total sound power of the unit. In that case additional measurement positions in the region of high noise radiation shall be used.

### 4.3 Sound power level of air outlet grille

Additional microphone positions will usually not be associated with equal areas on the measurement surface. In that case some of the measurement results have to be weighted differently and the calculation procedure for unequal areas as defined in ISO 3745 §8.1.2 shall be used. The surface sound pressure level  $L_{pf}$  is obtained as follows:

$$L_{pf} = 10 \log(1/S) [\sum S_i \cdot 10^{0.1L_{pi}}] \text{ dB(A) for } i = 1 \text{ to } N \quad (\text{formula 4})$$

- $L_{pi}$  = sound pressure level resulting from the i-th position
- $S_i$  = partial surface area associated with the i-th position
- $S$  = total surface area of measurement

This formula is used to determine the sound power level of the air outlet grille. Because path 3 is at the ground level of the air outlet grille the measured sound power levels are only valid from that height up. Therefore in this method the partial surface areas of path 3 are only half of what they are in the ISO 3744 measurement.

In order to complete the measuring box around the air outlet grille, measuring path 7 is chosen. This path is shown in appendix 4.

The resulting sound power level of the air outlet grille is shown in table 3.

**Table 3: Sound power levels mud pump unit (Lw in dB(A), ref. 1 pW)**

	Octave Band Centre Frequencies (Hz)									Total dB(A)
	31.5	63	125	250	500	1k	2k	4k	8k	
Air outlet grille	64.2	70.0	79.6	96.5	96.6	100.9	100.4	93.5	83.3	105.4
Mud pump unit without air outlet	69.7	76.4	84.7	93.1	95.2	99.1	98.7	94.3	82.7	103.8
Total mud pump unit	70.8	77.3	85.9	98.1	99.0	103.1	102.6	96.9	86.0	107.7

The air outlet grille generates almost 60% of the total sound power of the mud pump unit.

### 4.4 Working circumstances near the mud pump unit

The measurements of path 2 correspond roughly with the height of ears of workers near the unit. Except for the air inlet side the measured sound pressure levels do not exceed 82 decibels. In that direction additional measurements were made which point out that the sound pressure level on the air inlet side is 82 dB(A) at 2.5 meters distance from the air inlet.

Near the control panel a sound pressure level of 79 dB(A) was measured.

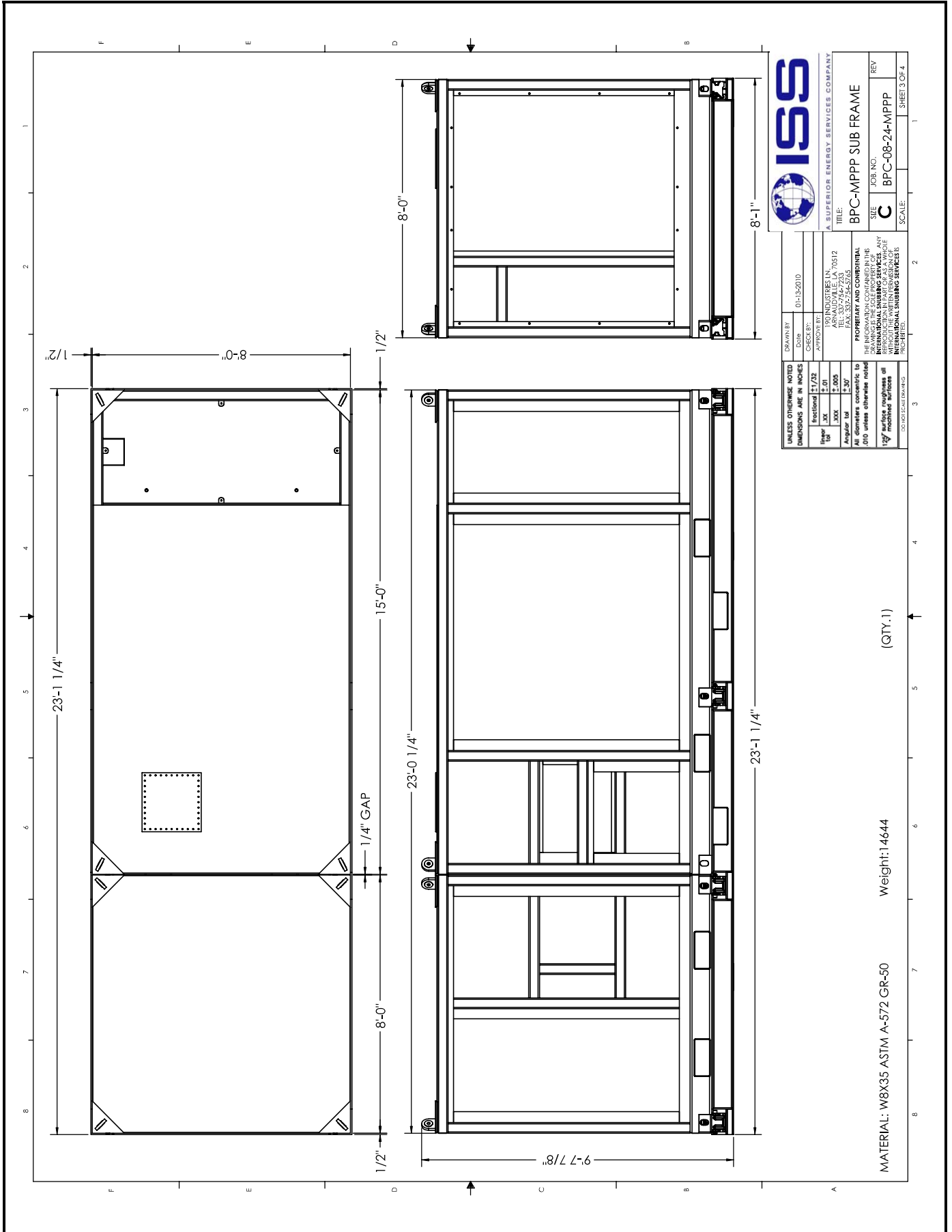
## 5 Conclusions

On behalf of Balance Point Control the Noordelijk Akoestisch Adviesburo B.V. carried out noise measurements at a mud pump unit produced by them.

The goal of the measurements is to determine the noise emission of the mud pump unit. The results of the measurements can be applied in a study to obtain an environmental permit to operate a petrochemical drilling installation.

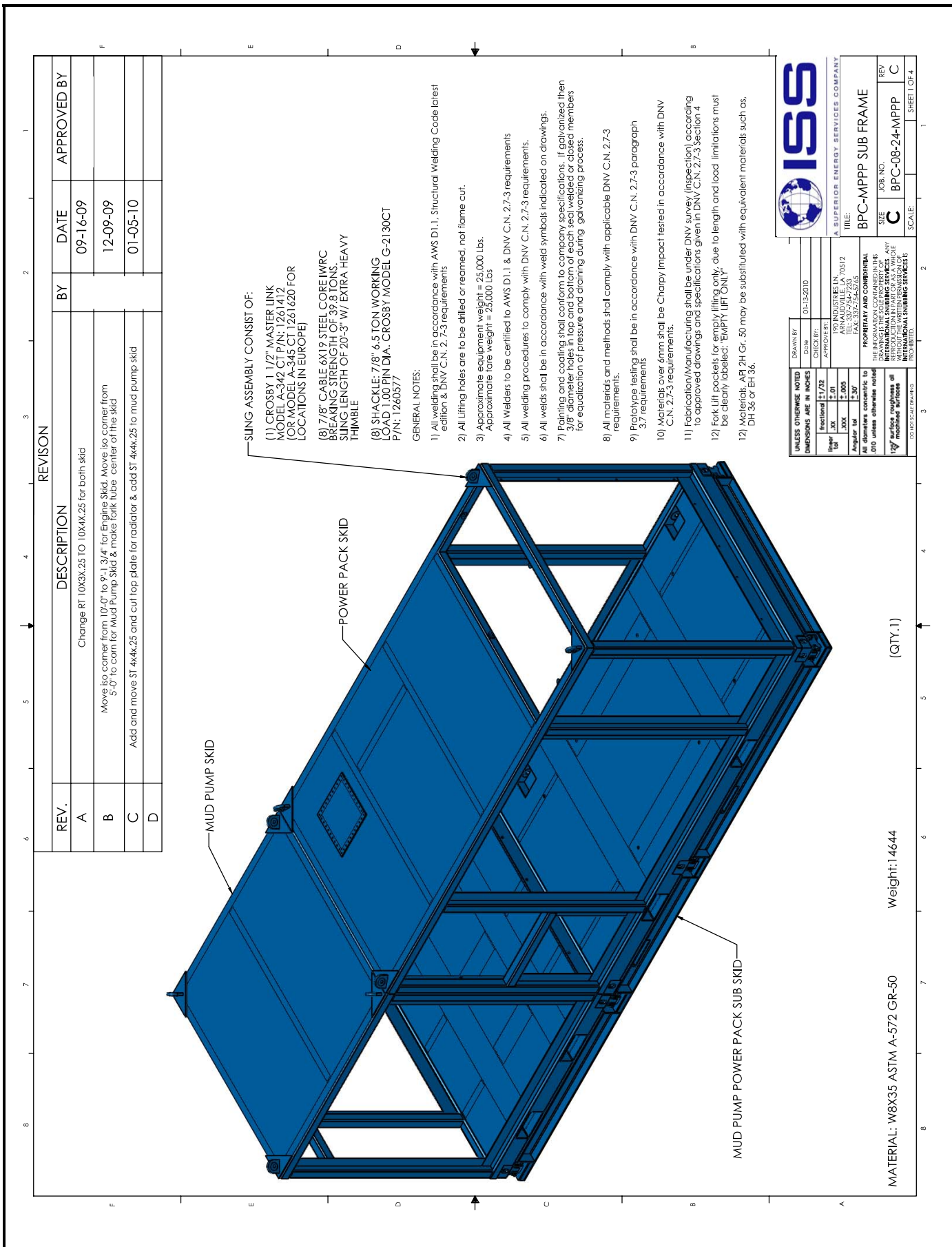
The sound power level of the mud pump unit is determined by the method as defined in ISO 3744. Additional measurements on the air outlet grille on top of the mud pump unit were carried out according to ISO 3745. The total sound power level of the mud pump unit and the air outlet grille are shown in table 3.

The measured sound pressure levels do not exceed 82 dB(A) at ear height at 2.5 meters distance from the unit. Near the air outlet grille higher levels can occur but not at ear height. Near the control panel a sound pressure level of 79 dB(A) was measured.



## Noise measurements at BPC mud pump unit

Drawing of mud pump unit



REV.	DESCRIPTION	BY	DATE	APPROVED BY
A	Change RT 10X3X.25 TO 10X4X.25 for both skid		09-16-09	
B	Move top corner from 10'0" to 9'-1 3/4" for Engine Skid. Move top corner from 5'-0" to corn for Mud Pump Skid & make fork tube center of the skid		12-09-09	
C	Add and move ST 4x4x.25 and cut top plate for radiator & add ST 4x4x.25 to mud pump skid		01-05-10	
D				

UNLESS OTHERWISE NOTED DIMENSIONS ARE IN INCHES		DRAWN BY: DLR:152010
Tolerance	Fractional ± 1/32	DATE: 01-13-2010
XXX	± .01	PROJECT NO:
XXX	± .005	100 INDUSTRIES, INC.
Angular tol	± .30'	ARNAUDVILLE, LA 70512
All diameters concentric to .010 unless otherwise noted		TEL: 337-754-5253
Top surface roughness of machined surfaces		FAX: 337-754-5253
TOTAL WEIGHT (LBS)		PROPERTY AND CONFIDENTIAL
TOTAL WEIGHT (LBS)		THE INFORMATION CONTAINED IN THIS DRAWING IS THE PROPERTY OF ISS SUPERIDE ENERGY SERVICES COMPANY. ANY REUSE OR REPRODUCTION OF THIS DRAWING WITHOUT THE WRITTEN PERMISSION OF ISS SUPERIDE ENERGY SERVICES COMPANY IS STRICTLY PROHIBITED.
TITLE: BPC-MPPP SUB FRAME		ISS
REV	JOB NO.	
C	BPC-08-24-MPPP	
C	SCALE:	

MATERIAL: W8X35 ASTM A-572 GR-50 Weight: 14644 (QTY: 1)

## Noise measurements at BPC mud pump unit

Drawing of mud pump unit



<b>Equipment</b>	<b>Brand name</b>	<b>Type</b>
Geluidsniveau-analysator	Rion	NA-29E
½" microfoon	Rion	UC-53
Akoestische kalibrator	Brüel & Kjær	4230

## **Noise measurements at BPC mud pump unit**

Summary of measurement equipment

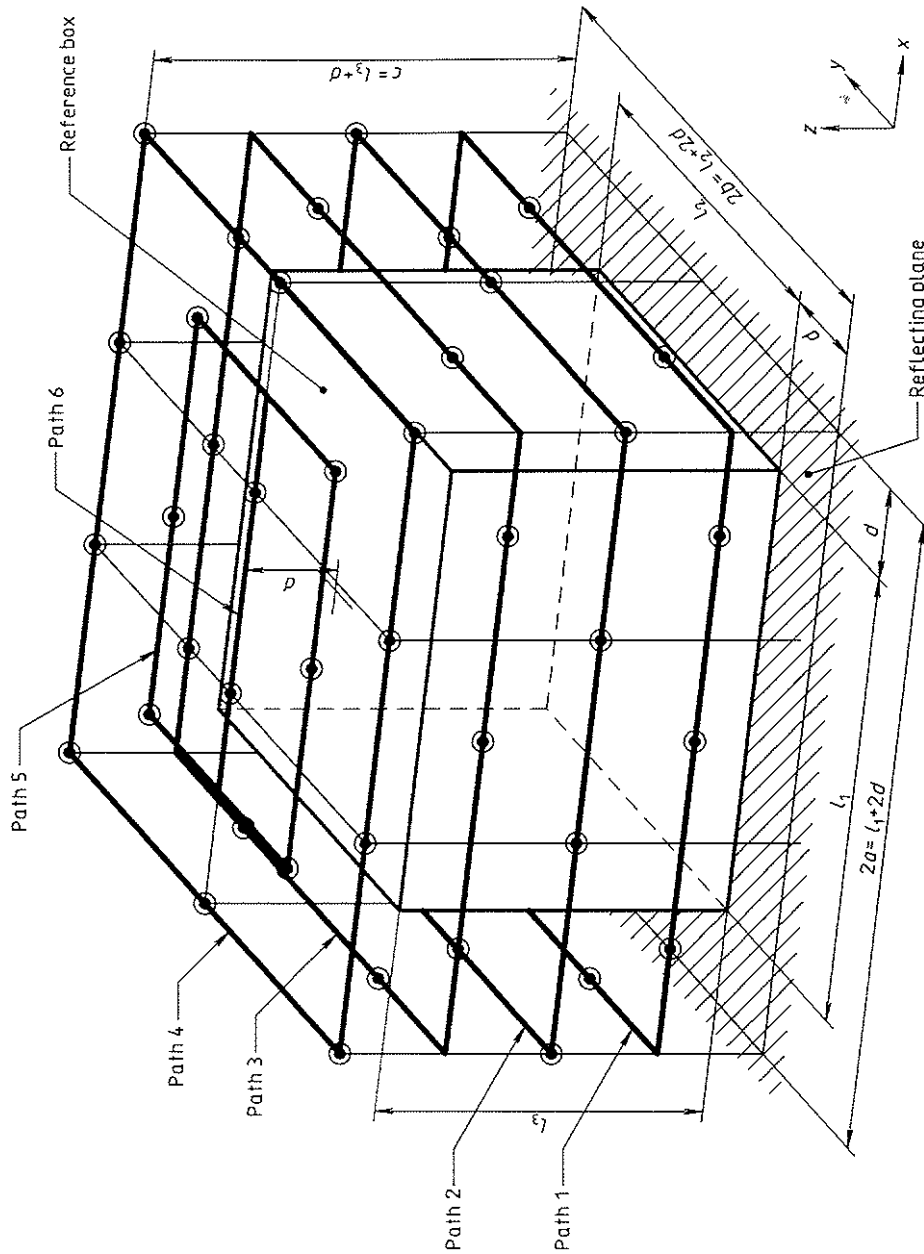
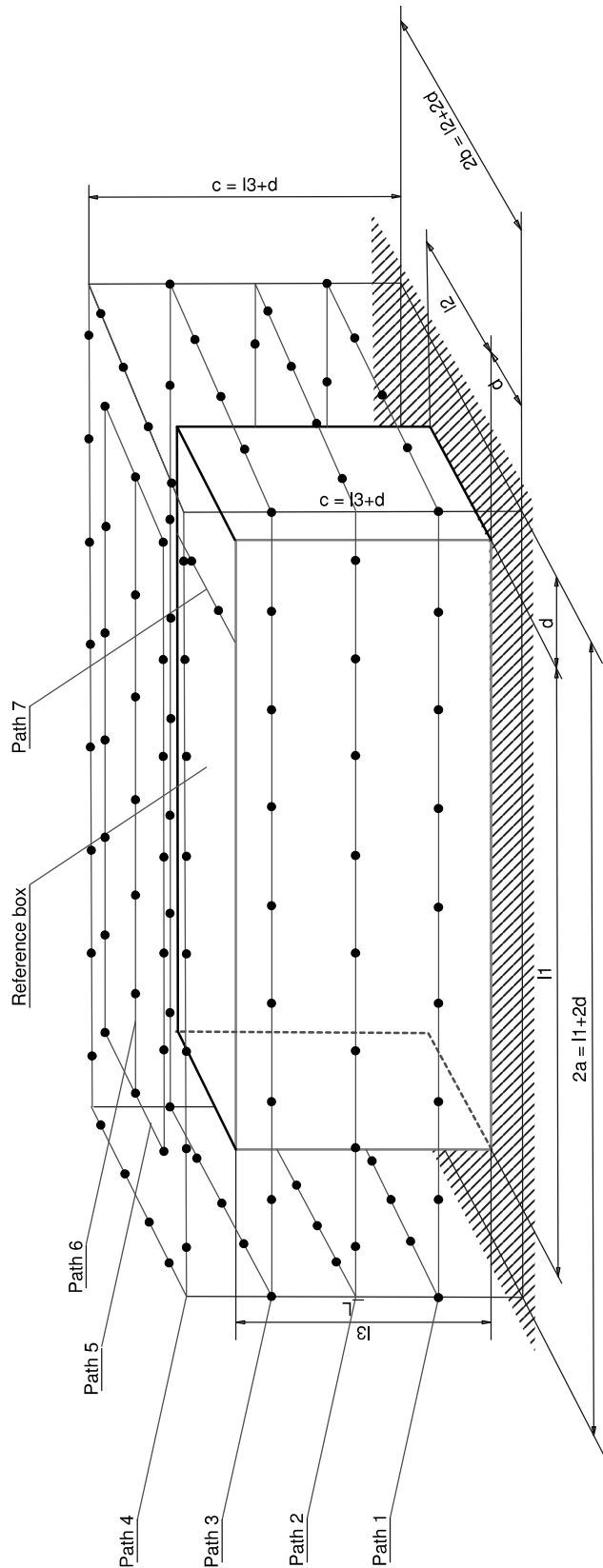


Figure C.6 — Example of a measurement surface and microphone positions (paths) for a large machine  
 ( $4d < l_1 \leq 7d$ ,  $d < l_2 \leq 4d$ ,  $2d < l_3 \leq 5d$ )

## Noise measurements at BPC mud pump unit

Microfone positions principally defined bij ISO 3744



## Noise measurements at BPC mud pump unit

Used microphone positions

ISO 3744 Determination of sound power levels of sources using sound pressure

Project : BPC mud pump unit  
 Date of measurement june 9th 2010  
 Measurement Object **mud pump unit**  
 Operation condition **test**

Measured octave band centre frequency [dB(A) reference 20 µPa]

	Octave band centre frequency (Hz)									Total
	31.5	63	125	250	500	1k	2k	4k	8k	
Measuring path 1	47.6	59.2	67.4	72.5	70.4	69.4	67.5	65.2	55.5	77.3
Measuring path 1	48.7	55.3	63.9	72.0	70.5	72.3	70.9	68.0	59.2	78.2
Measuring path 1	48.8	61.5	69.9	74.2	74.5	73.8	72.4	70.3	62.8	80.8
Measuring path 1	49.6	52.7	63.1	74.2	71.7	72.6	72.5	68.8	59.7	79.4
Measuring path 1	49.3	52.3	60.7	69.7	69.3	71.8	71.2	69.4	57.2	77.5
Measuring path 1	49.8	57.3	65.8	68.7	68.5	69.8	69.9	65.5	53.9	76.2
Measuring path 1	50.7	57.8	66.0	69.8	70.2	71.8	69.4	64.6	52.5	77.1
Measuring path 1	50.7	55.0	63.3	67.4	70.6	74.0	71.9	66.5	54.2	78.1
Measuring path 1	54.1	52.2	61.7	67.0	72.1	76.1	76.2	68.9	58.0	80.6
Measuring path 1	55.4	52.5	63.4	67.2	73.1	77.2	77.2	70.2	59.6	81.6
Measuring path 1	53.4	53.9	62.2	70.1	71.3	76.3	75.3	68.9	57.7	80.4
Measuring path 1	51.4	54.0	62.0	69.2	70.9	75.3	73.5	68.6	59.5	79.4
Measuring path 1	50.7	55.3	64.2	71.1	70.4	73.5	73.4	72.4	62.7	79.6
Measuring path 1	47.3	53.5	60.7	72.8	72.4	75.3	77.6	77.6	65.7	82.8
Measuring path 1	44.9	58.0	66.1	73.0	73.2	77.0	79.4	80.2	67.8	84.7
Measuring path 1	50.0	63.1	71.4	74.6	73.9	76.8	77.7	76.6	69.0	83.6
Measuring path 1	50.6	62.3	70.3	73.1	73.3	76.3	76.0	75.3	67.4	82.5
Measuring path 1	49.7	58.1	65.8	72.2	71.7	73.2	75.1	73.4	62.8	80.5
Measuring path 1	48.4	61.4	69.3	69.0	69.9	72.2	71.7	70.4	60.1	78.5
Measuring path 1	47.2	59.8	68.0	69.7	72.1	70.8	68.8	66.3	57.2	77.6
Measuring path 1	47.8	55.5	63.8	65.7	68.7	69.2	67.3	61.1	54.9	74.7
Measuring path 1	49.1	53.1	61.2	69.8	69.9	69.7	66.3	62.4	57.6	75.7
Measuring path 1	48.1	57.5	65.6	70.4	69.0	68.9	64.2	59.9	54.2	75.4
Measuring path 1	46.4	58.3	66.8	70.6	70.9	68.0	65.9	63.8	54.2	76.2
Measuring path 2	46.5	57.1	65.7	71.9	71.1	68.3	66.7	62.3	53.1	76.6
Measuring path 2	46.6	56.6	65.5	72.1	71.2	70.1	68.1	63.1	54.9	77.2
Measuring path 2	48.2	55.9	65.0	71.6	72.1	73.5	70.6	68.0	58.6	78.8
Measuring path 2	48.7	59.7	68.0	71.0	71.6	73.3	71.7	68.7	59.4	79.0
Measuring path 2	47.0	58.1	66.1	72.5	70.9	71.9	71.4	68.2	58.1	78.5
Measuring path 2	46.2	54.5	59.5	70.2	69.5	71.1	70.8	66.4	55.5	77.0
Measuring path 2	47.8	57.9	64.7	67.9	69.8	71.5	71.8	64.6	53.2	77.1
Measuring path 2	49.5	57.5	65.1	69.7	71.3	73.7	71.9	65.9	53.6	78.4
Measuring path 2	51.2	56.4	64.1	71.9	72.9	75.2	74.3	67.3	55.1	80.2
Measuring path 2	53.9	55.1	62.8	71.2	72.3	77.6	77.4	69.7	59.0	81.9
Measuring path 2	54.7	54.2	60.9	71.2	73.2	78.0	76.7	70.4	59.2	82.0
Measuring path 2	51.5	52.1	60.4	73.8	73.1	75.2	74.6	70.2	58.1	80.8
Measuring path 2	51.2	53.1	62.2	74.9	72.3	73.9	73.7	70.1	60.3	80.4
Measuring path 2	49.7	55.7	64.3	72.4	72.8	74.9	76.2	75.1	64.6	81.7
Measuring path 2	45.0	53.1	60.8	72.0	76.6	78.9	80.7	80.0	69.0	85.6
Measuring path 2	49.2	58.0	65.6	73.1	77.2	82.2	83.8	82.6	72.1	88.3
Measuring path 2	52.3	57.6	65.4	72.8	78.6	82.7	83.7	84.7	71.4	89.2
Measuring path 2	51.0	53.9	61.7	70.8	73.5	78.2	79.0	78.0	67.1	84.0
Measuring path 2	49.6	56.0	64.0	68.3	70.9	74.1	75.4	74.3	62.6	80.5
Measuring path 2	47.3	53.5	62.2	66.7	69.6	71.3	71.6	69.5	58.9	77.3
Measuring path 2	47.0	51.1	60.2	67.0	69.8	71.8	70.6	67.6	56.9	76.9
Measuring path 2	48.0	50.9	60.4	68.0	67.6	68.8	66.2	60.7	56.1	74.3
Measuring path 2	47.8	52.6	61.5	68.2	66.7	67.9	64.8	59.0	53.4	73.6
Measuring path 2	46.3	52.5	61.3	67.5	69.9	67.6	64.5	60.9	52.1	74.3
Measuring path 3	45.4	51.4	61.5	68.7	69.8	71.5	70.6	62.5	51.8	76.6
Measuring path 3	45.7	51.1	61.9	66.3	67.9	71.9	71.3	63.7	51.8	76.4
Measuring path 3	46.5	51.0	62.8	67.7	69.7	72.9	73.5	65.2	53.7	78.0
Measuring path 3	46.9	53.3	62.9	68.7	71.2	75.6	75.7	68.3	55.1	80.1
Measuring path 3	46.1	54.2	62.0	71.8	73.0	75.8	76.1	69.9	56.5	81.0
Measuring path 3	46.1	55.7	62.8	73.5	73.4	77.5	77.5	71.3	59.2	82.4
Measuring path 3	48.3	54.5	60.5	71.7	75.4	79.8	78.6	72.3	61.0	83.7
Measuring path 3	48.9	53.8	59.9	71.3	74.2	78.7	77.0	70.2	58.3	82.5
Measuring path 3	48.8	54.0	61.8	72.0	74.4	78.3	76.5	68.9	56.1	82.2
Measuring path 3	52.5	54.8	64.1	77.4	79.2	83.8	82.9	72.7	61.3	87.8
Measuring path 3	53.9	55.3	65.1	74.5	79.9	85.2	83.3	73.2	61.7	88.4
Measuring path 3	52.0	53.0	62.1	75.9	78.7	84.0	82.9	73.8	62.7	87.7
Measuring path 3	50.4	51.6	60.1	74.2	74.9	78.7	77.5	71.7	59.0	83.1
Measuring path 3	51.3	53.0	61.9	75.5	76.3	79.4	78.8	72.4	61.1	84.2
Measuring path 3	49.4	53.8	63.5	75.0	77.2	80.2	80.5	75.6	63.8	85.3

**Noise measurements at BPC mud pump unit**

Calculated sound power levels



Measuring path 3	45.3	48.3	58.5	68.6	70.1	74.3	73.0	68.8	57.4	78.7
Measuring path 3	45.6	49.6	59.2	67.8	70.3	75.3	74.5	64.1	54.2	79.2
Measuring path 3	46.4	50.5	59.6	70.0	70.9	75.7	74.5	63.7	53.9	79.6
Measuring path 3	45.9	50.2	58.8	67.0	70.5	73.9	73.2	63.2	52.0	78.1
Measuring path 3	45.3	49.5	60.5	68.9	69.3	71.4	70.7	62.1	51.8	76.5
Measuring path 4	44.2	46.3	58.3	65.5	70.4	75.0	75.0	64.3	53.2	79.1
Measuring path 4	44.9	48.2	57.8	66.9	71.2	76.2	76.0	66.7	54.5	80.2
Measuring path 4	45.7	51.9	61.0	70.0	73.4	77.7	77.3	68.2	56.8	81.8
Measuring path 4	45.7	53.0	61.1	74.8	75.7	80.2	78.8	70.5	59.0	84.2
Measuring path 4	44.7	52.8	60.9	76.4	78.0	80.9	81.6	74.1	63.3	86.1
Measuring path 4	46.2	54.9	63.4	77.1	78.5	81.5	80.9	74.7	63.9	86.2
Measuring path 4	47.6	53.9	62.0	76.0	78.9	82.3	81.2	74.8	64.8	86.6
Measuring path 4	47.6	51.7	60.1	74.4	77.0	82.7	81.3	74.1	63.7	86.3
Measuring path 4	49.4	53.1	62.6	78.4	79.7	85.3	83.5	76.3	65.5	88.9
Measuring path 4	51.6	54.7	65.5	78.4	82.8	88.6	87.0	79.5	68.1	92.0
Measuring path 4	51.2	53.9	63.7	80.5	81.4	86.8	85.2	79.0	67.6	90.6
Measuring path 4	50.2	52.4	61.6	77.9	79.3	85.1	83.6	77.0	66.2	88.8
Measuring path 4	49.5	51.7	60.0	77.5	78.5	82.8	83.1	76.1	64.9	87.5
Measuring path 4	48.6	53.2	61.1	78.3	79.0	83.4	83.0	77.2	66.0	87.9
Measuring path 4	44.9	54.5	63.2	75.3	79.3	81.8	82.5	76.0	65.0	86.9
Measuring path 4	44.3	51.4	60.5	72.0	76.1	79.7	79.4	75.0	61.1	84.3
Measuring path 4	46.0	52.6	61.2	72.1	75.3	79.2	78.5	72.2	59.3	83.5
Measuring path 4	46.7	53.5	60.5	71.3	74.8	77.8	77.0	70.5	56.6	82.2
Measuring path 4	46.1	52.3	59.9	67.1	72.8	77.2	76.3	70.0	56.3	81.2
Measuring path 4	45.4	49.8	58.4	67.9	72.3	76.1	74.7	67.4	55.7	80.0
Measuring path 4	45.5	49.5	58.8	69.4	71.8	76.7	74.6	65.9	54.5	80.2
Measuring path 4	45.5	48.7	58.7	71.6	72.3	77.0	75.6	64.3	53.6	80.9
Measuring path 4	45.1	46.8	57.8	69.0	71.7	75.8	74.8	64.6	53.4	79.8
Measuring path 4	44.6	46.3	57.2	66.0	70.9	74.7	74.2	64.2	53.1	78.8
Measuring path 5 over container edge	45.5	46.0	57.8	66.3	72.2	77.5	75.1	65.8	54.8	80.6
Measuring path 5 over container edge	46.7	51.8	60.5	67.6	73.8	79.1	76.5	70.6	56.8	82.3
Measuring path 5 over container edge	47.4	53.0	62.5	71.2	75.1	80.8	78.5	70.8	59.2	84.0
Measuring path 5 over container edge	47.6	55.0	63.1	71.1	75.9	82.3	81.9	73.4	62.4	86.0
Measuring path 5 over container edge	48.6	55.3	65.2	80.4	80.2	85.3	86.7	78.8	67.7	90.4
Measuring path 5 over container edge	50.6	60.1	69.5	85.8	84.5	88.0	87.7	81.9	71.0	93.1
Measuring path 5 over container edge	50.0	58.4	68.5	88.3	85.9	89.0	88.6	81.8	71.3	94.4
Measuring path 5 over container edge	51.4	58.8	69.3	83.7	87.1	91.3	91.2	83.9	73.0	95.7
Measuring path 5 over container edge	50.2	57.4	67.6	90.0	87.0	90.3	89.8	82.7	72.1	95.7
Measuring path 5 over container edge	50.5	58.9	67.1	87.1	85.1	89.5	89.4	82.9	73.5	94.5
Measuring path 5 over container edge	46.8	58.3	66.3	75.1	80.4	85.9	85.0	77.4	66.4	89.6
Measuring path 5 over container edge	46.7	53.3	62.2	74.5	78.3	82.6	80.9	71.7	60.3	86.2
Measuring path 5 over container edge	47.1	55.4	63.5	71.3	77.1	81.4	79.5	71.5	58.4	84.9
Measuring path 5 over container edge	47.0	54.8	61.7	72.2	75.6	80.3	77.5	68.3	55.2	83.5
Measuring path 5 over container edge	46.3	52.6	61.4	68.1	73.3	78.2	76.0	66.6	54.2	81.5
Measuring path 5 over container edge	46.1	50.8	60.8	69.8	71.4	74.4	72.0	62.5	51.3	78.5
Measuring path 6 above container	47.0	54.1	62.0	71.0	74.3	76.9	75.1	66.8	54.6	81.1
Measuring path 6 above container	47.7	55.8	64.6	76.2	78.4	82.1	81.3	74.9	62.0	86.5
Measuring path 6 above container	48.1	56.0	64.7	75.8	78.0	81.3	79.7	71.0	60.0	85.4
Measuring path 6 above container	51.5	58.5	68.2	78.3	82.4	87.4	87.2	79.1	70.1	91.5
Measuring path 6 above container	53.7	60.5	71.2	78.7	87.8	91.8	91.5	84.9	76.1	96.0
Averaged sound pressure level (Lpf)	49.1	55.6	64.2	76.4	77.3	81.4	80.9	75.2	64.3	86.0
								highest sound pressure level		96.0
								lowest sound pressure level		73.6

Background noise	Octave band centre frequency (Hz)								Total	
	31.5	63	125	250	500	1k	2k	4k		8k
background noise panel side	19.7	28.5	30.4	38.1	38.3	42.8	40.0	33.0	22.1	46.7
background noise electric side	20.9	38.2	34.7	38.7	40.1	45.7	42.1	32.8	23.8	49.2
background noise air inlet side	21.5	37.5	34.6	40.8	43.8	46.2	41.5	33.3	24.4	50.1
background noise pump side	21.4	35.9	33.1	37.6	42.4	46.4	41.7	33.5	23.4	49.5

Length of reference box (l1) 7.0 m      a = 1/2 l1 + d      4.5 m  
 Width of reference box (l2) 2.5 m      b = 1/2 l2 + d      2.2 m  
 Height of reference box (l3) 2.9 m      c = L3 + d      3.9 m  
 Measuring distance (d) 1.0 m  
 Measurement surface (S) 146.5 m<sup>2</sup>

Calculating Sound power level	Octave band centre frequency (Hz)								Total	
	31.5	63	125	250	500	1k	2k	4k		8k
Averaged sound pressure level (Lpf)	49.1	55.6	64.2	76.4	77.3	81.4	80.9	75.2	64.3	86.0
Surface correction 10log(S/S0)	21.7	21.7	21.7	21.7	21.7	21.7	21.7	21.7	21.7	21.7
K background correction (delta L > 15)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total sound power level (Lw)	70.8	77.3	85.9	98.1	99.0	103.1	102.6	96.9	86.0	107.7

## Noise measurements at BPC mud pump unit

Calculated sound power levels

ISO 3745 Determination of sound power levels of sources using sound pressure

Project : BPC mud pump unit  
 Date of measurement june 9th 2010  
 Measurement Object **mud pump unit air outlet grille**  
 Operation condition **test**

Measured octave band centre frequency [dB(A) reference 20 µPa]

	Octave band centre frequency (Hz)									Total	area (m <sup>2</sup> )
	31.5	63	125	250	500	1k	2k	4k	8k		
Measuring path 3	48.3	54.5	60.5	71.7	75.4	79.8	78.6	72.3	61.0	83.7	0.55
Measuring path 3	48.9	53.8	59.9	71.3	74.2	78.7	77.0	70.2	58.3	82.5	0.56
Measuring path 3	48.8	54.0	61.8	72.0	74.4	78.3	76.5	68.9	56.1	82.2	0.55
Measuring path 3	52.5	54.8	64.1	77.4	79.2	83.8	82.9	72.7	61.3	87.8	0.55
Measuring path 3	53.9	55.3	65.1	74.5	79.9	85.2	83.3	73.2	61.7	88.4	0.55
Measuring path 3	52.0	53.0	62.1	75.9	78.7	84.0	82.9	73.8	62.7	87.7	0.55
Measuring path 3	50.4	51.6	60.1	74.2	74.9	78.7	77.5	71.7	59.0	83.1	0.55
Measuring path 3	51.3	53.0	61.9	75.5	76.3	79.4	78.8	72.4	61.1	84.2	0.56
Measuring path 3	49.4	53.8	63.5	75.0	77.2	80.2	80.5	75.6	63.8	85.3	0.55
Measuring path 7 above container	50.8	55.5	65.1	76.7	81.3	87.2	88.1	80.0	70.6	91.7	0.55
Measuring path 7 above container	50.8	59.1	67.9	79.3	81.5	87.2	86.5	79.0	69.7	91.1	0.55
Measuring path 4	47.6	53.9	62.0	76.0	78.9	82.3	81.2	74.8	64.8	86.6	1.19
Measuring path 4	47.6	51.7	60.1	74.4	77.0	82.7	81.3	74.1	63.7	86.3	1.19
Measuring path 4	49.4	53.1	62.6	78.4	79.7	85.3	83.5	76.3	65.5	88.9	1.18
Measuring path 4	51.6	54.7	65.5	78.4	82.8	88.6	87.0	79.5	68.1	92.0	1.18
Measuring path 4	51.2	53.9	63.7	80.5	81.4	86.8	85.2	79.0	67.6	90.6	1.18
Measuring path 4	50.2	52.4	61.6	77.9	79.3	85.1	83.6	77.0	66.2	88.8	1.18
Measuring path 4	49.5	51.7	60.0	77.5	78.5	82.8	83.1	76.1	64.9	87.5	1.19
Measuring path 4	48.6	53.2	61.1	78.3	79.0	83.4	83.0	77.2	66.0	87.9	1.19
Measuring path 5 over container edge	50.6	60.1	69.5	85.8	84.5	88.0	87.7	81.9	71.0	93.1	1.26
Measuring path 5 over container edge	50.0	58.4	68.5	88.3	85.9	89.0	88.6	81.8	71.3	94.4	1.26
Measuring path 5 over container edge	51.4	58.8	69.3	83.7	87.1	91.3	91.2	83.9	73.0	95.7	1.26
Measuring path 5 over container edge	50.2	57.4	67.6	90.0	87.0	90.3	89.8	82.7	72.1	95.7	1.26
Measuring path 5 over container edge	50.5	58.9	67.1	87.1	85.1	89.5	89.4	82.9	73.5	94.5	1.26
Measuring path 6 above container	53.7	60.5	71.2	78.7	87.8	91.8	91.5	84.9	76.1	96.0	1.26
Averaged soud pressure level (Lpf)	50.2	56.0	65.6	82.5	82.7	86.9	86.4	79.5	69.3	91.4	
Total sound power level (Lw)	64.2	70.0	79.6	96.5	96.6	100.9	100.4	93.5	83.3	105.4	23.1

highest soud pressure level	96.0
lowest soud pressure level	82.2

Background noise

	Octave band centre frequency (Hz)									Total
	31.5	63	125	250	500	1k	2k	4k	8k	
background noise panel side	19.7	28.5	30.4	38.1	38.3	42.8	40.0	33.0	22.1	46.7
background noise electric side	20.9	38.2	34.7	38.7	40.1	45.7	42.1	32.8	23.8	49.2
background noise air inlet side	21.5	37.5	34.6	40.8	43.8	46.2	41.5	33.3	24.4	50.1
background noise pump side	21.4	35.9	33.1	37.6	42.4	46.4	41.7	33.5	23.4	49.5

**Noise measurements at BPC mud pump unit**

Calculated sound power levels



## **BEPALEN GELUIDSVERMOGEN POWERPACK VAN BALANCE POINT CONTROL TE EMMEN**

Machine: Electrical Powerpack met code PP-32



noordelijk  
akoestisch  
adviesburo

# BEPALEN GELUIDSVERMOGEN POWERPACK VAN BALANCE POINT CONTROL TE EMMEN

Machine: Electrical Powerpack met code PP-32

<b>Opdrachtgever</b>	Balance Point Controle B.V. Karel Doormanstraat 4 7825 VT Emmen
<b>Contactpersoon</b>	
<b>Uitgevoerd door</b>	Noordelijk Akoestisch Adviesburo BV
<b>Behandeld door</b>	
<b>Datum</b>	4 oktober 2019
<b>Kenmerk</b>	6180/NAA/jv/ft/1

## INLEIDING

In opdracht van Balance Point Control B.V. (BPC) te Emmen zijn geluidsmetingen uitgevoerd aan een elektrisch aangedreven hydraulische powerpack (code PP-32). De unit is gebouwd in een container. De metingen zijn uitgevoerd op dinsdag 17 september 2019. Tijdens de geluidsmetingen stond de machine opgesteld op het bedrijfsterrein van BPC in Emmen. Het doel van de geluidsmetingen is het geluidsvermogen van het powerpack vast te stellen. De geluidsmetingen zijn uitgevoerd, en het geluidsvermogen is vastgesteld, conform de NEN/ISO 3744:2010. Ter aanvulling zijn er ook nog metingen uitgevoerd conform de in Nederland gehanteerde norm "Handleiding meten en rekenen industrielawaai" (versie 1999), in het vervolg van dit rapport de Handleiding genoemd.

## MEETOPSTELLING

Het powerpack (container) stond tijdens de geluidsmetingen opgesteld op het bedrijfsterrein van BPC te Emmen. In bijlage 1 zijn enkele foto's van het powerpack weergegeven. De container stond opgesteld op een harde ondergrond. In de directe omgeving waren geen afschermdende of reflecterende voorwerpen aanwezig die de metingen hebben beïnvloed. Tijdens de metingen werd de powerpack gevoed door een circa 25 meter verderop staande generator. De generator heeft geen invloed gehad op de gemeten geluidsniveaus.

Een grafische voorstelling van de meetopstelling en de gehanteerde meetpunten, voor de ISO 3744 meting, is weergegeven in bijlage 2. De meetopstelling en de gehanteerde meetpunten voor de metingen conform de Handleiding zijn weergegeven in bijlage 4 blad 3.

## WEERSOMSTANDIGHEDEN TIJDENS DE METINGEN

De weersomstandigheden tijdens de geluidsmetingen hebben geen negatieve invloed hebben gehad op de gemeten geluidsniveaus.

## BEDRIJFSCONDITIE POWERPACK TIJDENS GELUIDSMETINGEN

Tijdens de geluidsmetingen was het powerpack normaal in bedrijf. De condities waren:

- Power : 2x 200 kW
- Speed: 1485 rpm
- Pressure CB 1/2 : 1.500 psi
- Pressure priority: 1.800 psi
- Pressure rotary: 2.000 psi
- Pressure jack: 50 kW

## STOORINVLOEDEN TIJDENS DE GELUIDSMETINGEN

Tijdens de geluidsmetingen aan het powerpack is geen hinder ondervonden van stoorgeluid.

## GEBRUIKTE APPARATUUR

De apparatuur die gebruikt is voor de metingen en voor de uitwerking van de meetgegevens is vermeld in bijlage 3. Tijdens de metingen was de microfoon steeds voorzien van een windbol. Voor en na de metingen is het meet-systeem gecontroleerd met behulp van een referentiebron. Er zijn geen onregelmatigheden geconstateerd.

## RESULTATEN GELUIDSMETINGEN

### Geluidsvermogen powerpack bepaald conform NEN/ISO 3744

Zoals in de inleiding reeds vermeld is het geluidsvermogen van de machine bepaald conform NEN/ISO 3744:2010. De gehanteerde meetpunten zijn weergegeven in bijlage 2. De meetresultaten en de berekening van het geluidsvermogen is weergegeven in bijlage 4 blad 1 en 2. In onderstaande tabel wordt het geluidsvermogen, bij de gemeten condities, weergegeven.

**Tabel 1: Geluidsvermogen powerpack conform ISO 3744 (Lw in dB(A), t.o.v. 1 pW)**

Bron	Octaafbandmiddenfrequenties (Hz)								Totaal dB(A)	
	31,5	63	125	250	500	1k	2k	4k		8k
Powerpack PP-32	56,8	69,8	80,5	87,6	87,2	96,8	91,6	82,4	69,0	98,8

De meetonzekerheid is conform de NEN/ISO 3744:2010 berekend op 3 dB (zie bijlage 4 blad 2). Het berekende geluidsvermogen is aldus 99 dB(A) +/- 3 dB. In dit geval is het 95% zeker dat het geluidsvermogen van het powerpack, onder de gemeten condities, niet meer dan 102 dB(A) bedraagt.

### Geluidsvermogen powerpack bepaald conform de Handleiding

Ter informatie is het geluidsvermogen van het powerpack eveneens bepaald conform de in Nederland gehanteerde norm (Handleiding). De meetopstelling en de gehanteerde meetpunten zijn weergegeven in bijlage 4 blad 3. Op dit blad is tevens de richtingsafhankelijke geluidsemissie grafisch weergegeven. De meetresultaten en de berekening van het geluidsvermogen is weergegeven in bijlage 4 blad 4. In onderstaande tabel wordt het geluidsvermogen, bij de gemeten condities, weergegeven.

**Tabel 2: Geluidsvermogen powerpack conform Handleiding (Lw in dB(A), t.o.v. 1 pW)**

Bron	Octaafbandmiddenfrequenties (Hz)								Totaal dB(A)	
	31,5	63	125	250	500	1k	2k	4k		8k
Powerpack PP-32	63,5	76,3	82,9	89,0	89,9	97,9	91,2	84,5	75,0	99,9

Het door het powerpack geproduceerde geluid is breedbandig ruisvormig en heeft geen duidelijk tonaal, impuls of laagfrequent karakter.

## BIJLAGEN

- 1 Foto's powerpack PP-32
- 2 Grafisch voorstelling meetopstelling en meetpunten conform ISO 3744
- 3 Gebruikte apparatuur
- 4 Meetresultaten en berekende geluidsvermogens

Side A



Side D & A



Side C



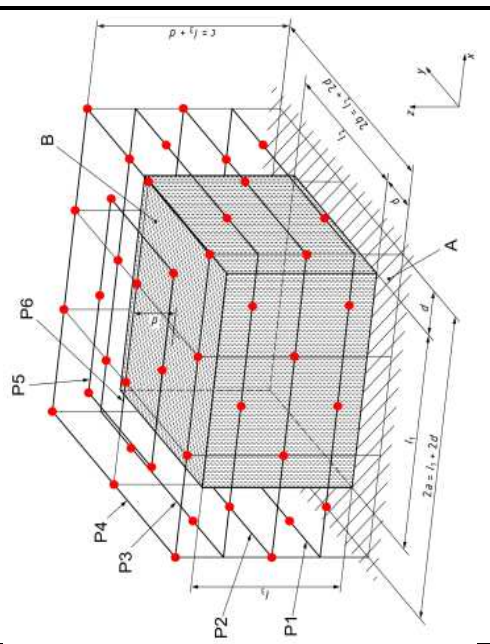
Side B



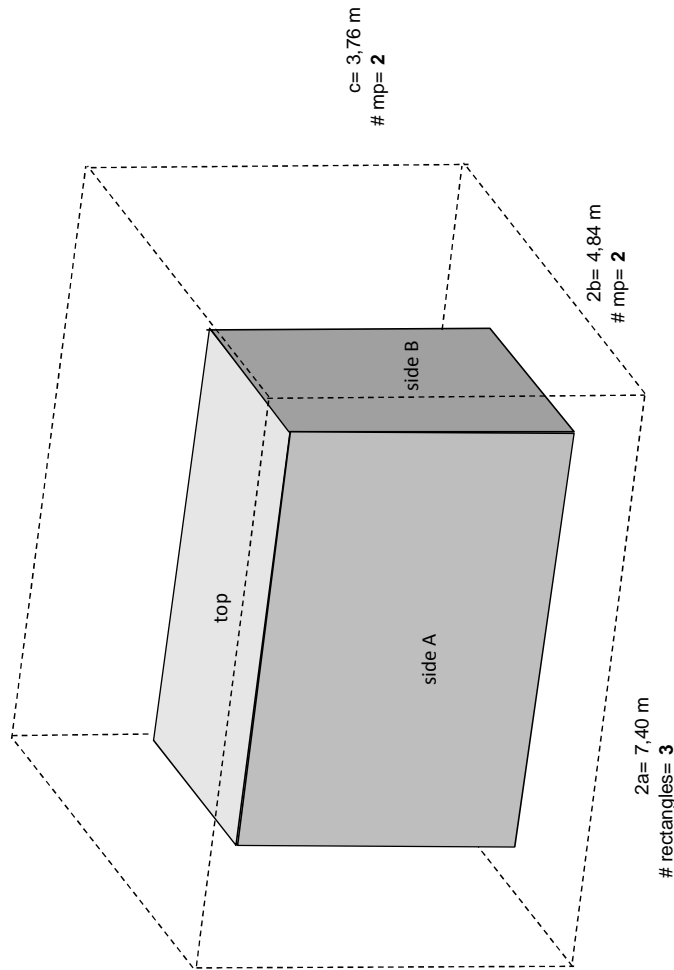
**C.11 - measurement surface with microphone positions and paths for a large machine**  
(with dimensions  $4d < l_1 \leq 7d$ ,  $d < l_2 \leq 4d$ ,  $2d \leq l_3 \leq 5d$ )

**A.4. Beispiel für Quader-Meißfläche (bei einer reflektierende Ebene),**  
Meßpunkte und Meßpfade bei großen Maschinen  
( $4d < l_1 \leq 7d$ ,  $d < l_2 < 4d$ ,  $2d < l_3 \leq 5d$ )

	4,8	$\leq 5 \leq 8,4$	WAAR	WAAR
$d < l_2 \leq 4d$	1,2	$< 2,44 \leq 4,8$	WAAR	WAAR
$2d \leq l_3 \leq 5d$	2,4	$\leq 2,56 \leq 6,0$	WAAR	WAAR



Length	7,40 m	4,84 m	Height	3,76 m
main	2,47 m	2,42 m	L1	0,94 m
sub	1,23 m	1,21 m	L2	1,88 m
			L3	2,82 m
			L4/5/6	3,76 m



Source	5,00 m	Width	2,44 m	Height	2,56 m	d	1,20 m
Ref. box	7,40 m	4,84 m	3,76 m				
side:	A & C	B & D	top				

Measuring surface ( $S = 4(ab + bc + ca)$ )			
a	b	c	S
3,70 m	2,42 m	3,76 m	127,9

<b>Apparaat</b>	<b>Merk</b>	<b>Type</b>
Geluidsniveau-analysator	Brüel & Kjær	2250
½" microfoon	Brüel & Kjær	4189
afscherming tegen windinvloed	Brüel & Kjær	UA-1650
Akoestische referentiebron	Brüel & Kjær	4231

ISO 3744 Determination of sound power levels of sources using sound pressure  
Parallelepiped measurement surface

Project : Bepalen geluidsvermogen Powerpack van Balance Point Control  
Date of measurement: 17 september 2019  
Measurement object: Electrical Powerpack PP-32  
Operation condition: Power: 2x 200 kW; Speed: 1485 rpm; Pressure CB 1/2: 1.500 psi;  
Pressure priority: 1.800 psi; Pressure rotary: 2.000 psi; Pressure jack:  
50 bar

Measured octave band centre frequency [dB(A) reference 20 µPa]

	Octave band centre frequency (Hz)									Total
	31,5	63	125	250	500	1k	2k	4k	8k	
mp 1; PP-32; P1 (side A)	38,4	51,1	61,9	73,8	72,2	82,7	81,0	71,1	56,9	85,7
mp 2; PP-32; P1 (side A)	37,5	50,1	61,9	70,4	71,3	81,3	78,9	71,9	55,5	84,1
mp 3; PP-32; P1 (side A)	44,1	54,8	63,5	72,5	68,2	81,3	79,0	67,3	51,1	83,9
mp 4; PP-32; P1 (side B)	42,6	55,1	65,6	72,3	70,6	83,1	72,8	66,9	50,0	84,2
mp 5; PP-32; P1 (side B)	42,3	55,6	66,8	79,0	72,0	84,0	73,6	66,3	50,0	85,8
mp 6; PP-32; P1 (side C)	45,6	54,8	61,9	69,8	67,6	83,4	79,4	69,5	52,2	85,2
mp 7; PP-32; P1 (side C)	44,2	52,2	60,8	68,4	68,5	85,5	83,3	71,2	56,0	87,8
mp 8; PP-32; P1 (side C)	42,1	49,2	59,6	67,9	70,4	84,1	82,0	71,2	57,0	86,5
mp 9; PP-32; P1 (side D)	42,2	51,6	65,2	79,6	75,3	87,6	79,5	70,0	57,0	89,1
mp 10; PP-32; P1 (side D)	39,8	52,2	60,9	73,9	79,4	83,8	78,1	69,9	56,3	86,3
mp 11; PP-32; P2 (side A/D)	43,8	51,2	61,7	68,4	72,8	77,8	72,2	64,0	51,2	80,3
mp 12; PP-32; P2 (side A)	44,6	53,5	61,0	68,1	70,8	78,0	72,7	64,9	53,1	80,2
mp 13; PP-32; P2 (side A)	37,0	50,3	63,1	67,8	67,8	79,2	73,6	65,4	49,5	80,9
mp 14; PP-32; P2 (side A/B)	38,3	49,8	63,5	68,0	69,3	78,3	69,4	61,4	46,6	79,8
mp 15; PP-32; P2 (side B)	38,1	53,2	64,3	67,5	68,3	76,7	69,6	59,8	46,7	78,6
mp 16; PP-32; P2 (side C/B)	41,0	51,2	62,7	69,1	67,6	81,2	70,0	61,5	47,4	82,0
mp 17; PP-32; P2 (side C)	44,0	51,8	61,7	66,5	67,8	78,8	76,1	64,5	51,9	81,2
mp 18; PP-32; P2 (side C)	37,4	51,9	59,7	67,4	69,7	78,5	75,2	63,7	57,8	80,9
mp 19; PP-32; P2 (side C/D)	38,3	49,5	61,9	71,3	69,0	79,3	72,4	63,8	52,5	81,1
mp 20; PP-32; P2 (side D)	40,3	55,5	66,1	75,9	73,3	79,0	75,6	66,4	55,5	82,7
mp 21; PP-32; P3 (side A)	35,8	50,3	61,5	64,6	67,4	74,8	72,3	62,5	47,9	77,7
mp 22; PP-32; P3 (side A)	38,4	51,1	60,7	68,8	67,7	74,1	72,2	63,1	50,9	77,7
mp 23; PP-32; P3 (side A)	35,5	48,5	64,2	64,6	64,4	77,6	69,9	61,5	48,0	78,8
mp 24; PP-32; P3 (side B)	36,3	51,8	62,5	67,4	66,5	75,6	67,6	57,6	43,4	77,4
mp 25; PP-32; P3 (side B)	36,2	50,8	63,8	68,3	67,1	76,4	67,4	58,2	43,9	78,1
mp 26; PP-32; P3 (side C)	38,6	50,3	61,6	67,3	65,8	77,3	71,7	63,1	48,3	79,1
mp 27; PP-32; P3 (side C)	42,0	50,8	59,5	71,1	68,0	77,7	73,7	65,4	51,6	80,2
mp 28; PP-32; P3 (side C)	39,2	49,2	59,8	65,3	67,1	77,7	73,5	62,4	55,3	79,7
mp 29; PP-32; P3 (side D)	35,1	50,7	63,5	73,2	68,0	77,4	70,5	61,5	49,6	79,8
mp 30; PP-32; P3 (side D)	34,6	53,1	61,1	68,9	69,4	76,0	70,0	61,8	49,6	78,4
mp 31; PP-32; P4 (side A/D)	34,1	46,6	60,1	63,6	65,3	71,9	66,4	60,6	47,2	74,4
mp 32; PP-32; P4 (side A)	36,9	49,8	59,0	65,1	64,7	72,5	69,9	62,1	44,9	75,6
mp 33; PP-32; P4 (side A)	35,6	46,9	60,9	66,2	67,1	74,4	67,2	60,5	49,3	76,5
mp 34; PP-32; P4 (side A/B)	34,5	47,9	62,0	65,1	66,9	72,7	65,4	58,3	45,1	75,1
mp 35; PP-32; P4 (side B)	33,3	52,5	63,2	68,2	67,3	73,1	67,3	60,8	46,1	76,1
mp 36; PP-32; P4 (side C/B)	35,1	50,3	60,6	64,2	65,4	74,6	65,4	58,3	46,1	76,1
mp 37; PP-32; P4 (side C)	38,2	50,7	61,0	67,0	66,0	78,7	67,1	62,1	46,3	79,6
mp 38; PP-32; P4 (side C)	37,4	49,1	60,0	63,5	65,8	72,3	68,7	62,7	45,6	75,2
mp 39; PP-32; P4 (side C/D)	36,0	47,8	59,8	61,4	65,9	70,5	67,6	61,0	47,9	73,9
mp 40; PP-32; P4 (side D)	35,4	50,1	60,0	65,1	68,8	72,5	66,7	61,2	49,0	75,5
mp 41; PP-32; P5 (top A/D)	36,1	49,0	58,4	63,6	67,3	70,8	64,3	59,2	44,1	73,8
mp 42; PP-32; P5 (top A)	37,4	49,4	60,7	65,0	65,8	71,5	65,6	60,1	46,0	74,3

## BIJLAGE 4 - MEETRESULTATEN EN BEREKENDE GELUIDSVERMOGENS

mp 43; PP-32; P5 (top A/B)	36,1	53,1	64,9	68,3	69,6	77,2	68,1	61,4	49,0	79,0
mp 44; PP-32; P5 (top B/C)	37,8	53,6	64,1	67,3	68,2	74,0	68,2	61,4	49,1	76,8
mp 45; PP-32; P5 (top C)	35,3	51,7	61,4	66,0	67,6	71,6	66,4	59,6	47,0	74,9
mp 46; PP-32; P5 (top C/D)	39,2	51,4	58,8	65,1	63,8	69,6	63,5	59,2	47,4	72,7
mp 47; PP-32; P6 (top D)	37,3	50,9	60,1	65,4	65,9	75,4	64,2	59,2	49,6	76,7
mp 48; PP-32; P6 (top B)	35,3	54,3	65,4	66,9	69,3	78,0	68,2	62,3	50,4	79,5
Averaged sound pressure level (L'p)	39,3	52,2	63,0	70,1	69,7	79,3	74,1	64,9	51,5	81,3
Highest sound pressure level										89,1
Lowest sound pressure level										72,7
$\Delta L$										16,4

$\Delta L$  < number of measurement positions      OK

### Background noise

	Octave band centre frequency (Hz)									Total
	31,5	63	125	250	500	1k	2k	4k	8k	
Background					50,0					50,0
Background					50,0					50,0
Averaged sound pressure level	-	-	-	-	50,0	-	-	-	-	50,0

Difference measured levels and background noise :    31,3  $\rightarrow k_1 = 0$

Measured outdoors (Y/N):    Y     $\rightarrow k_2 = 0$

Measurement surface (S):    56,0 m<sup>2</sup>

### Calculating Sound power level [dB(A) reference 1 pW]

	Octave band centre frequency (Hz)									Total
	31,5	63	125	250	500	1k	2k	4k	8k	
Averaged sound pressure level (L'p)	39,3	52,2	63,0	70,1	69,7	79,3	74,1	64,9	51,5	81,3
+ Surface correction $10\log(S/S_0)$	17,5	17,5	17,5	17,5	17,5	17,5	17,5	17,5	17,5	17,5
- Correction background noise $K_1$	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
- Corrections test environment $K_2$	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
Sound power level ( $L_w$ )	56,8	69,7	80,5	87,6	87,2	96,8	91,6	82,4	69,0	98,8

### Measurement uncertainty

Accuracy grade:	2
Standard deviation $\sigma_{omc}$ :	0,5    dB
Coverage factor 95%:	2,0
Standard deviation $\sigma_{ro}$ :	1,5    dB
Measurement uncertainty 95% (U):	3    dB

**Total Sound Power Level ( $L_w$ ) =                    99 +/- 3    dB(A)**

## Guide for Measuring and Calculating Industrial Noise, 1999

### Method II.2 - Source strength, concentrated noise source

Project : Bepalen geluidsvermogen Powerpack van Balance Point Control  
 Measurement date : 17 September 2019  
 Measurement object : Electrical Powerpack PP-32  
 Condition : Power: 2x 200 kW; Speed: 1485 rpm; Pressure CB 1/2: 1.500 psi;  
 Pressure priority: 1.800 psi; Pressure rotary: 2.000 psi; Pressure jack:  
 50 bar

#### Measured equivalent sound pressure levels [dB(A) re 20 µPa]

	Full octave band centre frequencies [Hz]									Total
	31,5	63	125	250	500	1k	2k	4k	8k	
mp 1; PP-32 @ 10m (side A)	34,7	48,0	51,6	57,3	60,0	64,4	61,7	52,4	40,9	67,9
mp 2; PP-32 @ 10m (side A/B)	35,0	47,9	54,5	60,2	58,8	71,9	62,1	54,8	42,7	72,9
mp 3; PP-32 @ 10m (side B)	34,9	49,6	54,2	59,2	59,0	65,0	56,7	49,4	36,3	67,5
mp 4; PP-32 @ 10m (side C/B)	36,2	48,8	55,1	61,2	60,5	68,7	62,6	56,7	47,6	71,0
mp 5; PP-32 @ 10m (side C)	34,4	45,3	53,7	56,9	57,3	69,2	61,0	54,0	45,3	70,5
mp 6; PP-32 @ 10m (side C/D)	32,7	45,4	52,0	61,1	62,4	69,0	64,3	57,8	49,7	71,6
mp 7; PP-32 @ 10m (side D)	31,5	43,1	53,3	59,2	63,3	69,0	62,2	55,9	46,1	71,2
mp 8; PP-32 @ 10m (side A/D)	33,1	44,8	53,7	61,4	61,2	68,5	62,0	56,3	46,3	70,8
Average sound pressure level; $L_{Aeq,T}$	34,3	47,1	53,7	59,8	60,7	68,7	62,0	55,3	45,8	70,7

Largest source dimension (d) : 8,0 m  
 Source height ( $h_b$ ) : 2,0 m  
 Microphone height ( $h_m$ ) : 4,0 m  
 Projection measuring distance ( $R_{proj}$ ) : 10,0 m  
 Measurements on : hemi bol  
 Measuring distance (R) : 10,2 m  
 Must comply to meteo window : No

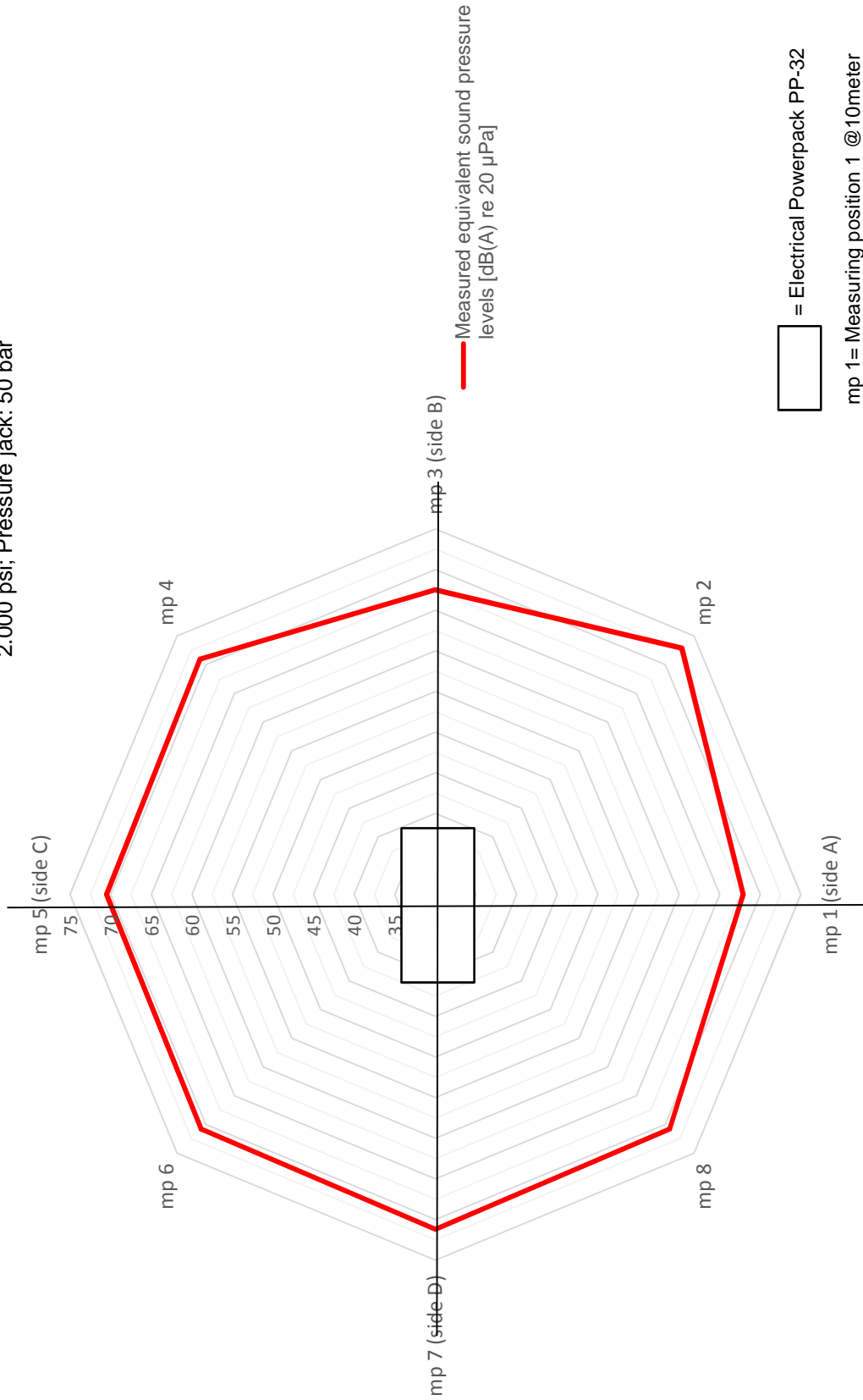
#### Immission-relevant source strength [dB(A) re 1 pW]

	Full octave band centre frequencies [Hz]									Total
	31,5	63	125	250	500	1k	2k	4k	8k	
Average sound pressure level; $L_{Aeq,T}$	34,3	47,1	53,7	59,8	60,7	68,7	62,0	55,3	45,8	70,7
+ Geometrical propagation; $D_{geo}$	31,2	31,2	31,2	31,2	31,2	31,2	31,2	31,2	31,2	31,2
+ Ground effect; $D_{bodem}$	-2,0	-2,0	-2,0	-2,0	-2,0	-2,0	-2,0	-2,0	-2,0	-2,0
+ Air absorption; $a_{lu,R}$	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
<b>Sound Power Level (Average all directions); <math>L_w</math></b>	<b>63,5</b>	<b>76,3</b>	<b>82,9</b>	<b>89,0</b>	<b>89,9</b>	<b>97,9</b>	<b>91,2</b>	<b>84,5</b>	<b>75,0</b>	<b>99,9</b>

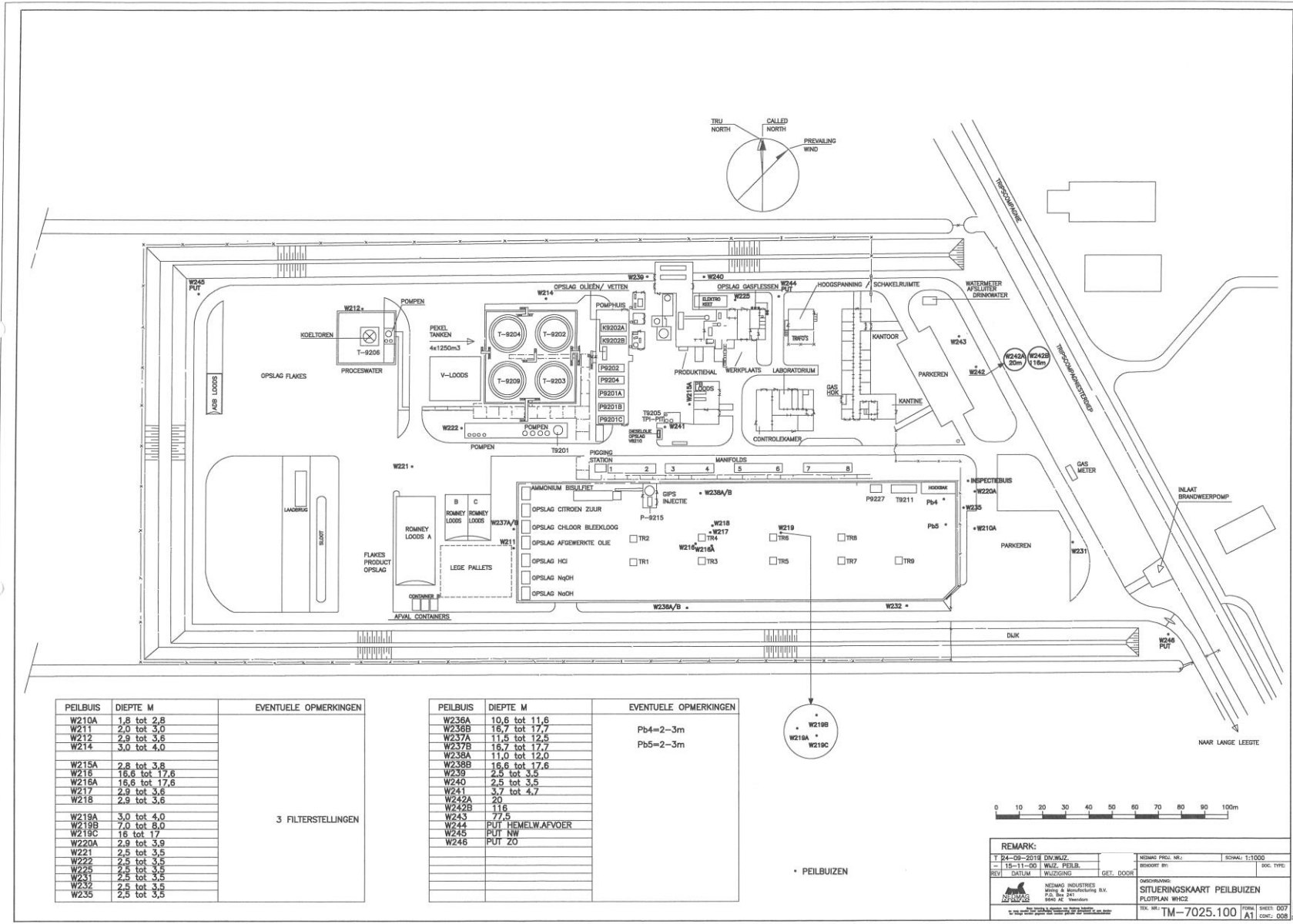
### Electrical Powerpack PP-32

Power: 2x 200 kW; Speed: 1485 rpm; Pressure CB 1/2:  
 1.500 psi; Pressure priority: 1.800 psi; Pressure rotary:  
 2.000 psi; Pressure jack: 50 bar

Top View



Bijlage 3: posities peilbuizen

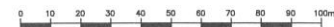


PEILBUIS	DIEPTE M	EVENTUELE OPMERKINGEN
W210A	1,8 tot 2,8	
W211	2,0 tot 3,0	
W212	2,9 tot 3,6	
W214	3,0 tot 4,0	
W215A	2,8 tot 3,8	
W216	16,6 tot 17,6	
W216A	15,6 tot 17,6	
W217	2,9 tot 3,6	
W218	2,9 tot 3,6	
W219A	3,0 tot 4,0	
W219B	7,0 tot 8,0	
W219C	16 tot 17	
W220A	2,9 tot 3,9	
W221	2,5 tot 3,5	
W222	2,5 tot 3,5	
W225	2,5 tot 3,5	
W241	2,5 tot 3,5	
W232	2,5 tot 3,5	
W235	2,5 tot 3,5	

3 FILTERSTELLINGEN

PEILBUIS	DIEPTE M	EVENTUELE OPMERKINGEN
W236A	10,6 tot 11,6	
W236B	16,7 tot 17,7	Pb4=2-3m
W237A	11,5 tot 12,5	
W237B	16,7 tot 17,7	Pb5=2-3m
W238A	11,0 tot 12,0	
W238B	16,6 tot 17,6	
W239	2,5 tot 3,5	
W240	2,5 tot 3,5	
W241	3,7 tot 4,7	
W242A	20	
W242B	11,6	
W243	77,5	
W244	PUT HEMELW.AFVOER	
W245	PUT NW	
W246	PUT ZO	

\* PEILBUIZEN



<b>REMARKS:</b>			
T 24-09-2016 OMWAZ.	NEDMAG PEIL. NR.	SCHAAL: 1:1000	
15-11-00 WAZ. PEILB.	BEHOORT BIJ:	OFG. TYP.	
REVI DATUM	WUZZIGING	GET. DOOR	
OBSCHRIJVING: SITUERINGSKAART PEILBUIZEN			
PLOTPLAN WHC2			
TEK. NR.	TM-7025.100	FORM	SHEET: 007
			CONTR. DOOR