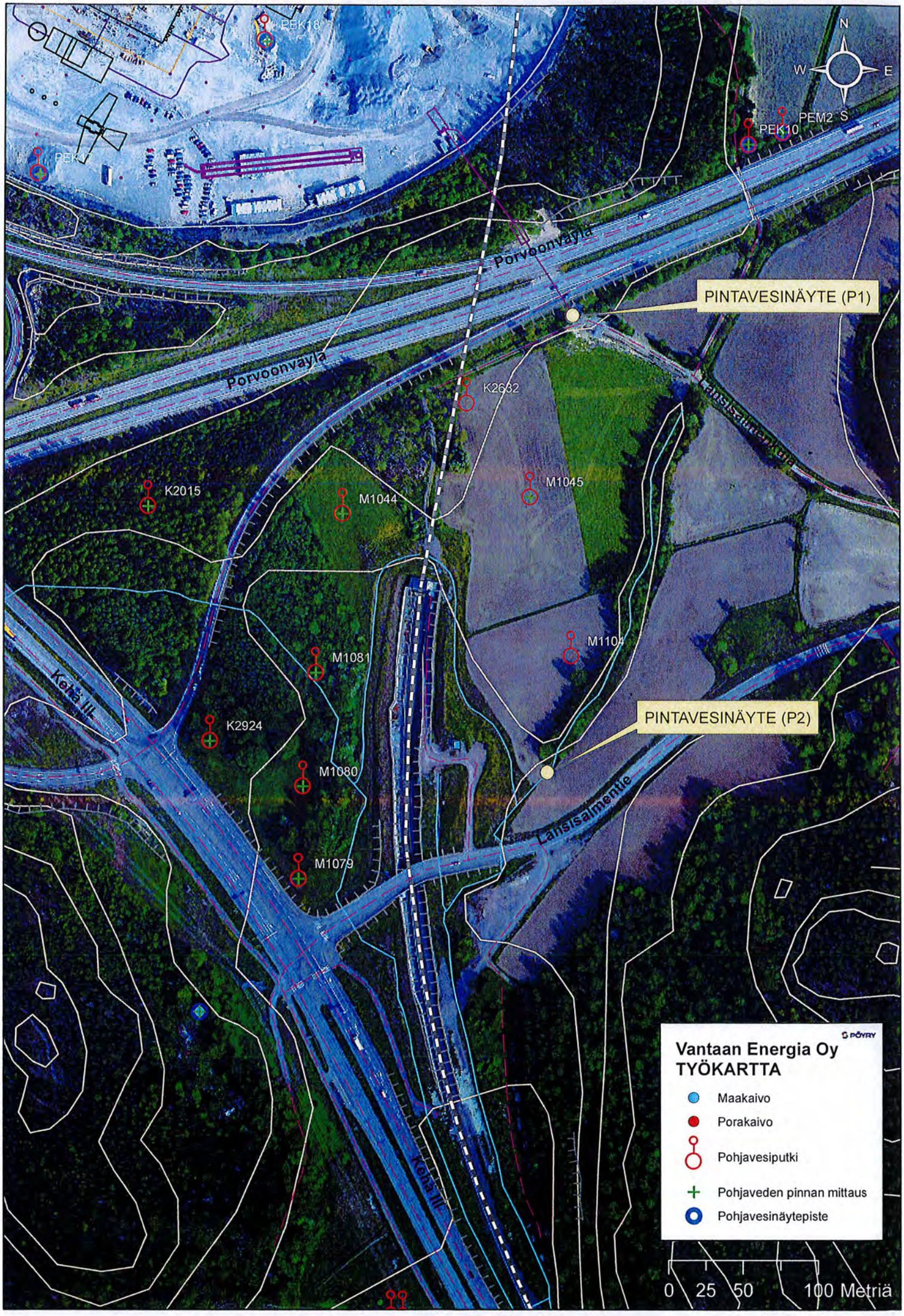
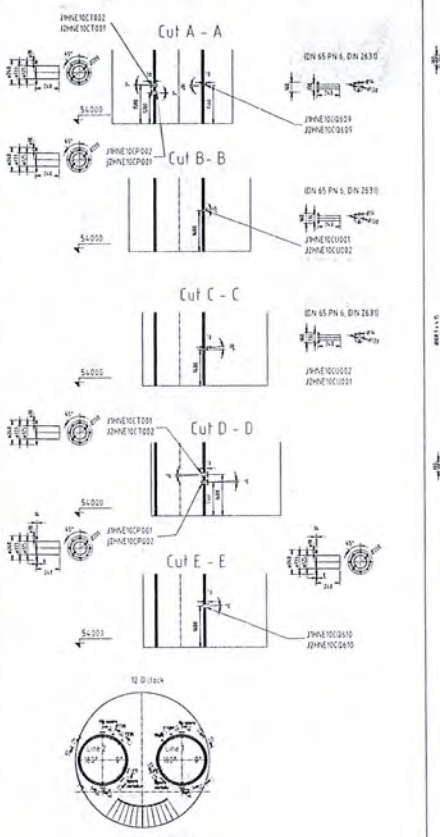

PEK18
PEK1
PEK10
PEM2
N
W
E
S
Porvoonväylä
Porvoonväylä
PINTAVESINÄYTE (P1)
K2632
Lansisalmentie
K2015
M1044
M1045
M1104
M1081
Kehä III
K2924
PINTAVESINÄYTE (P2)
M1080
Lansisalmentie
M1079
Kehä III
PÖYRY
Vantaan Energia Oy
TYÖKARTTA
Maakaivo
Porakaivo
Pohjavesiputki
Pohjaveden pinnan mittaus
Pohjavesinäytepiste
0 25 50 100 Metriä

**Pohjavesi ja salaojanäytteenotto**

| *Parametri* | *Mittausmenetelmä* | *Analysointistandardi* | *Yksikkö* | *Määritysraja* | *Mittausepävarmuus* |
|---|---|---|---|---|---|
| Happamuus (pH) | näyte | SFS 3021 | - | 0,2 | 5 % |
| Sameus | näyte | SFS-EN ISO 7027 | FNU | 0,2 | 20 - 30 % |
| Sähkönjohtavuus | näyte | SFS-EN 27888 | mS/m | 0,5 | 5 % |
| Kloridi | näyte | SFS-EN ISO 10304-1 | mg/l | 0,3 | 12 % |
| Sulfaatti | näyte | SFS-EN ISO 10304-1 | mg/l | 0,3 | 11 % |
| Nitraatti | näyte | SFS 3031 kum. standardi | µg/l | 25 | 25 % |
| Nitriitti | näyte | SFS 3029 | µg/l | 5 | 10 - 25 % |
| Ammonium | näyte | SFS 3032 | mgNH4/l | 0,02 | 10 - 15 % |
| $COD_{Mn}$ | näyte | SFS 3036 | mg/l | 1 | 25 % |
| $COD_{Cr}$ | näyte | ISO 15705 | mg/l | 15 | 25 % |
| Hiilivedyt (C5-C10) | näyte | ISO 11423-1 | mg/l | 0,02 | |
| Öljyhiilivedyt (C10-C40) | näyte | SFS-EN ISO 9377-2 | mg/l | 0,03 | 42 % |
| PAH (16 yhdistettä) | näyte | SFS-ISO 18287 | µg/l | 0,1 | 20-45 % |
| PCB (7 yhdistettä) | näyte | SFS-EN ISO 6468 | µg/l | 0,1 | 20 %* |
| Alkuaineiden liukoiset pitoisuudet: | | | | | |
| Elohopea Hg | näyte | SFS-EN 1483 | µg/l | 0,2 | 40 % |
| Kadmium Cd | näyte | ISO 11885, EN ISO 17294-2 | µg/l | 1 | 21 % |
| Tallium Tl | näyte | EN ISO 17294-2 | µg/l | 0,5 | 20 % |
| Arseeni As | näyte | ISO 11885, EN ISO 17294-2 | µg/l | 10 | 31 % |
| Lyijy Pb | näyte | ISO 11885, EN ISO 17294-2 | µg/l | 10 | 20 % |
| Kromi Cr | näyte | ISO 11885, EN ISO 17294-2 | µg/l | 10 | 16 % |
| Kupari Cu | näyte | ISO 11885, EN ISO 17294-2 | µg/l | 10 | 15 % |
| Nikkeli Ni | näyte | ISO 11885, EN ISO 17294-2 | µg/l | 10 | 20 % |
| Sinkki Zn | näyte | ISO 11885, EN ISO 17294-2 | µg/l | 10 | 21 % |
| Barium Ba | näyte | ISO 11885, EN ISO 17294-2 | µg/l | 10 | 21 % |
| Kobolti Co | näyte | ISO 11885, EN ISO 17294-2 | µg/l | 10 | 20 % |
| Vanadiini V | näyte | ISO 11885, EN ISO 17294-2 | µg/l | 10 | 30 % |
| Alumiini Al | näyte | ISO 11885, EN ISO 17294-2 | µg/l | 20 | 20 %* |
| Antimoni Sb | näyte | ISO 11885, EN ISO 17294-2 | µg/l | 10 | 20 %* |
| Natrium Na | näyte | ISO 11885, EN ISO 17294-2 | µg/l | 20 | 20 %* |
| Kalsium Ca | näyte | ISO 11885, EN ISO 17294-2 | µg/l | 20 | 20 %* |
| Fosfori P | näyte | ISO 11885 | µg/l | 50 | 20 %* |

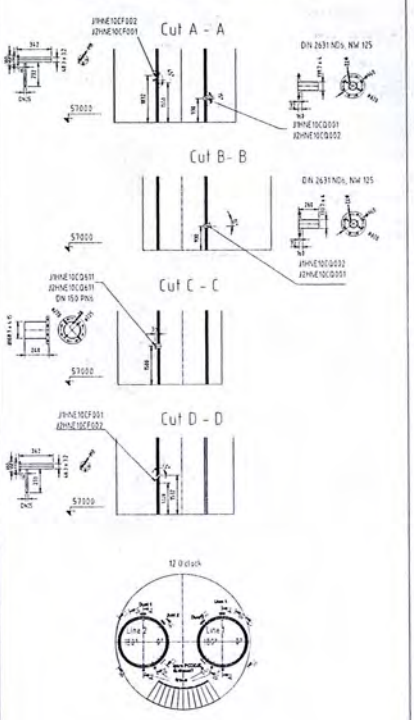
# Analyser platform A




Placement of measuring devices on line 1&2 level 54000

| Cut | Line | Port angle | Height from platform | KKS | Description |
|---|---|---|---|---|---|
| Cut A-A | Line 1/2 | 98/ 90 | 1500 | J1HNE10CS429//J2HNE10CS429 | SPARE(HG) |
| Cut B-B | Line 1/2 | 112.5/ 67.5 | 1420 | J1HNE10CU001//J2HNE10CU002 | FTIR 1/FTIR2 |
| Cut C-C | Line 1/2 | 135/ 45 | 1420 | J1HNE10CU002//J2HNE10CU001 | FTIR 2/FTIR1 |
| Cut D-D | Line 1/2 | 202.5/ 337.5 | 1305 | J1HNE10CP001//J2HNE10CP002 | PRESSURE 1/PRESSURE 2 |
| Cut D-D | Line 1/2 | 202.5/ 337.5 | 1420 | J1HNE10CT001//J2HNE10CT002 | TEMP 1/TEMP 2 |
| Cut E-E | Line 1/2 | 225/ 315 | 1420 | J1HNE10CS610//J2HNE10CS610 | SPARE [illegible] |
| Cut A-A | Line 1/2 | 270/ 270 | 1200 | J1HNE10CP003//J2HNE10CP001 | PRESSURE 3/PRESSURE 1 |
| Cut A-A | Line 1/2 | 270/ 270 | 1500 | J1HNE10CT003//J2HNE10CT001 | TEMP 3/TEMP1 |

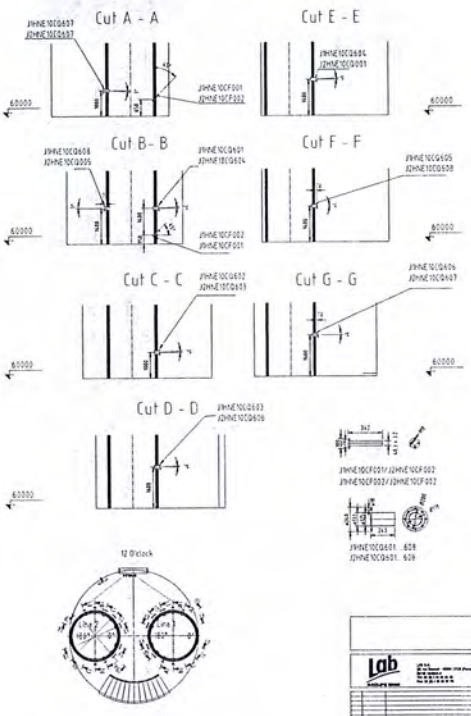
# Analyser platform B




Placement of measuring devices on line 1&2 level 57000

| Cut | Line | Port angle | Height from platform | KKS | Description |
|---|---|---|---|---|---|
| Cut A-A | Line 1/2 | 90/ 90 | 930 | J1HNE10CS331//J2HNE10CS332 | OUST 1/OUST 2 |
| Cut B-B | Line 1/2 | 135/45 | 930 | J1HNE10CS333//J2HNE10CS331 | OUST 2/OUST1 |
| Cut C-C | Line 1/2 | 225/315 | 1560 | J1HNE10CS615//J2HNE10CS611 | SPARE(PIDO-5) |
| Cut D-D | Line 1/2 | 247.5/292.5 | 1830 | J1HNE10CP001//J2HNE10CP002 | FLOW1TRANS/FLOW2TRANS |
| Cut D-D | Line 1/2 | 247.5/292.5 | 1560 | | FLOW 1 TRANS/FLOW2 DRAIN |
| Cut A-A | Line 1/2 | 270 | 1530 | J1HNE10CP002//J2HNE10CP001 | FLOW2DRANS/FLOW1TRANS |
| Cut A-A | Line 1/2 | 270 | 1038 | | FLOW2DRANS/FLOW1DRAIN |

# Analyser platform C




Placement of measuring devices on line 1&2 level 60000

| Cut | Line | Port angle | Height from platform | KKS | Description |
|---|---|---|---|---|---|
| Cut A-A | Line 1/2 | 67.5/ 112.5 | 1650 | J1HNE10CP001//J2HNE10CP002 | FLOW1RECIVER/FLOW2RECIVER |
| Cut B-B | Line 1/2 | 90/90 | 1500 | J1HNE10CP002//J2HNE10CP001 | FLOW2RECIVER/FLOW1RECIVER |
| Cut B-B | Line 1/2 | 90/90 | 1400 | J1HNE10CS601//J2HNE10CS604 | REF 5/REF4 |
| Cut C-C | Line 1/2 | 112.5/ 67.5 | 1600 | J1HNE10CU603//J2HNE10CU603 | REF 3/REF 3 |
| Cut D-D | Line 1/2 | 135 | 1600 | J1HNE10CU603//J2HNE10CU602 | REF 3/REF 2 |
| Cut E-E | Line 1/2 | 157.5/ 202.5 | 1600 | J1HNE10CU604//J2HNE10CU601 | REF 4/REF 1 |
| Cut F-F | Line 1/2 | 202.5/ 337.5 | 1400 | J1HNE10CU605//J2HNE10CU608 | REF 5/REF 8 |
| Cut G-G | Line 1/2 | 225/ 315 | 1600 | J1HNE10CU605//J2HNE10CU607 | REF 5/REF 7 |
| Cut A-A | Line 1/2 | 247.5/ 292.5 | 1600 | J1HNE10CU607//J2HNE10CU606 | REF 7/REF 6 |
| Cut B-B | Line 1/2 | 270/ 270 | 1400 | J1HNE10CU606//J2HNE10C2605 | REF 6/REF 5 |

Lab

Vantaan Energia
Jätevoimalaitos LVV

LAB Helsinki
Placement of measurement devices
Hs70 Ø/d/b= 5300/1802/1800 mm

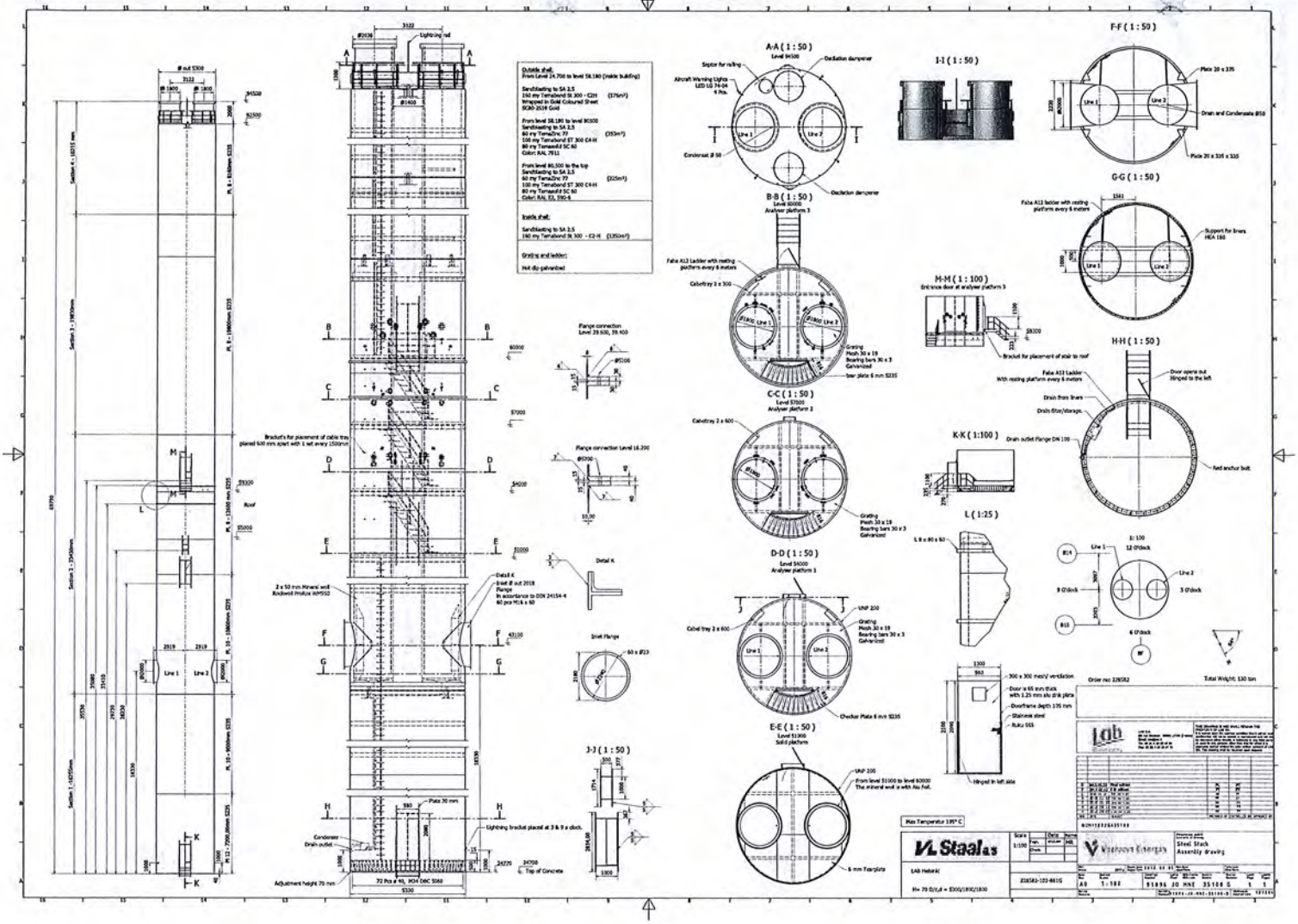
Order nr. 228582 Weight 103 tons

31896 - FIHNE - 35185 B

Staalas

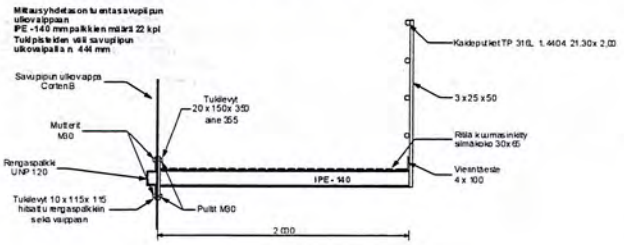
LAB Helsinki
Placement of measurement devices
Hs70 Ø/d/b= 5300/1802/1800 mm

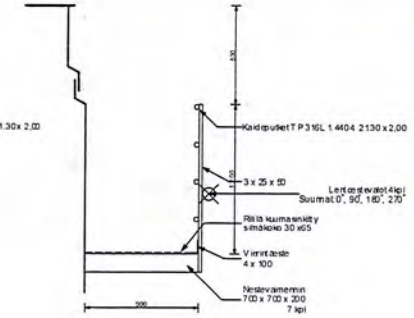
228582-368

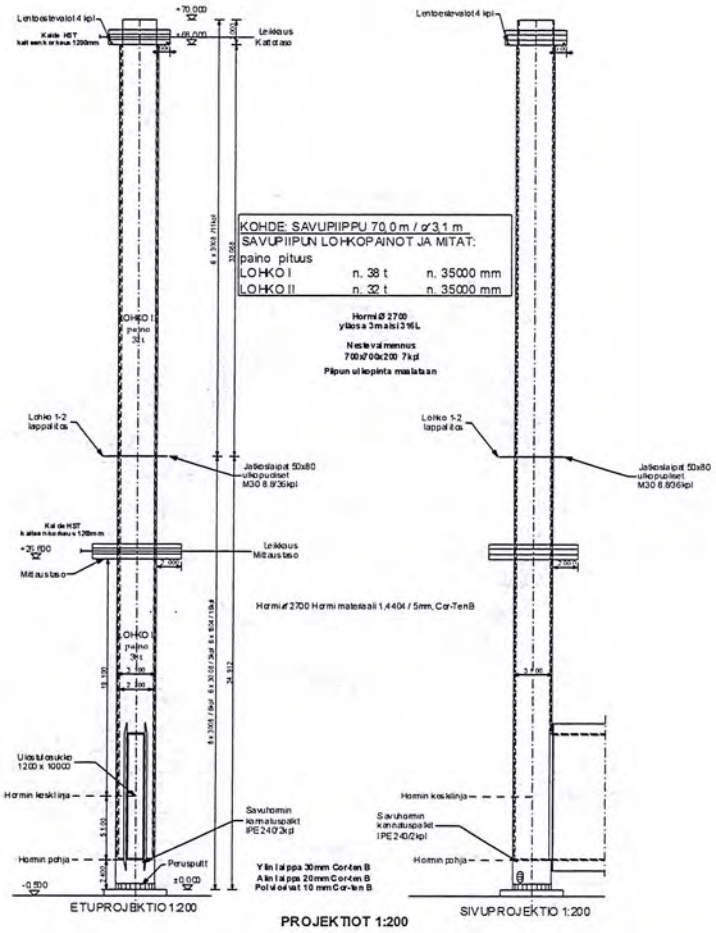


A-A ( 1 : 50 )
B-B ( 1 : 50 )
C-C ( 1 : 50 )
D-D ( 1 : 50 )
E-E ( 1 : 50 )
F-F ( 1 : 50 )
G-G ( 1 : 50 )
H-H ( 1 : 50 )
I-I ( 1 : 50 )
J-J ( 1 : 50 )
K-K ( 1:100 )
L ( 1:25 )
M-M ( 1 : 100 )
Outside shell:
From Level 24.700 to level 58.180 (inside building)
Sandblasting to SA 2.5
160 my Tamaboné St 300 - C2H (375m²)
Wrapped in Gold Coloured Sheet
SC80-2519 Gold
From level 58.180 to level 80500
Sandblasting to SA 2.5
60 my TamaZinc 77
100 my TamaBond ST 300 C4 H
80 my TamaeAid SC 60
Color: RAL 7911
From level 80.500 to the top
Sandblasting to SA 2.5
60 my TamaZinc 77
100 my TamaBond ST 300 C4 H
80 my TamaeAid SC 60
Color: RAL E3, 590-6
(325m²)
Inside shell:
Sandblasting to SA 2.5
160 my TamaBond St 300 - C2-H (1350m²)
Grating and ladder:
Hot dip galvanized
Max Temperature 195° C
VL Staal
LAB Helsinki
Steel Stack
Assembly drawing

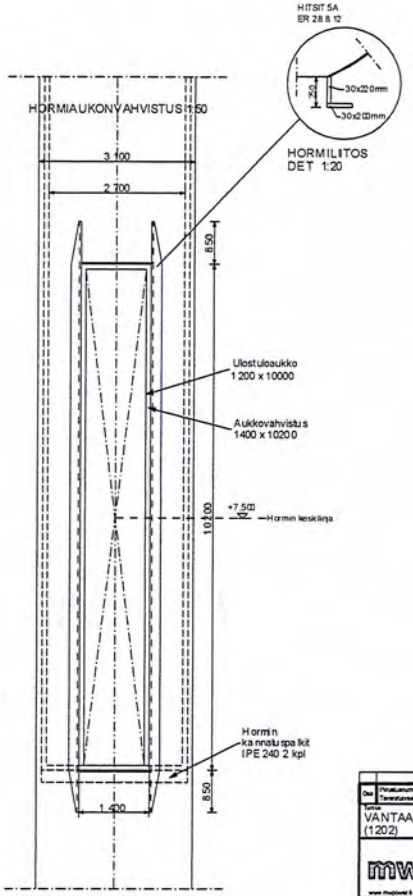
## KATTOTASON JA MITTAUSTASON KAITEET JA TASON TUENTA ULKOVAIPPAAN 1:20




PROJEKTIOT 1:200







HORMILITOS DET 1:20

VESMETA Oy

| | | | | | |
|---|---|---|---|---|---|
| Osa / Part | Piirustusnumero / Drawing number | Oman tai kokoonpanoryhmän nimike / Name of own or assembly group | Standardi tai kuitenk. / Standard or other | Muoto, malli / Type, model | Määrä / Quantity |
| Tehtaan / Factory: VANTAAN ENERGIA OY (1202) | | Pvm / Date: 25.9.2012 | Suunn. / Drawn | Tark. / Chkd | Hyv. / Appd |
| mw power | | SAVUPIIPPU 70 M Savupiippu Ø 3,1m / 70m / 2,7m / 5mm / 100mm PÄÄPIIPPU J3HNE02 | | | Piirustus / Drawing 12029171 Rev. 0 |

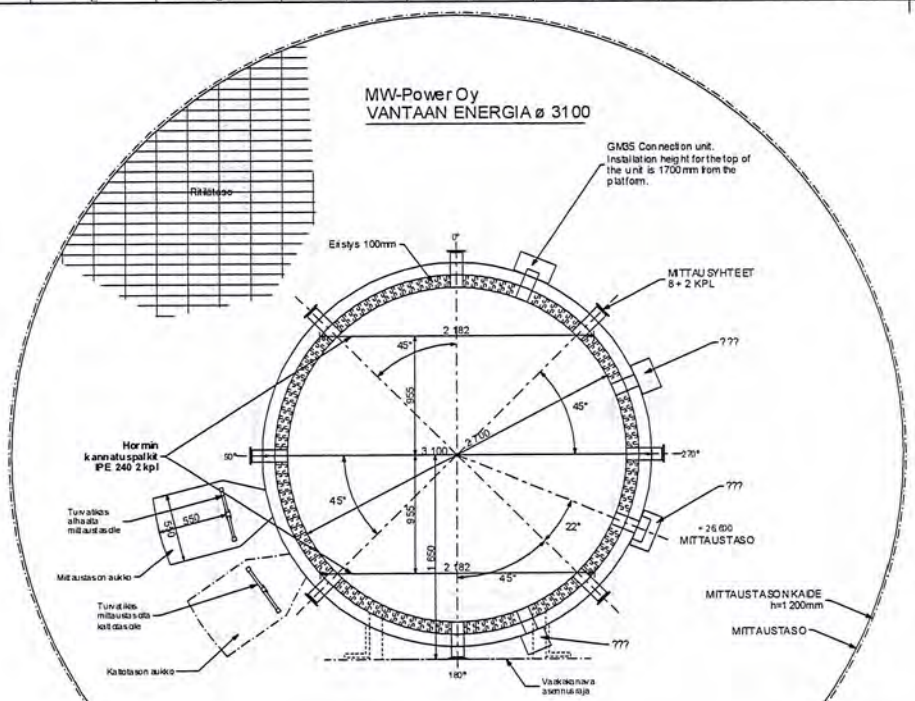
**Vantaan Energia**
Jätevoimalaitos (JV1)

Piirustuksen sisältö / Contents of Drawing
MWPower Oy
Savupiippu Vantaan Energia
Savupiippu Ø 3,1m / 70m / 2,7m / 5mm / 100mm

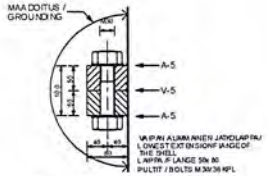
| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Piirt. / Drawn | PT 25.9.2012 | Suunn./pvm / Dsgnd/Date | PT 25.9.2012 | Hyv./pvm / Appd/Date | | | | | | | |
| Koko / Size A1 | Suhde / Scale 1:1/A1 | Toimittaja / Supplier | | Laitos / Plant | KKS-Tunnus / KKS-code | Numero / Number 86387-J3-HNE-00003 | | Muutos / Revision 0 | Lehti / Page 1 | Lehtiä / Pages 2 | |

Korvaa / Replaces | Korvattu / Replaced | Hyväksytty / Delivered/Date

MW-Power Oy
VANTAAN ENERGIA ø 3100

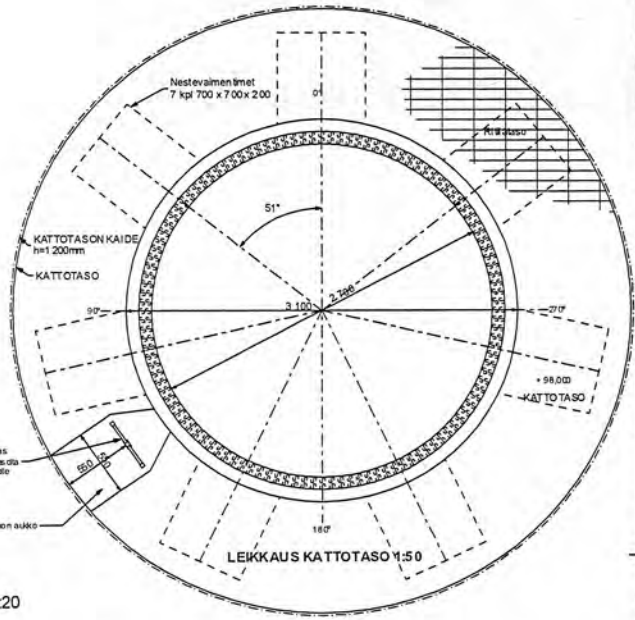



LEIKKAUS MITTAUSTASO 1:50



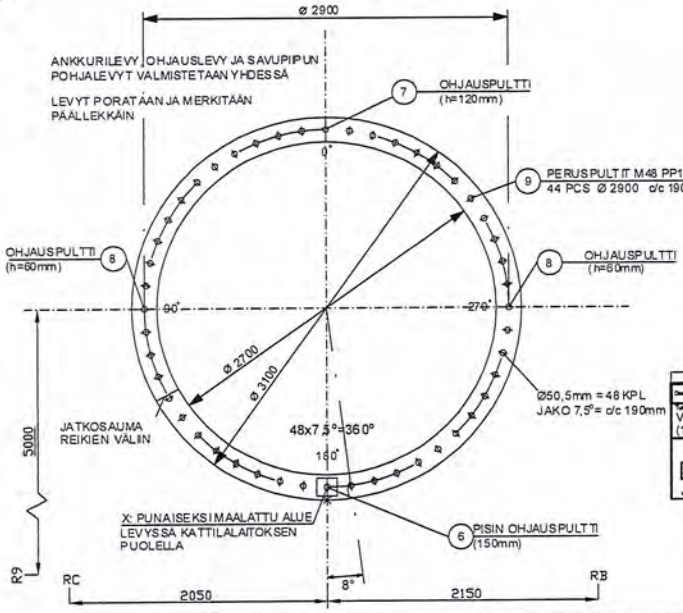

LAIPPA LOHKOLLA 1-2 1:5
FLANGE OF THE BLOCKS 1-2

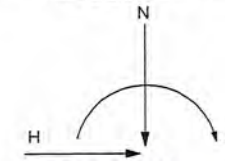
MW-Power Oy
VANTAAN ENERGIA ø 3100




LEIKKAUS KATTOTASO 1:50

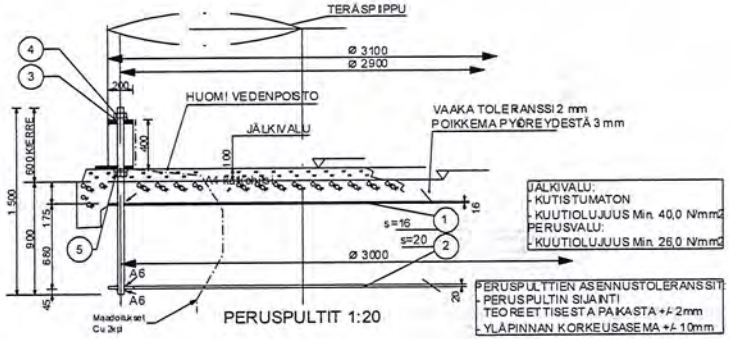
PERUSPULTIT 1:20




PERUSKUORMAT:
FOUNDATION LOADINGS:

| | | |
|---|---|---|
| MOMENTTI | M= | 7568,6 kNm |
| NORMAALIVOIMA | N= | 679,6 kN |
| LEIKKAUSVOIMA | H= | 184,0 kN |




JÄLKIVALU:
- KUTISTUMATON
- KUUTIOLUJUUS Min. 40,0 N/mm2

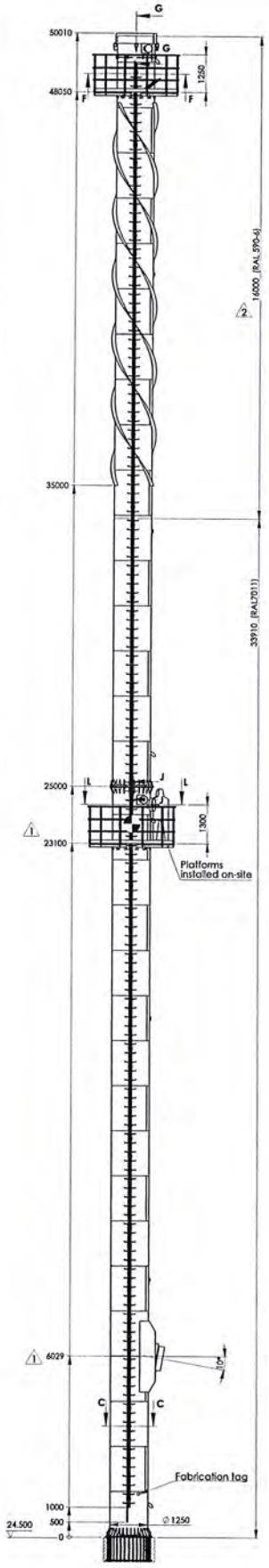
PERUSVALU:
- KUUTIOLUJUUS Min. 26,0 N/mm2

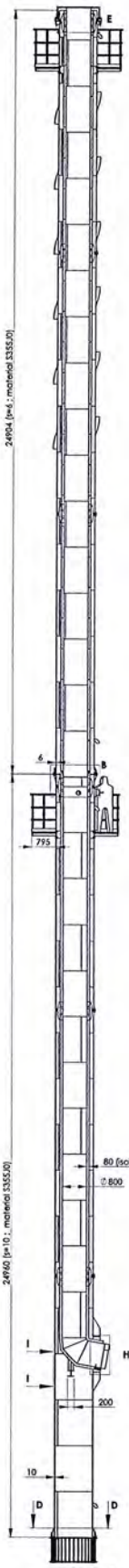
PERUSPULTTIEN ASENNUSTOLERANSSIT:
- PERUSPULTIN SIJAINTI TEOREETTISESTA PAIKASTA +/- 2mm
- YLÄPINNAN KORKEUSASEMA +/- 10mm

VESMETA

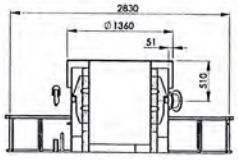
| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Dnro | Tarkastuksen/ Tarkastuksessa | Osan tai kokoonpanon/yksikön | Sijainti/ tai kohteen | Muutos, muist./ Lähtomerkit | | Kpl | |
| Tilaaja: VANTAAN ENERGIA OY (1202) | | | Pvm: 25.9.2012 | | | Mittakaava: A1 | |
| | | | Suunn. | Piir. | Tark. | Hyv. | Luku: |
| mw power | | | SAVUPIIPPU 70 M Savupiippu Ø 3,1m / 70m / 2,7m / 5mm / 100mm PAAPIIPPU J3HNE02 | | | | Työnro: 12029171 |
| Vantaan Energia Jätevoimalaitos (JVT) | | | MWPower Oy Savupiippu Vantaan Energia Savupiippu Ø 3,1m / 70m / 2,7m / 5mm / 100mm | | | | |
| Piirt: PT 25.9.2012 | Suunn./pvm: PT 25.9.2012 | Hyv./pvm: | Tark./pvm: | | | | |
| Koko: A1 | Suhdeluku: 1:1/A1 | Tarkistaja: | Kirj.-tunnus: | Numero: 86387-J3-HNE-00003 | Muutos: 0 | Sivu: 2 | Sivuja: 2 |
| Hyväksyjä: | | | | | | | |

| REVISIONS | | | |
|---|---|---|---|
| REV. | DESCRIPTION | DATE | DESIGNER |
| 1 | Pole tilted height changed from 8000 to 8229 mm, Middle platform and top platform height changed and flue gas measurement connections added. Ladder orientation changed. | 12.04.2013 | R. Kauler |
| 2 | Cleaning hatch diameter changed, solid RAL added, grounding connection changed | 18.04.2013 | R. Kauler |

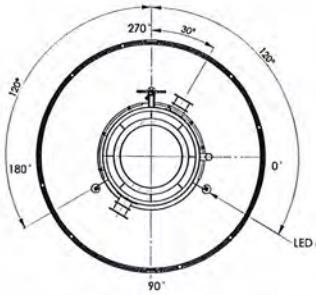



SECTION A-A

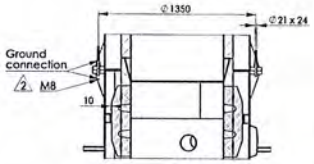



SECTION G-G
SCALE 1 : 30

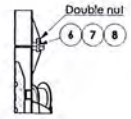



SECTION F-F
SCALE 1 : 30

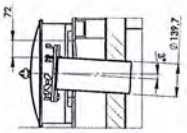
DETAIL E
SCALE 1 : 20



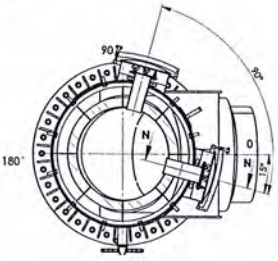

DETAIL B
SCALE 1 : 20



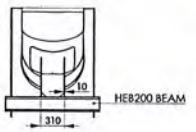

SECTION J-J
SCALE 1 : 20



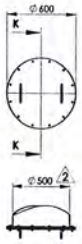

SECTION N-N
SCALE 1 : 10



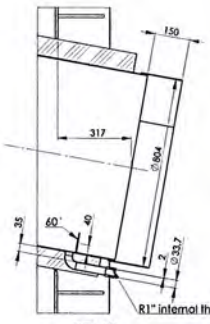

SECTION L-L
SCALE 1 : 20



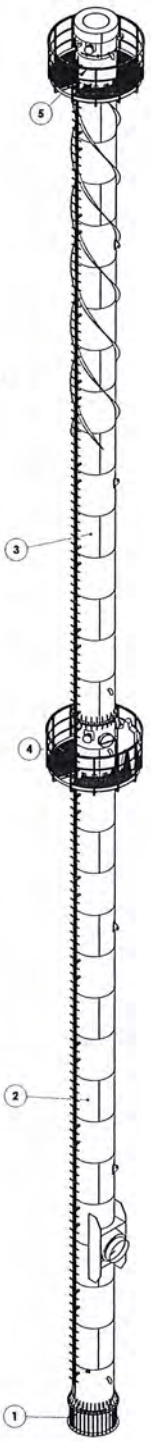

SECTION I-I
SCALE 1 : 30



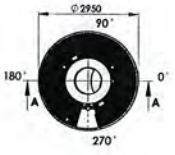
SECTION K-K
SCALE 1 : 20

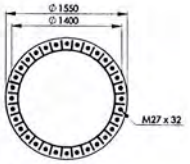



DETAIL H
SCALE 1 : 10

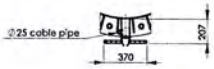



- Ulkovaippa materiaali S355J0
- Sisävaippa materiaali 1.4404 s=4
- Eristys 80 mm PV100 VM
- Pintakäsittely raepuhallus, polyuretaanimaalaus EPPUR160/3
- Nousuvaunu ja väljaat 2 paria
- Nuohousluukku asennettavaksi solaan




SECTION D-D
SCALE 1 : 30




SECTION C-C
SCALE 1 : 20

| Pos | QTY. | Detail | Dimensions | Material | Weight | Remarks |
|---|---|---|---|---|---|---|
| 8 | 46 | WASHER | M18(d18) KZn DIN 125 | KZn | 0.0 | |
| 7 | 48 | NUT | M18 DIN934 | 10 KZN | | |
| 6 | 22 | BOLT | M18 x 100 DIN 933 | 10.9 KZN | | |
| 5 | 1 | TOP PLATFORM | Drawing No.: W130351.4000 | | 425.3 | |
| 4 | 1 | MIDDLE PLATFORM | Drawing No.: W130351.3000 | | 436.5 | |
| 3 | 1 | SAVUPIIPPU H=25-50 m | Drawing No.: W130522.2000 | | 7973.7 | |
| 2 | 1 | SAVUPIIPPU H=0-25 m | Drawing No.: W130522.1000 | | 10778.1 | |
| 1 | 1 | Peruspulteto E2363 | Drawing No.: W130521.000 | | 213.0 | |

Quantity: 1 | Weight: 19828.1kg | Remark: | Sheet: 1/1

| Designed by: | Checked by: | Approved by - date: | Scale: | Date: | Working no. |
|---|---|---|---|---|---|
| Ranes Kauler | Janno Lehtme | - | 1:70(Custom) | 5.06.2013 | W130522 |

ESTANC

Title: SAVUPIIPPU H=50 m

Project: Höyrytys OY / Savupiippu H=50m

Drawing no. W130522.0000 rev.2

# Calculation of measurement uncertainty

## according to EN ISO 14956, EN 14181 and EN 15267-3

Version 5.0

### Device data

| | |
|---|---|
| Customer | VE 87460-J0-HNE-00022 |
| Identification | JV1 J1HNE10CF001-U01,J1HNE10CF002-U02,J2HNE10CF001-U01,J2HNE10CF002-U01 |
| Serial number | Date 2013-03-21 |
| Measuring system | FLOWSIC100 |

### Input values

| Component | Certification range | | Emissions limit value | | | Confidence interval | |
|---|---|---|---|---|---|---|---|
| Gas velocity | 16,00 | m/s | 40,00 | m/s | * | 10 | % * |

* For this measuring component no emlission limit values and confidence intervals are defined: Therefore full scale values and exemplary confidence intervals are used here.

** The emissions limit value for NOx is give as NO2-concentration, therefore the value as NO-concentration is decreased by the factor 1.53.

| Interferent | Concentration | | Interferent | Concentration | |
|---|---|---|---|---|---|
| Oxygen (O2) | 3,00 | Vol% | Ammonia (NH3) | 20,00 | mg/m³ |
| Oxygen (O2) | 21,00 | Vol% | Sulfur dioxide (SO2) | 200,00 | mg/m³ |
| Water (H2O) | 30,00 | Vol% | Sulfur dioxide (SO2) | 1 000,00 | mg/m³ |
| Carbon monoxide (CO) | 300,00 | mg/m³ | Hydrogen chloride (HCl) | 50,00 | mg/m³ |
| Carbon dioxide (CO2) | 15,00 | Vol% | Hydrogen chloride (HCl) | 200,00 | mg/m³ |
| Methane (CH4) | 50,00 | mg/m³ | | | |
| Dinitrogen oxide (N2O) | 20,00 | mg/m³ | | | |
| Dinitrogen oxide (N2O) | 100,00 | mg/m³ | | | |
| Nitrogen monoxide (NO) | 300,00 | mg/m³ | | | |
| Nitrogen dioxide (NO2) | 30,00 | mg/m³ | | | |

**Required quality of the measurement**

| | | | |
|---|---|---|---|
| Requirement to response time | 25 | % ** | Requirement of the legislation, the customer or authority |
| Averaging time of measured values | 30 | min | |

*** Possible values are 25% for dynamic (standard) or 10 % for highly dynamic processes (EN ISO 14956, 7.2)*

### Summary of the results

| Component | Response time | s(AMS) values | | Quality of the measurement |
|---|---|---|---|---|
| | | Zero point | Span point | |
| Gas velocity | Requirements fulfilled | 0,3682 | 0,3672 | Requirements fulfilled |

SICK | MAIHAK

# Calculation of Uncertainties according to EN ISO 14956 and EN 14181 (QAL1)

## Input data

| Data of measuring system | | | |
|---|---|---|---|
| Customer | VE 87460-J0-HNE-00021 | Order conform. no. | |
| Identification | JV1 | Serial no. | |

**Measuring system** **FWE 200** **Measured component** **dust**

| Starting value | | |
|---|---|---|
| **Emission limit value** | 10 mg/m³ | ***J1HNE10CQ001-U01, J1HNE10CQ002-U01, J2HNECQ001-U01, J2HNECQ002-U01*** |

| **Performance characteristics** (for operation within the device specifications) | | |
|---|---|---|
| Response time | 1,000 min | adjustable: 0.1 -360 s (0.002 - 6.0 min) |
| Non-linearity | 0,090 mg/m³ | at 10 mg/m³ dust |
| Uncertainty of reproducebility | 0,278 mg/m³ | at 10 mg/m³ dust |
| Influence power fluctuations | 0,200 mg/m³ | at 10 mg/m³ dust |
| Influence contamination | 0,290 mg/m³ | at 10 mg/m³ dust |
| Detection limit | 0,027 mg/m³ | |
| * Maintenance interval | 12 weeks | |

| | Zero point | Reference point | |
|---|---|---|---|
| Instability / drift | 0,010 mg/m³ | 0,010 mg/m³ | per interval * |

*The following performance characteristics have no or only marginal influence on the measurement: rel. ambient humidity, ambient temperature, vibrations, operation position, misalignment, gas flow*

| Required quality of measurement | | | |
|---|---|---|---|
| Tested value of dust-concentration | 10 | mg/m³ | ***Requirement given by customer, regulations or authorities*** |
| Averaging time of measuring values | 30 | min | |
| 95%-confidence interval of values | 30 | % | |

SICK | MAIHAK

## Analysis and results

**Required performance regarding to dynamic operation conditions**

| | | |
|---|---|---|
| Requirement to response time* | 25 | % of 30 min; i.e. 7,5 min |
| Measured response time | 1,00 | min |
| Conclusion | Requirement fulfilled | |

** Possible values are 25% for dynamic (standard) or 10% for highly dynamic processes (EN ISO 14956, 7.2)*

**Quantification of the influence of selected performance characteristics by standard uncertainties**

| | | |
|---|---|---|
| Uncertainty non-linearity | 0,0520 | mg/m³ |
| Uncertainty of reproducebility | 0,2778 | mg/m³ |
| Uncertainty power fluctuations | 0,1155 | mg/m³ |
| Uncertainty contamination | 0,1674 | mg/m³ |

| | Zero point | | Reference point | |
|---|---|---|---|---|
| Uncertainty instability / drift | 0,0058 | mg/m³ | 0,0058 | mg/m³ |

**Results**

**Estimation of the combined standard uncertainties**

| | Zero point | Reference point |
|---|---|---|
| $s_{AMS}$ = | 0,3482 | 0,3482 |

**Measurement uncertainty refering to the emission limit value**

| | | |
|---|---|---|
| Estimation of the expanded measurement uncertainty | 0,70 | at 10 mg/m³ dust |
| Estimation of the relative expanded measurement uncertainty | 7,0 | % |
| Evaluation of the compliance with the required quality of the measurement | Requirement fulfilled | |

# Calculation of measurement uncertainty

## according to EN ISO 14956, EN 14181 and EN 15267-3

Version 5.0

### Device data

| | | | |
|---|---|---|---|
| **Customer** | Vantaan Energia | | |
| **Identification** | JV1 | | |
| **Serial number** | | **Date** | 2013-03-21 |
| **Measuring system** | **FLOWSIC100** | **Component** | **Gas velocity** |

### Input values

| | | | | | | |
|---|---|---|---|---|---|---|
| Certification range | 16 | m/s | | Requirement to response time | 25 | % |
| Measuring range | 40 | m/s | | Averaging time of measured values | 30 | min |
| Confidence interval | 10 | % | * | | | |

Attention: The 2001/80/EC and 2000/76/EC gives no requirements for these components.

### Genaral information

| | | | | | |
|---|---|---|---|---|---|
| **Maintenance interval** | 6 | months | **Detection limit** | 0,07 | m/s |

### Required performance regarding dynamic operating conditions

| | | | |
|---|---|---|---|
| Measured response time | 0,17 | min | |
| Requirement to response time | 7,50 | min | 25% of the averaging time of 30 min |

**Result** Requirements fulfilled

### Calculation of the expanded uncertainty

| Interferent | Zero point | | Span point | |
|---|---|---|---|---|
| 3 Vol% Oxygen (O2) | 0,00 | m/s | 0,00 | m/s |
| 21 Vol% Oxygen (O2) | 0,00 | m/s | 0,00 | m/s |
| 30 Vol% Water (H2O) | 0,00 | m/s | 0,00 | m/s |
| 300 mg/m³ Carbon monoxide (CO) | 0,00 | m/s | 0,00 | m/s |
| 15 Vol% Carbon dioxide (CO2) | 0,00 | m/s | 0,00 | m/s |
| 50 mg/m³ Methane (CH4) | 0,00 | m/s | 0,00 | m/s |
| 20 mg/m³ Dinitrogen oxide (N2O) | 0,00 | m/s | 0,00 | m/s |
| 100 mg/m³ Dinitrogen oxide (N2O) | 0,00 | m/s | 0,00 | m/s |
| 300 mg/m³ Nitrogen monoxide (NO) | 0,00 | m/s | 0,00 | m/s |
| 30 mg/m³ Nitrogen dioxide (NO2) | 0,00 | m/s | 0,00 | m/s |
| 20 mg/m³ Ammonia (NH3) | 0,00 | m/s | 0,00 | m/s |
| 200 mg/m³ Sulfur dioxide (SO2) | 0,00 | m/s | 0,00 | m/s |
| 1000 mg/m³ Sulfur dioxide (SO2) | 0,00 | m/s | 0,00 | m/s |
| 50 mg/m³ Hydrogen chloride (HCl) | 0,00 | m/s | 0,00 | m/s |
| 200 mg/m³ Hydrogen chloride (HCl) | 0,00 | m/s | 0,00 | m/s |
| | 0,00 | m/s | 0,00 | m/s |
| | 0,00 | m/s | 0,00 | m/s |
| | 0,00 | m/s | 0,00 | m/s |
| | 0,00 | m/s | 0,00 | m/s |
| | 0,00 | m/s | 0,00 | m/s |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| The summation includes only values | < | -0,08 | m/s | or | > | 0,08 | m/s |
| Sum of the positive cross-sensitivities | | 0,00 | m/s | | | 0,00 | m/s |
| Sum of the negative cross-sensitivities | | 0,00 | m/s | | | 0,00 | m/s |

# Calculation of measurement uncertainty

## according to EN ISO 14956, EN 14181 and EN 15267-3

Version 5.0

### Device data

| | | | |
|---|---|---|---|
| **Customer** | Vantaan Energia | | |
| **Identification** | JV1 | | |
| **Serial number** | | **Date** | 2013-03-21 |
| **Measuring system** | **FLOWSIC100** | **Component** | **Gas velocity** |

### Influences of the process characteristics

| **Process characteristics** | **Largest difference according to type approval** | | | |
|---|---|---|---|---|
| | **Zero point** | | **Span point** | |
| Lack-of-fit (Linearity) | -0,53 | m/s | -0,53 | m/s |
| Zero drift from the field test | -0,13 | m/s | 0,00 | m/s |
| Span drift from the field test | 0,00 | m/s | -0,13 | m/s |
| Influence of ambient temperature at span point | 0,03 | m/s | 0,02 | m/s |
| Influence of sample gas pressure | 0,00 | m/s | 0,00 | m/s |
| Influence of sample gas flow | 0,00 | m/s | 0,00 | m/s |
| Influence of voltage | -0,04 | m/s | 0,00 | m/s |
| Cross-sensitivity | 0,00 | m/s | 0,00 | m/s |
| Repeatability at span point | 0,00 | m/s | 0,00 | m/s |
| Standard deviation from paired maesurements under field conditions | 0,08 | m/s | 0,08 | m/s |
| Uncertainty of provided reference material | 0,32 | m/s | 0,32 | m/s |
| Misalignment | 0,00 | m/s | 0,00 | m/s |
| Convertion rate of AMS for measurement of NOx | 0,00 | m/s | 0,00 | m/s |
| Changes of response fasctors | 0,00 | m/s | 0,00 | m/s |

| **Process characteristics** | | | **Standard uncertainty** | | | |
|---|---|---|---|---|---|---|
| | | | **Zero point** | | **Span point** | |
| Lack-of-fit (Linearity) | $u_{lof}$ | = | -0,3048 | m/s | -0,3048 | m/s |
| Zero drift from the field test | $u_{d,z}$ | = | -0,0739 | m/s | 0,0000 | m/s |
| Span drift from the field test | $u_{d,s}$ | = | 0,0000 | m/s | -0,0739 | m/s |
| Influence of ambient temperature at span point | $u_t$ | = | 0,0176 | m/s | 0,0111 | m/s |
| Influence of sample gas pressure | $u_p$ | = | 0,0000 | m/s | 0,0000 | m/s |
| Influence of sample gas flow | $u_f$ | = | 0,0000 | m/s | 0,0000 | m/s |
| Influence of voltage | $u_v$ | = | -0,0222 | m/s | -0,0018 | m/s |
| Cross-sensitivity | $u_i$ | = | 0,0000 | m/s | 0,0000 | m/s |
| Repeatability at span point | $u_r$ | = | 0,0000 | m/s | 0,0000 | m/s |
| Standard deviation from paired maesurements under field conditions | $u_D$ | = | 0,0471 | m/s | 0,0471 | m/s |
| Uncertainty of provided reference material | $u_{rm}$ | = | 0,1848 | m/s | 0,1848 | m/s |
| Misalignment | $u_{mb}$ | = | 0,0000 | m/s | 0,0000 | m/s |
| Convertion rate of AMS for measurement of NOx | $u_{ce}$ | = | 0,0000 | m/s | 0,0000 | m/s |
| Changes of response fasctors | $u_{rf}$ | = | 0,0000 | m/s | 0,0000 | m/s |

### Calculation of the combined standard uncertainties

| | | **Zero point** | | **Span point** | |
|---|---|---|---|---|---|
| **Combined standard uncertainty** | **s(AMS) values** | 0,3682 | m/s | 0,3672 | m/s |

### Verification of compliance with the requirements

| | | | |
|---|---|---|---|
| Combined standard uncertainty | 0,38 | m/s | according to EN 15267-3 |
| Expanded uncertainty | 0,74 | m/s | according to EN 15267-3 |
| Relative expanded uncertainty | 1,84 | % | of the measuring range of 40 m/s |
| Allowed expanded uncertainty | 10,00 | % | of the measuring range of 40 m/s |
| Allowed expanded uncertainty | 4,00 | m/s | |

**Result** Requirements fulfilled

**Attention: The 2001/80/EC and 2000/76/EC gives no requirements for these components.**

# Calculation of measurement uncertainty

## according to EN ISO 14956, EN 14181 and EN 15267-3

Version 5.0

### Device data

| | | | |
|---|---|---|---|
| **Customer** | VE 87460-J3-HNA-00023 | | |
| **Identification** | J3HNA02CQ011-U01 | | |
| **Serial number** | | **Date** | 2013-03-21 |
| **Measuring system** | **GM32 GMP** | | |

### Input values

| Component | Certification range | | Emissions limit value | | Confidence interval | |
|---|---|---|---|---|---|---|
| NO | 70,00 | mg/m³ | 120,00 ** | mg/m³ | 20 | % |
| SO2 | 75,00 | mg/m³ | 100,00 | mg/m³ | 20 | % |

* For this measuring component no emlission limit values and confidence intervals are defined: Therefore full scale values and exemplary confidence intervals are used here.

** The emissions limit value for NOx is give as NO2-concentration, therefore the value as NO-concentration is decreased by the factor 1.53.

| Interferent | Concentration | | Interferent | Concentration | |
|---|---|---|---|---|---|
| Oxygen (O2) | 3,00 | Vol% | Ammonia (NH3) | 20,00 | mg/m³ |
| Oxygen (O2) | 21,00 | Vol% | Sulfur dioxide (SO2) | 200,00 | mg/m³ |
| Water (H2O) | 30,00 | Vol% | Sulfur dioxide (SO2) | 1 000,00 | mg/m³ |
| Carbon monoxide (CO) | 300,00 | mg/m³ | Hydrogen chloride (HCl) | 50,00 | mg/m³ |
| Carbon dioxide (CO2) | 15,00 | Vol% | Hydrogen chloride (HCl) | 200,00 | mg/m³ |
| Methane (CH4) | 50,00 | mg/m³ | | | |
| Dinitrogen oxide (N2O) | 20,00 | mg/m³ | | | |
| Dinitrogen oxide (N2O) | 100,00 | mg/m³ | | | |
| Nitrogen monoxide (NO) | 300,00 | mg/m³ | | | |
| Nitrogen dioxide (NO2) | 30,00 | mg/m³ | | | |

### Required quality of the measurement

| | | | |
|---|---|---|---|
| Requirement to response time | 25 | % ** | Requirement of the legislation, the customer or authority |
| Averaging time of measured values | 30 | min | |

** *Possible values are 25% for dynamic (standard) or 10 % for highly dynamic processes (EN ISO 14956, 7.2)*

### Summary of the results

| Component | Response time | s(AMS) values | | Quality of the measurement |
|---|---|---|---|---|
| | | Zero point | Span point | |
| NO | Requirements fulfilled | 1,0933 | 2,1935 | Requirements fulfilled |
| SO2 | Requirements fulfilled | 1,7474 | 2,1324 | Requirements fulfilled |

# Calculation of measurement uncertainty

## according to EN ISO 14956, EN 14181 and EN 15267-3

Version 5.0

### Device data

| | | | |
|---|---|---|---|
| **Customer** | Vantaan Energia | | |
| **Identification** | JV1 at HRSG. Only NO-measurement | | |
| **Serial number** | | **Date** | 2013-03-21 |
| **Measuring system** | **GM32 GMP** | **Component** | **NO** |

### Input values

| | | | | | |
|---|---|---|---|---|---|
| Certification range | 70 | mg/m³ | Requirement to response time | 25 | % |
| Emissions limit value | 120 | mg/m³ | Averaging time of measured values | 30 | min |
| Confidence interval | 20 | % | | | |

### Genaral information

| | | | | | |
|---|---|---|---|---|---|
| **Maintenance interval** | 3 | months | **Detection limit** | 0,13 | mg/m³ |

### Required performance regarding dynamic operating conditions

| | | | |
|---|---|---|---|
| Measured response time | 0,78 | min | |
| Requirement to response time | 7,50 | min | 25% of the averaging time of 30 min |

**Result** Requirements fulfilled

### Calculation of the expanded uncertainty

| **Interferent** | **Zero point** | | **Span point** | |
|---|---|---|---|---|
| 3 Vol% Oxygen (O2) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 21 Vol% Oxygen (O2) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 30 Vol% Water (H2O) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 300 mg/m³ Carbon monoxide (CO) | 0,00 | mg/m³ | -0,34 | mg/m³ |
| 15 Vol% Carbon dioxide (CO2) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 50 mg/m³ Methane (CH4) | 0,00 | mg/m³ | 0,29 | mg/m³ |
| 20 mg/m³ Dinitrogen oxide (N2O) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 100 mg/m³ Dinitrogen oxide (N2O) | 0,00 | mg/m³ | **0,49** | mg/m³ |
| 300 mg/m³ Nitrogen monoxide (NO) | | | | |
| 30 mg/m³ Nitrogen dioxide (NO2) | 0,35 | mg/m³ | **0,49** | mg/m³ |
| 20 mg/m³ Ammonia (NH3) | 0,00 | mg/m³ | **0,57** | mg/m³ |
| 200 mg/m³ Sulfur dioxide (SO2) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 1000 mg/m³ Sulfur dioxide (SO2) | **-0,66** | mg/m³ | **-0,50** | mg/m³ |
| 50 mg/m³ Hydrogen chloride (HCl) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 200 mg/m³ Hydrogen chloride (HCl) | **0,38** | mg/m³ | **1,40** | mg/m³ |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| The summation includes only values | < | -0,35 | mg/m³ | or | > | 0,35 | mg/m³ |
| Sum of the positive cross-sensitivities | | 0,38 | mg/m³ | | | 2,95 | mg/m³ |
| Sum of the negative cross-sensitivities | | -0,66 | mg/m³ | | | -0,50 | mg/m³ |

# Calculation of measurement uncertainty

## according to EN ISO 14956, EN 14181 and EN 15267-3

Version 5.0

### Device data

| | | | |
|---|---|---|---|
| **Customer** | Vantaan Energia | | |
| **Identification** | JV1 at HRSG. Only NO-measurement | | |
| **Serial number** | | **Date** | 2013-03-21 |
| **Measuring system** | **GM32 GMP** | **Component** | **NO** |

### Influences of the process characteristics

| **Process characteristics** | **Largest difference according to type approval** | | | |
|---|---|---|---|---|
| | **Zero point** | | **Span point** | |
| Lack-of-fit (Linearity) | -0,56 | mg/m³ | -0,56 | mg/m³ |
| Zero drift from the field test | 0,42 | mg/m³ | 0,00 | mg/m³ |
| Span drift from the field test | 0,00 | mg/m³ | -1,61 | mg/m³ |
| Influence of ambient temperature at span point | 0,14 | mg/m³ | 0,42 | mg/m³ |
| Influence of sample gas pressure | -0,07 | mg/m³ | -0,07 | mg/m³ |
| Influence of sample gas flow | 0,00 | mg/m³ | 0,00 | mg/m³ |
| Influence of voltage | -0,14 | mg/m³ | 0,21 | mg/m³ |
| Cross-sensitivity | -0,66 | mg/m³ | 2,95 | mg/m³ |
| Repeatability at span point | 0,00 | mg/m³ | 0,00 | mg/m³ |
| Standard deviation from paired maesurements under field conditions | 0,81 | mg/m³ | 0,81 | mg/m³ |
| Uncertainty of provided reference material | 1,40 | mg/m³ | 1,40 | mg/m³ |
| Misalignment | 0,00 | mg/m³ | 0,00 | mg/m³ |
| Convertion rate of AMS for measurement of NOx | 0,00 | mg/m³ | 0,00 | mg/m³ |
| Changes of response fasctors | 0,00 | mg/m³ | 0,00 | mg/m³ |

| **Process characteristics** | | | **Standard uncertainty** | | | |
|---|---|---|---|---|---|---|
| | | | **Zero point** | | **Span point** | |
| Lack-of-fit (Linearity) | $u_{lof}$ | = | -0,3233 | mg/m³ | -0,3233 | mg/m³ |
| Zero drift from the field test | $u_{d,z}$ | = | 0,2425 | mg/m³ | 0,0000 | mg/m³ |
| Span drift from the field test | $u_{d,s}$ | = | 0,0000 | mg/m³ | -0,9295 | mg/m³ |
| Influence of ambient temperature at span point | $u_t$ | = | 0,0808 | mg/m³ | 0,2425 | mg/m³ |
| Influence of sample gas pressure | $u_p$ | = | -0,0404 | mg/m³ | -0,0404 | mg/m³ |
| Influence of sample gas flow | $u_f$ | = | 0,0000 | mg/m³ | 0,0000 | mg/m³ |
| Influence of voltage | $u_v$ | = | -0,0808 | mg/m³ | 0,1212 | mg/m³ |
| Cross-sensitivity | $u_i$ | = | -0,3799 | mg/m³ | 1,7015 | mg/m³ |
| Repeatability at span point | $u_r$ | = | 0,0000 | mg/m³ | 0,0000 | mg/m³ |
| Standard deviation from paired maesurements under field conditions | $u_D$ | = | 0,4686 | mg/m³ | 0,4686 | mg/m³ |
| Uncertainty of provided reference material | $u_{rm}$ | = | 0,8083 | mg/m³ | 0,8083 | mg/m³ |
| Misalignment | $u_{mb}$ | = | 0,0000 | mg/m³ | 0,0000 | mg/m³ |
| Convertion rate of AMS for measurement of NOx | $u_{ce}$ | = | 0,0000 | mg/m³ | 0,0000 | mg/m³ |
| Changes of response fasctors | $u_{rf}$ | = | 0,0000 | mg/m³ | 0,0000 | mg/m³ |

### Calculation of the combined standard uncertainties

| | | **Zero point** | | **Span point** | |
|---|---|---|---|---|---|
| **Combined standard uncertainty** | **s(AMS) values** | 1,0933 | mg/m³ | 2,1935 | mg/m³ |

### Verification of compliance with the requirements

| | | | |
|---|---|---|---|
| Combined standard uncertainty | 2,21 | mg/m³ | according to EN 15267-3 |
| Expanded uncertainty | 4,33 | mg/m³ | according to EN 15267-3 |
| Relative expanded uncertainty | 3,60 | % | of the emissions limit value of 120 mg/m³ |
| Allowed expanded uncertainty | 20,00 | % | of the emissions limit value of 120 mg/m³ |
| Allowed expanded uncertainty | 24,00 | mg/m³ | |

**Result** Requirements fulfilled

# Calculation of measurement uncertainty

## according to EN ISO 14956, EN 14181 and EN 15267-3

Version 5.0

### Device data

| | | | |
|---|---|---|---|
| **Customer** | Vantaan Energia | | |
| **Identification** | JV1 at HRSG. Only NO-measurement | | |
| **Serial number** | | **Date** | 2013-03-21 |
| **Measuring system** | **GM32 GMP** | **Component** | **SO2** |

### Input values

| | | | | | |
|---|---|---|---|---|---|
| Certification range | 75 | mg/m³ | Requirement to response time | 25 | % |
| Emissions limit value | 100 | mg/m³ | Averaging time of measured values | 30 | min |
| Confidence interval | 20 | % | | | |

### Genaral information

| | | | | | |
|---|---|---|---|---|---|
| **Maintenance interval** | 3 | months | **Detection limit** | 0,41 | mg/m³ |

### Required performance regarding dynamic operating conditions

| | | | |
|---|---|---|---|
| Measured response time | 0,80 | min | |
| Requirement to response time | 7,50 | min | 25% of the averaging time of 30 min |

**Result** | Requirements fulfilled |

### Calculation of the expanded uncertainty

| **Interferent** | **Zero point** | | **Span point** | |
|---|---|---|---|---|
| 3 Vol% Oxygen (O2) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 21 Vol% Oxygen (O2) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 30 Vol% Water (H2O) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 300 mg/m³ Carbon monoxide (CO) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 15 Vol% Carbon dioxide (CO2) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 50 mg/m³ Methane (CH4) | 0,00 | mg/m³ | **0,46** | mg/m³ |
| 20 mg/m³ Dinitrogen oxide (N2O) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 100 mg/m³ Dinitrogen oxide (N2O) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 300 mg/m³ Nitrogen monoxide (NO) | **-1,66** | mg/m³ | **-2,01** | mg/m³ |
| 30 mg/m³ Nitrogen dioxide (NO2) | **0,77** | mg/m³ | **1,07** | mg/m³ |
| 20 mg/m³ Ammonia (NH3) | 0,00 | mg/m³ | **0,61** | mg/m³ |
| 200 mg/m³ Sulfur dioxide (SO2) | | | | |
| 1000 mg/m³ Sulfur dioxide (SO2) | | | | |
| 50 mg/m³ Hydrogen chloride (HCl) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 200 mg/m³ Hydrogen chloride (HCl) | 0,00 | mg/m³ | **-0,54** | mg/m³ |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| The summation includes only values | < | -0,38 | mg/m³ | or | > | 0,38 | mg/m³ |
| Sum of the positive cross-sensitivities | | 0,77 | mg/m³ | | | 2,14 | mg/m³ |
| Sum of the negative cross-sensitivities | | -1,66 | mg/m³ | | | -2,55 | mg/m³ |

# Calculation of measurement uncertainty

## according to EN ISO 14956, EN 14181 and EN 15267-3

Version 5.2

### Device data

| | |
|---|---|
| **Customer** | VE 87460-J0-CFC-00020 |
| **Identification** | J1CFC01, J1CFC02. J2CFC01, J2CFC02 |
| **Serial number** | |
| **Date** | 2013-03-21 |
| **Measuring system** | **MCS100FT** |

### Input values

| Component | Certification range | | Emissions limit value | | | Confidence interval | |
|---|---|---|---|---|---|---|---|
| CO | 75,00 | mg/m³ | 50,00 | mg/m³ | | 10 | % |
| CO2 | 25,00 | Vol% | 20,00 | Vol% | * | 20 | % * |
| NO | 200,00 | mg/m³ | 200,00 | ** mg/m³ | | 20 | % |
| NO2 | 100,00 | mg/m³ | 200,00 | mg/m³ | | 20 | % |
| N2O | 50,00 | mg/m³ | 20,00 | mg/m³ | * | 20 | % * |
| SO2 | 75,00 | mg/m³ | 50,00 | mg/m³ | | 20 | % |
| HCl | 15,00 | mg/m³ | 10,00 | mg/m³ | | 40 | % |
| HF | 3,00 | mg/m³ | 1,00 | mg/m³ | | 40 | % |
| NH3 | 10,00 | mg/m³ | 20,00 | mg/m³ | * | 40 | % * |
| H2O | 40,00 | Vol% | 20,00 | Vol% | * | 40 | % * |
| CH4 | 50,00 | mg/m³ | 20,00 | mg/m³ | * | 20 | % * |
| Corg | 15,00 | mg/m³ | 10,00 | mg/m³ | | 30 | % |
| O2 | 21,00 | Vol% | 20,00 | Vol% | * | 20 | % * |

* For this measuring component no emission limit values and confidence intervals are defined: Therefore full scale values and exemplary confidence intervals are used here.

** The emissions limit value for NOx is give as NO2-concentration, therefore the value as NO-concentration is decreased by the factor 1.53.

| Interferent | Concentration | | Interferent | Concentration | |
|---|---|---|---|---|---|
| Oxygen (O2) | 3,00 | Vol% | Ammonia (NH3) | 20,00 | mg/m³ |
| Oxygen (O2) | 21,00 | Vol% | Sulfur dioxide (SO2) | 200,00 | mg/m³ |
| Water (H2O) | 30,00 | Vol% | Sulfur dioxide (SO2) | 1 000,00 | mg/m³ |
| Carbon monoxide (CO) | 300,00 | mg/m³ | Hydrogen chloride (HCl) | 50,00 | mg/m³ |
| Carbon dioxide (CO2) | 15,00 | Vol% | Hydrogen chloride (HCl) | 200,00 | mg/m³ |
| Methane (CH4) | 50,00 | mg/m³ | | | |
| Dinitrogen oxide (N2O) | 20,00 | mg/m³ | | | |
| Dinitrogen oxide (N2O) | 100,00 | mg/m³ | | | |
| Nitrogen monoxide (NO) | 300,00 | mg/m³ | | | |
| Nitrogen dioxide (NO2) | 30,00 | mg/m³ | | | |

### Required quality of the measurement

| | | | |
|---|---|---|---|
| Requirement to response time | 25 | % ** | Requirement of the legislation, the customer or authority |
| Averaging time of measured values | 30 | min | |

** *Possible values are 25% for dynamic (standard) or 10 % for highly dynamic processes (EN ISO 14956, 7.2)*

### Summary of the results

| Component | Response time | s(AMS) values | | Quality of the measurement |
|---|---|---|---|---|
| | | Zero point | Span point | |
| CO | Requirements fulfilled | 1,6432 | 2,2629 | Requirements fulfilled |
| CO2 | Requirements fulfilled | 0,6360 | 0,7807 | Requirements fulfilled |
| NO | Requirements fulfilled | 5,0080 | 6,9800 | Requirements fulfilled |
| NO2 | Requirements fulfilled | 3,4784 | 3,6244 | Requirements fulfilled |
| N2O | Requirements fulfilled | 1,0292 | 1,3577 | Requirements fulfilled |
| SO2 | Requirements fulfilled | 2,0330 | 2,9414 | Requirements fulfilled |
| HCl | Requirements fulfilled | 0,5535 | 0,6030 | Requirements fulfilled |
| HF | Requirements fulfilled | 0,1472 | 0,1281 | Requirements fulfilled |
| NH3 | Requirements fulfilled | 0,3146 | 0,2855 | Requirements fulfilled |
| H2O | Requirements fulfilled | 0,9910 | 1,0581 | Requirements fulfilled |
| CH4 | Requirements fulfilled | 1,1383 | 1,4824 | Requirements fulfilled |
| Corg | Requirements fulfilled | 0,7007 | 0,6750 | Requirements fulfilled |
| O2 | Requirements fulfilled | 0,2816 | 0,3226 | Requirements fulfilled |

# Calculation of measurement uncertainty

## according to EN ISO 14956, EN 14181 and EN 15267-3

Version 5.2

### Device data

| | | | |
|---|---|---|---|
| **Customer** | Vantaan Energia | | |
| **Identification** | JV1 | | |
| **Serial number** | | **Date** | 2013-03-21 |
| **Measuring system** | **MCS100FT** | **Component** | **CO** |

### Input values

| | | | | | |
|---|---|---|---|---|---|
| Certification range | 75 | mg/m³ | Requirement to response time | 25 | % |
| Emissions limit value | 50 | mg/m³ | Averaging time of measured values | 30 | min |
| Confidence interval | 10 | % | | | |

### Genaral information

| | | | | | |
|---|---|---|---|---|---|
| **Maintenance interval** | 6 | months | **Detection limit** | 0,32 | mg/m³ |

### Required performance regarding dynamic operating conditions

| | | | |
|---|---|---|---|
| Measured response time | 2,97 | min | |
| Requirement to response time | 7,50 | min | 25% of the averaging time of 30 min |

**Result** | **Requirements fulfilled**

### Calculation of the expanded uncertainty

| **Interferent** | **Zero point** | | **Span point** | |
|---|---|---|---|---|
| 3 Vol% Oxygen (O2) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 21 Vol% Oxygen (O2) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 30 Vol% Water (H2O) | 0,00 | mg/m³ | **0,75** | mg/m³ |
| 300 mg/m³ Carbon monoxide (CO) | | | | |
| 15 Vol% Carbon dioxide (CO2) | **1,20** | mg/m³ | 0,00 | mg/m³ |
| 50 mg/m³ Methane (CH4) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 20 mg/m³ Dinitrogen oxide (N2O) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 100 mg/m³ Dinitrogen oxide (N2O) | **-1,35** | mg/m³ | **-2,63** | mg/m³ |
| 300 mg/m³ Nitrogen monoxide (NO) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 30 mg/m³ Nitrogen dioxide (NO2) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 20 mg/m³ Ammonia (NH3) | 0,00 | mg/m³ | **0,53** | mg/m³ |
| 200 mg/m³ Sulfur dioxide (SO2) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 1000 mg/m³ Sulfur dioxide (SO2) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 50 mg/m³ Hydrogen chloride (HCl) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 200 mg/m³ Hydrogen chloride (HCl) | 0,00 | mg/m³ | 0,00 | mg/m³ |

| | | | | |
|---|---|---|---|---|
| Sum of the positive cross-sensitivities | 1,20 | mg/m³ | 1,28 | mg/m³ |
| Sum of the negative cross-sensitivities | -1,35 | mg/m³ | -2,63 | mg/m³ |

# Calculation of measurement uncertainty

## according to EN ISO 14956, EN 14181 and EN 15267-3

Version 5.2

### Device data

| | | | |
|---|---|---|---|
| **Customer** | Vantaan Energia | | |
| **Identification** | JV1 | | |
| **Serial number** | | **Date** | 2013-03-21 |
| **Measuring system** | **MCS100FT** | **Component** | **CO** |

### Influences of the process characteristics

| **Process characteristics** | **Largest difference according to type approval** | | | |
|---|---|---|---|---|
| | **Zero point** | | **Span point** | |
| Lack-of-fit (Linearity) | 1,50 | mg/m³ | 1,50 | mg/m³ |
| Zero drift from the field test | 1,13 | mg/m³ | 0,00 | mg/m³ |
| Span drift from the field test | 0,00 | mg/m³ | -1,35 | mg/m³ |
| Influence of ambient temperature at span point | 0,15 | mg/m³ | -1,28 | mg/m³ |
| Influence of sample gas pressure | 0,00 | mg/m³ | 0,00 | mg/m³ |
| Influence of sample gas flow | 0,00 | mg/m³ | -0,08 | mg/m³ |
| Influence of voltage | 0,15 | mg/m³ | 0,23 | mg/m³ |
| Cross-sensitivity | -1,35 | mg/m³ | -2,63 | mg/m³ |
| Repeatability at span point | 0,16 | mg/m³ | 0,22 | mg/m³ |
| Standard deviation from paired maesurements under field conditions | 0,68 | mg/m³ | 0,68 | mg/m³ |
| Uncertainty of provided reference material | 1,50 | mg/m³ | 1,50 | mg/m³ |
| Misalignment | 0,00 | mg/m³ | 0,00 | mg/m³ |
| Convertion rate of AMS for measurement of NOx | 0,00 | mg/m³ | 0,00 | mg/m³ |
| Changes of response fasctors | 0,00 | mg/m³ | 0,00 | mg/m³ |

| **Process characteristics** | | | **Standard uncertainty** | | | |
|---|---|---|---|---|---|---|
| | | | **Zero point** | | **Span point** | |
| Lack-of-fit (Linearity) | $u_{lof}$ | = | 0,8660 | mg/m³ | 0,8660 | mg/m³ |
| Zero drift from the field test | $u_{d,z}$ | = | 0,6495 | mg/m³ | 0,0000 | mg/m³ |
| Span drift from the field test | $u_{d,s}$ | = | 0,0000 | mg/m³ | -0,7794 | mg/m³ |
| Influence of ambient temperature at span point | $u_t$ | = | 0,0866 | mg/m³ | -0,7361 | mg/m³ |
| Influence of sample gas pressure | $u_p$ | = | 0,0000 | mg/m³ | 0,0000 | mg/m³ |
| Influence of sample gas flow | $u_f$ | = | 0,0000 | mg/m³ | -0,0433 | mg/m³ |
| Influence of voltage | $u_v$ | = | 0,0866 | mg/m³ | 0,1299 | mg/m³ |
| Cross-sensitivity | $u_i$ | = | -0,7794 | mg/m³ | -1,5155 | mg/m³ |
| Repeatability at span point | $u_r$ | = | 0,0924 | mg/m³ | 0,1270 | mg/m³ |
| Standard deviation from paired maesurements under field conditions | $u_D$ | = | 0,3945 | mg/m³ | 0,3945 | mg/m³ |
| Uncertainty of provided reference material | $u_{rm}$ | = | 0,8660 | mg/m³ | 0,8660 | mg/m³ |
| Misalignment | $u_{mb}$ | = | 0,0000 | mg/m³ | 0,0000 | mg/m³ |
| Convertion rate of AMS for measurement of NOx | $u_{ce}$ | = | 0,0000 | mg/m³ | 0,0000 | mg/m³ |
| Changes of response fasctors | $u_{rf}$ | = | 0,0000 | mg/m³ | 0,0000 | mg/m³ |

### Calculation of the combined standard uncertainties

| | | **Zero point** | | **Span point** | |
|---|---|---|---|---|---|
| **Combined standard uncertainty** | **s(AMS) values** | 1,6432 | mg/m³ | 2,2629 | mg/m³ |

### Verification of compliance with the requirements

| | | | |
|---|---|---|---|
| Combined standard uncertainty | 2,35 | mg/m³ | according to EN 15267-3 |
| Expanded uncertainty | 4,61 | mg/m³ | according to EN 15267-3 |
| Relative expanded uncertainty | 9,23 | % | of the emissions limit value of 50 mg/m³ |
| Allowed expanded uncertainty | 10,00 | % | of the emissions limit value of 50 mg/m³ |
| Allowed expanded uncertainty | 5,00 | mg/m³ | |

**Result** Requirements fulfilled

# Calculation of measurement uncertainty

## according to EN ISO 14956, EN 14181 and EN 15267-3

Version 5.2

### Device data

| | | | |
|---|---|---|---|
| **Customer** | Vantaan Energia | | |
| **Identification** | JV1 | | |
| **Serial number** | | **Date** | 2013-03-21 |
| **Measuring system** | **MCS100FT** | **Component** | **CO2** |

### Input values

| | | | | | | |
|---|---|---|---|---|---|---|
| Certification range | 25 | Vol% | | Requirement to response time | 25 | % |
| Measuring range | 20 | Vol% | | Averaging time of measured values | 30 | min |
| Confidence interval | 20 | % | * | | | |

Attention: The 2001/80/EC and 2000/76/EC gives no requirements for these components.

### Genaral information

| | | | | | |
|---|---|---|---|---|---|
| **Maintenance interval** | 3 | months | **Detection limit** | 0,06 | Vol% |

### Required performance regarding dynamic operating conditions

| | | | |
|---|---|---|---|
| Measured response time | 3,03 | min | |
| Requirement to response time | 7,50 | min | 25% of the averaging time of 30 min |

**Result** Requirements fulfilled

### Calculation of the expanded uncertainty

| **Interferent** | **Zero point** | | **Span point** | |
|---|---|---|---|---|
| 3 Vol% Oxygen (O2) | 0,00 | Vol% | 0,00 | Vol% |
| 21 Vol% Oxygen (O2) | 0,00 | Vol% | 0,00 | Vol% |
| 30 Vol% Water (H2O) | **-0,33** | Vol% | **0,48** | Vol% |
| 300 mg/m³ Carbon monoxide (CO) | 0,00 | Vol% | 0,00 | Vol% |
| 15 Vol% Carbon dioxide (CO2) | | | | |
| 50 mg/m³ Methane (CH4) | 0,00 | Vol% | 0,00 | Vol% |
| 20 mg/m³ Dinitrogen oxide (N2O) | 0,00 | Vol% | 0,00 | Vol% |
| 100 mg/m³ Dinitrogen oxide (N2O) | **-0,40** | Vol% | **-0,35** | Vol% |
| 300 mg/m³ Nitrogen monoxide (NO) | 0,00 | Vol% | 0,00 | Vol% |
| 30 mg/m³ Nitrogen dioxide (NO2) | 0,00 | Vol% | 0,00 | Vol% |
| 20 mg/m³ Ammonia (NH3) | 0,00 | Vol% | **-0,35** | Vol% |
| 200 mg/m³ Sulfur dioxide (SO2) | 0,00 | Vol% | 0,00 | Vol% |
| 1000 mg/m³ Sulfur dioxide (SO2) | 0,00 | Vol% | **0,33** | Vol% |
| 50 mg/m³ Hydrogen chloride (HCl) | 0,00 | Vol% | 0,00 | Vol% |
| 200 mg/m³ Hydrogen chloride (HCl) | 0,00 | Vol% | **-0,13** | Vol% |

| | | |
|---|---|---|
| Sum of the positive cross-sensitivities | 0,00 Vol% | 0,80 Vol% |
| Sum of the negative cross-sensitivities | -0,73 Vol% | -0,83 Vol% |

# Calculation of measurement uncertainty

## according to EN ISO 14956, EN 14181 and EN 15267-3

Version 5.2

### Device data

| | | | |
|---|---|---|---|
| **Customer** | Vantaan Energia | | |
| **Identification** | JV1 | | |
| **Serial number** | | **Date** | 2013-03-21 |
| **Measuring system** | **MCS100FT** | **Component** | **CO2** |

### Influences of the process characteristics

| **Process characteristics** | **Largest difference according to type approval** | | | |
|---|---|---|---|---|
| | **Zero point** | | **Span point** | |
| Lack-of-fit (Linearity) | 0,18 | Vol% | 0,18 | Vol% |
| Zero drift from the field test | 0,53 | Vol% | 0,00 | Vol% |
| Span drift from the field test | 0,00 | Vol% | 0,68 | Vol% |
| Influence of ambient temperature at span point | 0,08 | Vol% | 0,53 | Vol% |
| Influence of sample gas pressure | 0,00 | Vol% | 0,00 | Vol% |
| Influence of sample gas flow | 0,00 | Vol% | -0,03 | Vol% |
| Influence of voltage | -0,03 | Vol% | 0,10 | Vol% |
| Cross-sensitivity | -0,73 | Vol% | -0,83 | Vol% |
| Repeatability at span point | 0,03 | Vol% | 0,05 | Vol% |
| Standard deviation from paired maesurements under field conditions | 0,35 | Vol% | 0,35 | Vol% |
| Uncertainty of provided reference material | 0,50 | Vol% | 0,50 | Vol% |
| Misalignment | 0,00 | Vol% | 0,00 | Vol% |
| Convertion rate of AMS for measurement of NOx | 0,00 | Vol% | 0,00 | Vol% |
| Changes of response fasctors | 0,00 | Vol% | 0,00 | Vol% |

| **Process characteristics** | | | **Standard uncertainty** | | | |
|---|---|---|---|---|---|---|
| | | | **Zero point** | | **Span point** | |
| Lack-of-fit (Linearity) | $u_{lof}$ | = | 0,1010 | Vol% | 0,1010 | Vol% |
| Zero drift from the field test | $u_{d,z}$ | = | 0,3031 | Vol% | 0,0000 | Vol% |
| Span drift from the field test | $u_{d,s}$ | = | 0,0000 | Vol% | 0,3897 | Vol% |
| Influence of ambient temperature at span point | $u_t$ | = | 0,0433 | Vol% | 0,3031 | Vol% |
| Influence of sample gas pressure | $u_p$ | = | 0,0000 | Vol% | 0,0000 | Vol% |
| Influence of sample gas flow | $u_f$ | = | 0,0000 | Vol% | -0,0144 | Vol% |
| Influence of voltage | $u_v$ | = | -0,0144 | Vol% | 0,0577 | Vol% |
| Cross-sensitivity | $u_i$ | = | -0,4186 | Vol% | -0,4763 | Vol% |
| Repeatability at span point | $u_r$ | = | 0,0173 | Vol% | 0,0289 | Vol% |
| Standard deviation from paired maesurements under field conditions | $u_D$ | = | 0,2046 | Vol% | 0,2046 | Vol% |
| Uncertainty of provided reference material | $u_{rm}$ | = | 0,2887 | Vol% | 0,2887 | Vol% |
| Misalignment | $u_{mb}$ | = | 0,0000 | Vol% | 0,0000 | Vol% |
| Convertion rate of AMS for measurement of NOx | $u_{ce}$ | = | 0,0000 | Vol% | 0,0000 | Vol% |
| Changes of response fasctors | $u_{rf}$ | = | 0,0000 | Vol% | 0,0000 | Vol% |

### Calculation of the combined standard uncertainties

| | | **Zero point** | | **Span point** | |
|---|---|---|---|---|---|
| **Combined standard uncertainty** | **s(AMS) values** | 0,6360 | Vol% | 0,7807 | Vol% |

### Verification of compliance with the requirements

| | | | |
|---|---|---|---|
| Combined standard uncertainty | 0,84 | Vol% | according to EN 15267-3 |
| Expanded uncertainty | 1,64 | Vol% | according to EN 15267-3 |
| Relative expanded uncertainty | 8,21 | % | of the measuring range of 20 Vol% |
| Allowed expanded uncertainty | 20,00 | % | of the measuring range of 20 Vol% |
| Allowed expanded uncertainty | 4,00 | Vol% | |

**Result** Requirements fulfilled

**Attention: The 2001/80/EC and 2000/76/EC gives no requirements for these components.**

# Calculation of measurement uncertainty

## according to EN ISO 14956, EN 14181 and EN 15267-3

Version 5.2

### Device data

| | | | |
|---|---|---|---|
| **Customer** | Vantaan Energia | | |
| **Identification** | JV1 | | |
| **Serial number** | | **Date** | 2013-03-21 |
| **Measuring system** | **MCS100FT** | **Component** | **NO** |

### Input values

| | | | | | |
|---|---|---|---|---|---|
| Certification range | 200 | mg/m³ | Requirement to response time | 25 | % |
| Emissions limit value | 200 | mg/m³ | Averaging time of measured values | 30 | min |
| Confidence interval | 20 | % | | | |

### Genaral information

| | | | | | |
|---|---|---|---|---|---|
| **Maintenance interval** | 6 | months | **Detection limit** | 0,76 | mg/m³ |

### Required performance regarding dynamic operating conditions

| | | | |
|---|---|---|---|
| Measured response time | 2,93 | min | |
| Requirement to response time | 7,50 | min | 25% of the averaging time of 30 min |

**Result** Requirements fulfilled

### Calculation of the expanded uncertainty

| **Interferent** | **Zero point** | | **Span point** | |
|---|---|---|---|---|
| 3 Vol% Oxygen (O2) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 21 Vol% Oxygen (O2) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 30 Vol% Water (H2O) | **-5,20** | mg/m³ | **3,20** | mg/m³ |
| 300 mg/m³ Carbon monoxide (CO) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 15 Vol% Carbon dioxide (CO2) | 0,00 | mg/m³ | **-4,80** | mg/m³ |
| 50 mg/m³ Methane (CH4) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 20 mg/m³ Dinitrogen oxide (N2O) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 100 mg/m³ Dinitrogen oxide (N2O) | 0,00 | mg/m³ | **2,00** | mg/m³ |
| 300 mg/m³ Nitrogen monoxide (NO) | | | | |
| 30 mg/m³ Nitrogen dioxide (NO2) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 20 mg/m³ Ammonia (NH3) | **1,40** | mg/m³ | 0,00 | mg/m³ |
| 200 mg/m³ Sulfur dioxide (SO2) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 1000 mg/m³ Sulfur dioxide (SO2) | 0,00 | mg/m³ | **1,20** | mg/m³ |
| 50 mg/m³ Hydrogen chloride (HCl) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 200 mg/m³ Hydrogen chloride (HCl) | 0,00 | mg/m³ | **1,60** | mg/m³ |

| | | | | |
|---|---|---|---|---|
| Sum of the positive cross-sensitivities | 1,40 | mg/m³ | 8,00 | mg/m³ |
| Sum of the negative cross-sensitivities | -5,20 | mg/m³ | -4,80 | mg/m³ |

# Calculation of measurement uncertainty

## according to EN ISO 14956, EN 14181 and EN 15267-3

Version 5.2

### Device data

| | | | |
|---|---|---|---|
| **Customer** | Vantaan Energia | | |
| **Identification** | JV1 | | |
| **Serial number** | | **Date** | 2013-03-21 |
| **Measuring system** | **MCS100FT** | **Component** | **NO** |

### Influences of the process characteristics

| **Process characteristics** | **Largest difference according to type approval** | | | |
|---|---|---|---|---|
| | **Zero point** | | **Span point** | |
| Lack-of-fit (Linearity) | 3,00 | mg/m³ | 3,00 | mg/m³ |
| Zero drift from the field test | 3,60 | mg/m³ | 0,00 | mg/m³ |
| Span drift from the field test | 0,00 | mg/m³ | -6,00 | mg/m³ |
| Influence of ambient temperature at span point | -0,80 | mg/m³ | -3,00 | mg/m³ |
| Influence of sample gas pressure | 0,00 | mg/m³ | 0,00 | mg/m³ |
| Influence of sample gas flow | 0,00 | mg/m³ | -0,20 | mg/m³ |
| Influence of voltage | 0,20 | mg/m³ | -1,60 | mg/m³ |
| Cross-sensitivity | -5,20 | mg/m³ | 8,00 | mg/m³ |
| Repeatability at span point | 0,38 | mg/m³ | 0,78 | mg/m³ |
| Standard deviation from paired maesurements under field conditions | 3,09 | mg/m³ | 3,09 | mg/m³ |
| Uncertainty of provided reference material | 4,00 | mg/m³ | 4,00 | mg/m³ |
| Misalignment | 0,00 | mg/m³ | 0,00 | mg/m³ |
| Convertion rate of AMS for measurement of NOx | 0,00 | mg/m³ | 0,00 | mg/m³ |
| Changes of response fasctors | 0,00 | mg/m³ | 0,00 | mg/m³ |

| **Process characteristics** | | | **Standard uncertainty** | | | |
|---|---|---|---|---|---|---|
| | | | **Zero point** | | **Span point** | |
| Lack-of-fit (Linearity) | $u_{lof}$ | = | 1,7321 | mg/m³ | 1,7321 | mg/m³ |
| Zero drift from the field test | $u_{d,z}$ | = | 2,0785 | mg/m³ | 0,0000 | mg/m³ |
| Span drift from the field test | $u_{d,s}$ | = | 0,0000 | mg/m³ | -3,4641 | mg/m³ |
| Influence of ambient temperature at span point | $u_t$ | = | -0,4619 | mg/m³ | -1,7321 | mg/m³ |
| Influence of sample gas pressure | $u_p$ | = | 0,0000 | mg/m³ | 0,0000 | mg/m³ |
| Influence of sample gas flow | $u_f$ | = | 0,0000 | mg/m³ | -0,1155 | mg/m³ |
| Influence of voltage | $u_v$ | = | 0,1155 | mg/m³ | -0,9238 | mg/m³ |
| Cross-sensitivity | $u_i$ | = | -3,0022 | mg/m³ | 4,6188 | mg/m³ |
| Repeatability at span point | $u_r$ | = | 0,2194 | mg/m³ | 0,4503 | mg/m³ |
| Standard deviation from paired maesurements under field conditions | $u_D$ | = | 1,7853 | mg/m³ | 1,7853 | mg/m³ |
| Uncertainty of provided reference material | $u_{rm}$ | = | 2,3094 | mg/m³ | 2,3094 | mg/m³ |
| Misalignment | $u_{mb}$ | = | 0,0000 | mg/m³ | 0,0000 | mg/m³ |
| Convertion rate of AMS for measurement of NOx | $u_{ce}$ | = | 0,0000 | mg/m³ | 0,0000 | mg/m³ |
| Changes of response fasctors | $u_{rf}$ | = | 0,0000 | mg/m³ | 0,0000 | mg/m³ |

### Calculation of the combined standard uncertainties

| | | **Zero point** | | **Span point** | |
|---|---|---|---|---|---|
| **Combined standard uncertainty** | **s(AMS) values** | 5,0080 | mg/m³ | 6,9800 | mg/m³ |

### Verification of compliance with the requirements

| | | | |
|---|---|---|---|
| Combined standard uncertainty | 7,28 | mg/m³ | according to EN 15267-3 |
| Expanded uncertainty | 14,27 | mg/m³ | according to EN 15267-3 |
| Relative expanded uncertainty | 7,14 | % | of the emissions limit value of 200 mg/m³ |
| Allowed expanded uncertainty | 20,00 | % | of the emissions limit value of 200 mg/m³ |
| Allowed expanded uncertainty | 40,00 | mg/m³ | |

**Result** Requirements fulfilled

# Calculation of measurement uncertainty

## according to EN ISO 14956, EN 14181 and EN 15267-3

Version 5.2

### Device data

| | | | |
|---|---|---|---|
| **Customer** | Vantaan Energia | | |
| **Identification** | JV1 | | |
| **Serial number** | | **Date** | 2013-03-21 |
| **Measuring system** | **MCS100FT** | **Component** | **NO2** |

### Input values

| | | | | | |
|---|---|---|---|---|---|
| Certification range | 100 | mg/m³ | Requirement to response time | 25 | % |
| Emissions limit value | 200 | mg/m³ | Averaging time of measured values | 30 | min |
| Confidence interval | 20 | % | | | |

### Genaral information

| | | | | | |
|---|---|---|---|---|---|
| **Maintenance interval** | 6 | months | **Detection limit** | 0,38 | mg/m³ |

### Required performance regarding dynamic operating conditions

| | | | |
|---|---|---|---|
| Measured response time | 3,30 | min | |
| Requirement to response time | 7,50 | min | 25% of the averaging time of 30 min |

**Result** | Requirements fulfilled

### Calculation of the expanded uncertainty

| **Interferent** | **Zero point** | | **Span point** | |
|---|---|---|---|---|
| 3 Vol% Oxygen (O2) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 21 Vol% Oxygen (O2) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 30 Vol% Water (H2O) | **-1,50** | mg/m³ | **1,00** | mg/m³ |
| 300 mg/m³ Carbon monoxide (CO) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 15 Vol% Carbon dioxide (CO2) | **0,50** | mg/m³ | **-1,10** | mg/m³ |
| 50 mg/m³ Methane (CH4) | **-0,90** | mg/m³ | 0,00 | mg/m³ |
| 20 mg/m³ Dinitrogen oxide (N2O) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 100 mg/m³ Dinitrogen oxide (N2O) | **1,00** | mg/m³ | 0,00 | mg/m³ |
| 300 mg/m³ Nitrogen monoxide (NO) | **3,20** | mg/m³ | **3,00** | mg/m³ |
| 30 mg/m³ Nitrogen dioxide (NO2) | | | | |
| 20 mg/m³ Ammonia (NH3) | 0,00 | mg/m³ | **-1,00** | mg/m³ |
| 200 mg/m³ Sulfur dioxide (SO2) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 1000 mg/m³ Sulfur dioxide (SO2) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 50 mg/m³ Hydrogen chloride (HCl) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 200 mg/m³ Hydrogen chloride (HCl) | 0,00 | mg/m³ | **-2,60** | mg/m³ |

| | | | | |
|---|---|---|---|---|
| Sum of the positive cross-sensitivities | 4,70 | mg/m³ | 4,00 | mg/m³ |
| Sum of the negative cross-sensitivities | -2,40 | mg/m³ | -4,70 | mg/m³ |

# Calculation of measurement uncertainty

## according to EN ISO 14956, EN 14181 and EN 15267-3

Version 5.2

### Device data

| | | | |
|---|---|---|---|
| **Customer** | Vantaan Energia | | |
| **Identification** | JV1 | | |
| **Serial number** | | **Date** | 2013-03-21 |
| **Measuring system** | **MCS100FT** | **Component** | **NO2** |

### Influences of the process characteristics

| **Process characteristics** | **Largest difference according to type approval** | | | |
|---|---|---|---|---|
| | **Zero point** | | **Span point** | |
| Lack-of-fit (Linearity) | 1,40 | mg/m³ | 1,40 | mg/m³ |
| Zero drift from the field test | -2,30 | mg/m³ | 0,00 | mg/m³ |
| Span drift from the field test | 0,00 | mg/m³ | 3,00 | mg/m³ |
| Influence of ambient temperature at span point | 1,30 | mg/m³ | 0,90 | mg/m³ |
| Influence of sample gas pressure | 0,00 | mg/m³ | 0,00 | mg/m³ |
| Influence of sample gas flow | 0,00 | mg/m³ | -0,10 | mg/m³ |
| Influence of voltage | 0,30 | mg/m³ | -0,60 | mg/m³ |
| Cross-sensitivity | 4,70 | mg/m³ | -4,70 | mg/m³ |
| Repeatability at span point | 0,19 | mg/m³ | 0,47 | mg/m³ |
| Standard deviation from paired maesurements under field conditions | 1,09 | mg/m³ | 1,09 | mg/m³ |
| Uncertainty of provided reference material | 2,00 | mg/m³ | 2,00 | mg/m³ |
| Misalignment | 0,00 | mg/m³ | 0,00 | mg/m³ |
| Convertion rate of AMS for measurement of NOx | 0,00 | mg/m³ | 0,00 | mg/m³ |
| Changes of response fasctors | 0,00 | mg/m³ | 0,00 | mg/m³ |

| **Process characteristics** | | | **Standard uncertainty** | | | |
|---|---|---|---|---|---|---|
| | | | **Zero point** | | **Span point** | |
| Lack-of-fit (Linearity) | $u_{lof}$ | = | 0,8083 | mg/m³ | 0,8083 | mg/m³ |
| Zero drift from the field test | $u_{d,z}$ | = | -1,3279 | mg/m³ | 0,0000 | mg/m³ |
| Span drift from the field test | $u_{d,s}$ | = | 0,0000 | mg/m³ | 1,7321 | mg/m³ |
| Influence of ambient temperature at span point | $u_t$ | = | 0,7506 | mg/m³ | 0,5196 | mg/m³ |
| Influence of sample gas pressure | $u_p$ | = | 0,0000 | mg/m³ | 0,0000 | mg/m³ |
| Influence of sample gas flow | $u_f$ | = | 0,0000 | mg/m³ | -0,0577 | mg/m³ |
| Influence of voltage | $u_v$ | = | 0,1732 | mg/m³ | -0,3464 | mg/m³ |
| Cross-sensitivity | $u_i$ | = | 2,7135 | mg/m³ | -2,7135 | mg/m³ |
| Repeatability at span point | $u_r$ | = | 0,1097 | mg/m³ | 0,2714 | mg/m³ |
| Standard deviation from paired maesurements under field conditions | $u_D$ | = | 0,6267 | mg/m³ | 0,6267 | mg/m³ |
| Uncertainty of provided reference material | $u_{rm}$ | = | 1,1547 | mg/m³ | 1,1547 | mg/m³ |
| Misalignment | $u_{mb}$ | = | 0,0000 | mg/m³ | 0,0000 | mg/m³ |
| Convertion rate of AMS for measurement of NOx | $u_{ce}$ | = | 0,0000 | mg/m³ | 0,0000 | mg/m³ |
| Changes of response fasctors | $u_{rf}$ | = | 0,0000 | mg/m³ | 0,0000 | mg/m³ |

### Calculation of the combined standard uncertainties

| | | **Zero point** | | **Span point** | |
|---|---|---|---|---|---|
| **Combined standard uncertainty** | **s(AMS) values** | 3,4784 | mg/m³ | 3,6244 | mg/m³ |

### Verification of compliance with the requirements

| | | | |
|---|---|---|---|
| Combined standard uncertainty | 3,86 | mg/m³ | according to EN 15267-3 |
| Expanded uncertainty | 7,57 | mg/m³ | according to EN 15267-3 |
| Relative expanded uncertainty | 3,78 | % | of the emissions limit value of 200 mg/m³ |
| Allowed expanded uncertainty | 20,00 | % | of the emissions limit value of 200 mg/m³ |
| Allowed expanded uncertainty | 40,00 | mg/m³ | |

**Result** Requirements fulfilled

# Calculation of measurement uncertainty

## according to EN ISO 14956, EN 14181 and EN 15267-3

Version 5.2

### Device data

| | | | |
|---|---|---|---|
| **Customer** | Vantaan Energia | | |
| **Identification** | JV1 | | |
| **Serial number** | | **Date** | 2013-03-21 |
| **Measuring system** | **MCS100FT** | **Component** | **N2O** |

### Input values

| | | | | | | |
|---|---|---|---|---|---|---|
| Certification range | 50 | mg/m³ | | Requirement to response time | 25 | % |
| Measuring range | 20 | mg/m³ | | Averaging time of measured values | 30 | min |
| Confidence interval | 20 | % | * | | | |

Attention: The 2001/80/EC and 2000/76/EC gives no requirements for these components.

### Genaral information

| | | | | | |
|---|---|---|---|---|---|
| **Maintenance interval** | 6 | months | **Detection limit** | 0,08 | mg/m³ |

### Required performance regarding dynamic operating conditions

| | | | |
|---|---|---|---|
| Measured response time | 2,92 | min | |
| Requirement to response time | 7,50 | min | 25% of the averaging time of 30 min |

**Result** Requirements fulfilled

### Calculation of the expanded uncertainty

| **Interferent** | **Zero point** | | **Span point** | |
|---|---|---|---|---|
| 3 Vol% Oxygen (O2) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 21 Vol% Oxygen (O2) | **0,40** | mg/m³ | **0,80** | mg/m³ |
| 30 Vol% Water (H2O) | **-0,50** | mg/m³ | **-0,80** | mg/m³ |
| 300 mg/m³ Carbon monoxide (CO) | 0,00 | mg/m³ | **-0,30** | mg/m³ |
| 15 Vol% Carbon dioxide (CO2) | **-0,70** | mg/m³ | 0,00 | mg/m³ |
| 50 mg/m³ Methane (CH4) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 20 mg/m³ Dinitrogen oxide (N2O) | | | | |
| 100 mg/m³ Dinitrogen oxide (N2O) | | | | |
| 300 mg/m³ Nitrogen monoxide (NO) | **0,95** | mg/m³ | **0,95** | mg/m³ |
| 30 mg/m³ Nitrogen dioxide (NO2) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 20 mg/m³ Ammonia (NH3) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 200 mg/m³ Sulfur dioxide (SO2) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 1000 mg/m³ Sulfur dioxide (SO2) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 50 mg/m³ Hydrogen chloride (HCl) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 200 mg/m³ Hydrogen chloride (HCl) | 0,00 | mg/m³ | 0,00 | mg/m³ |

| | | | | |
|---|---|---|---|---|
| Sum of the positive cross-sensitivities | 1,35 | mg/m³ | 1,75 | mg/m³ |
| Sum of the negative cross-sensitivities | -1,20 | mg/m³ | -1,10 | mg/m³ |

# Calculation of measurement uncertainty

## according to EN ISO 14956, EN 14181 and EN 15267-3

Version 5.2

### Device data

| | | | |
|---|---|---|---|
| **Customer** | Vantaan Energia | | |
| **Identification** | JV1 | | |
| **Serial number** | | **Date** | 2013-03-21 |
| **Measuring system** | **MCS100FT** | **Component** | **N2O** |

### Influences of the process characteristics

| **Process characteristics** | **Largest difference according to type approval** | | | |
|---|---|---|---|---|
| | **Zero point** | | **Span point** | |
| Lack-of-fit (Linearity) | 0,50 | mg/m³ | 0,50 | mg/m³ |
| Zero drift from the field test | 0,25 | mg/m³ | 0,00 | mg/m³ |
| Span drift from the field test | 0,00 | mg/m³ | -0,90 | mg/m³ |
| Influence of ambient temperature at span point | 0,10 | mg/m³ | -0,55 | mg/m³ |
| Influence of sample gas pressure | 0,00 | mg/m³ | 0,00 | mg/m³ |
| Influence of sample gas flow | 0,00 | mg/m³ | -0,05 | mg/m³ |
| Influence of voltage | 0,05 | mg/m³ | 0,20 | mg/m³ |
| Cross-sensitivity | 1,35 | mg/m³ | 1,75 | mg/m³ |
| Repeatability at span point | 0,04 | mg/m³ | 0,25 | mg/m³ |
| Standard deviation from paired maesurements under field conditions | 0,17 | mg/m³ | 0,17 | mg/m³ |
| Uncertainty of provided reference material | 1,00 | mg/m³ | 1,00 | mg/m³ |
| Misalignment | 0,00 | mg/m³ | 0,00 | mg/m³ |
| Convertion rate of AMS for measurement of NOx | 0,00 | mg/m³ | 0,00 | mg/m³ |
| Changes of response fasctors | 0,00 | mg/m³ | 0,00 | mg/m³ |

| **Process characteristics** | | | **Standard uncertainty** | | | |
|---|---|---|---|---|---|---|
| | | | **Zero point** | | **Span point** | |
| Lack-of-fit (Linearity) | $u_{lof}$ | = | 0,2887 | mg/m³ | 0,2887 | mg/m³ |
| Zero drift from the field test | $u_{d,z}$ | = | 0,1443 | mg/m³ | 0,0000 | mg/m³ |
| Span drift from the field test | $u_{d,s}$ | = | 0,0000 | mg/m³ | -0,5196 | mg/m³ |
| Influence of ambient temperature at span point | $u_t$ | = | 0,0577 | mg/m³ | -0,3175 | mg/m³ |
| Influence of sample gas pressure | $u_p$ | = | 0,0000 | mg/m³ | 0,0000 | mg/m³ |
| Influence of sample gas flow | $u_f$ | = | 0,0000 | mg/m³ | -0,0289 | mg/m³ |
| Influence of voltage | $u_v$ | = | 0,0289 | mg/m³ | 0,1155 | mg/m³ |
| Cross-sensitivity | $u_i$ | = | 0,7794 | mg/m³ | 1,0104 | mg/m³ |
| Repeatability at span point | $u_r$ | = | 0,0231 | mg/m³ | 0,1443 | mg/m³ |
| Standard deviation from paired maesurements under field conditions | $u_D$ | = | 0,1009 | mg/m³ | 0,1009 | mg/m³ |
| Uncertainty of provided reference material | $u_{rm}$ | = | 0,5774 | mg/m³ | 0,5774 | mg/m³ |
| Misalignment | $u_{mb}$ | = | 0,0000 | mg/m³ | 0,0000 | mg/m³ |
| Convertion rate of AMS for measurement of NOx | $u_{ce}$ | = | 0,0000 | mg/m³ | 0,0000 | mg/m³ |
| Changes of response fasctors | $u_{rf}$ | = | 0,0000 | mg/m³ | 0,0000 | mg/m³ |

### Calculation of the combined standard uncertainties

| | | **Zero point** | | **Span point** | |
|---|---|---|---|---|---|
| **Combined standard uncertainty** | **s(AMS) values** | 1,0292 | mg/m³ | 1,3577 | mg/m³ |

### Verification of compliance with the requirements

| | | | |
|---|---|---|---|
| Combined standard uncertainty | 1,37 | mg/m³ | according to EN 15267-3 |
| Expanded uncertainty | 2,68 | mg/m³ | according to EN 15267-3 |
| Relative expanded uncertainty | 13,38 | % | of the measuring range of 20 mg/m³ |
| Allowed expanded uncertainty | 20,00 | % | of the measuring range of 20 mg/m³ |
| Allowed expanded uncertainty | 4,00 | mg/m³ | |

**Result** Requirements fulfilled

**Attention: The 2001/80/EC and 2000/76/EC gives no requirements for these components.**

# Calculation of measurement uncertainty

## according to EN ISO 14956, EN 14181 and EN 15267-3

Version 5.2

### Device data

| | | | |
|---|---|---|---|
| **Customer** | Vantaan Energia | | |
| **Identification** | JV1 | | |
| **Serial number** | | **Date** | 2013-03-21 |
| **Measuring system** | **MCS100FT** | **Component** | **SO2** |

### Input values

| | | | | | |
|---|---|---|---|---|---|
| Certification range | 75 | mg/m³ | Requirement to response time | 25 | % |
| Emissions limit value | 50 | mg/m³ | Averaging time of measured values | 30 | min |
| Confidence interval | 20 | % | | | |

### Genaral information

| | | | | | |
|---|---|---|---|---|---|
| **Maintenance interval** | 6 | months | **Detection limit** | 0,24 | mg/m³ |

### Required performance regarding dynamic operating conditions

| | | | |
|---|---|---|---|
| Measured response time | 3,05 | min | |
| Requirement to response time | 7,50 | min | 25% of the averaging time of 30 min |

**Result** | Requirements fulfilled |

### Calculation of the expanded uncertainty

| **Interferent** | **Zero point** | | **Span point** | |
|---|---|---|---|---|
| 3 Vol% Oxygen (O2) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 21 Vol% Oxygen (O2) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 30 Vol% Water (H2O) | **1,28** | mg/m³ | **1,65** | mg/m³ |
| 300 mg/m³ Carbon monoxide (CO) | 0,00 | mg/m³ | **0,83** | mg/m³ |
| 15 Vol% Carbon dioxide (CO2) | **0,75** | mg/m³ | **0,38** | mg/m³ |
| 50 mg/m³ Methane (CH4) | 0,00 | mg/m³ | **0,38** | mg/m³ |
| 20 mg/m³ Dinitrogen oxide (N2O) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 100 mg/m³ Dinitrogen oxide (N2O) | 0,00 | mg/m³ | **0,38** | mg/m³ |
| 300 mg/m³ Nitrogen monoxide (NO) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 30 mg/m³ Nitrogen dioxide (NO2) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 20 mg/m³ Ammonia (NH3) | 0,00 | mg/m³ | **0,38** | mg/m³ |
| 200 mg/m³ Sulfur dioxide (SO2) | | | | |
| 1000 mg/m³ Sulfur dioxide (SO2) | | | | |
| 50 mg/m³ Hydrogen chloride (HCl) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 200 mg/m³ Hydrogen chloride (HCl) | 0,00 | mg/m³ | 0,00 | mg/m³ |

| | | |
|---|---|---|
| Sum of the positive cross-sensitivities | 2,03 mg/m³ | 3,98 mg/m³ |
| Sum of the negative cross-sensitivities | 0,00 mg/m³ | 0,00 mg/m³ |

# Calculation of measurement uncertainty

## according to EN ISO 14956, EN 14181 and EN 15267-3

Version 5.2

### Device data

| | | | |
|---|---|---|---|
| **Customer** | Vantaan Energia | | |
| **Identification** | JV1 | | |
| **Serial number** | | **Date** | 2013-03-21 |
| **Measuring system** | **MCS100FT** | **Component** | **SO2** |

### Influences of the process characteristics

| **Process characteristics** | **Largest difference according to type approval** | | | |
|---|---|---|---|---|
| | **Zero point** | | **Span point** | |
| Lack-of-fit (Linearity) | 0,83 | mg/m³ | 0,83 | mg/m³ |
| Zero drift from the field test | -1,88 | mg/m³ | 0,00 | mg/m³ |
| Span drift from the field test | 0,00 | mg/m³ | 2,33 | mg/m³ |
| Influence of ambient temperature at span point | 0,98 | mg/m³ | -1,13 | mg/m³ |
| Influence of sample gas pressure | 0,00 | mg/m³ | 0,00 | mg/m³ |
| Influence of sample gas flow | 0,00 | mg/m³ | -0,08 | mg/m³ |
| Influence of voltage | -0,60 | mg/m³ | 0,08 | mg/m³ |
| Cross-sensitivity | 2,03 | mg/m³ | 3,98 | mg/m³ |
| Repeatability at span point | 0,12 | mg/m³ | 0,16 | mg/m³ |
| Standard deviation from paired maesurements under field conditions | 0,74 | mg/m³ | 0,74 | mg/m³ |
| Uncertainty of provided reference material | 1,50 | mg/m³ | 1,50 | mg/m³ |
| Misalignment | 0,00 | mg/m³ | 0,00 | mg/m³ |
| Convertion rate of AMS for measurement of NOx | 0,00 | mg/m³ | 0,00 | mg/m³ |
| Changes of response fasctors | 0,00 | mg/m³ | 0,00 | mg/m³ |

| **Process characteristics** | | | **Standard uncertainty** | | | |
|---|---|---|---|---|---|---|
| | | | **Zero point** | | **Span point** | |
| Lack-of-fit (Linearity) | $u_{lof}$ | = | 0,4763 | mg/m³ | 0,4763 | mg/m³ |
| Zero drift from the field test | $u_{d,z}$ | = | -1,0825 | mg/m³ | 0,0000 | mg/m³ |
| Span drift from the field test | $u_{d,s}$ | = | 0,0000 | mg/m³ | 1,3423 | mg/m³ |
| Influence of ambient temperature at span point | $u_t$ | = | 0,5629 | mg/m³ | -0,6495 | mg/m³ |
| Influence of sample gas pressure | $u_p$ | = | 0,0000 | mg/m³ | 0,0000 | mg/m³ |
| Influence of sample gas flow | $u_f$ | = | 0,0000 | mg/m³ | -0,0433 | mg/m³ |
| Influence of voltage | $u_v$ | = | -0,3464 | mg/m³ | 0,0433 | mg/m³ |
| Cross-sensitivity | $u_i$ | = | 1,1691 | mg/m³ | 2,2950 | mg/m³ |
| Repeatability at span point | $u_r$ | = | 0,0693 | mg/m³ | 0,0924 | mg/m³ |
| Standard deviation from paired maesurements under field conditions | $u_D$ | = | 0,4249 | mg/m³ | 0,4249 | mg/m³ |
| Uncertainty of provided reference material | $u_{rm}$ | = | 0,8660 | mg/m³ | 0,8660 | mg/m³ |
| Misalignment | $u_{mb}$ | = | 0,0000 | mg/m³ | 0,0000 | mg/m³ |
| Convertion rate of AMS for measurement of NOx | $u_{ce}$ | = | 0,0000 | mg/m³ | 0,0000 | mg/m³ |
| Changes of response fasctors | $u_{rf}$ | = | 0,0000 | mg/m³ | 0,0000 | mg/m³ |

### Calculation of the combined standard uncertainties

| | | **Zero point** | | **Span point** | |
|---|---|---|---|---|---|
| **Combined standard uncertainty** | **s(AMS) values** | 2,0330 | mg/m³ | 2,9414 | mg/m³ |

### Verification of compliance with the requirements

| | | | |
|---|---|---|---|
| Combined standard uncertainty | 3,15 | mg/m³ | according to EN 15267-3 |
| Expanded uncertainty | 6,18 | mg/m³ | according to EN 15267-3 |
| Relative expanded uncertainty | 12,36 | % | of the emissions limit value of 50 mg/m³ |
| Allowed expanded uncertainty | 20,00 | % | of the emissions limit value of 50 mg/m³ |
| Allowed expanded uncertainty | 10,00 | mg/m³ | |

**Result** Requirements fulfilled

# Calculation of measurement uncertainty

## according to EN ISO 14956, EN 14181 and EN 15267-3

Version 5.2

### Device data

| | | | |
|---|---|---|---|
| **Customer** | Vantaan Energia | | |
| **Identification** | JV1 | | |
| **Serial number** | | **Date** | 2013-03-21 |
| **Measuring system** | **MCS100FT** | **Component** | **HCl** |

### Input values

| | | | | | |
|---|---|---|---|---|---|
| Certification range | 15 | mg/m³ | Requirement to response time | 25 | % |
| Emissions limit value | 10 | mg/m³ | Averaging time of measured values | 30 | min |
| Confidence interval | 40 | % | | | |

### Genaral information

| | | | | | |
|---|---|---|---|---|---|
| **Maintenance interval** | 6 | months | **Detection limit** | 0,08 | mg/m³ |

### Required performance regarding dynamic operating conditions

| | | | |
|---|---|---|---|
| Measured response time | 3,18 | min | |
| Requirement to response time | 7,50 | min | 25% of the averaging time of 30 min |

**Result** | **Requirements fulfilled**

### Calculation of the expanded uncertainty

| **Interferent** | **Zero point** | | **Span point** | |
|---|---|---|---|---|
| 3 Vol% Oxygen (O2) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 21 Vol% Oxygen (O2) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 30 Vol% Water (H2O) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 300 mg/m³ Carbon monoxide (CO) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 15 Vol% Carbon dioxide (CO2) | **0,09** | mg/m³ | 0,00 | mg/m³ |
| 50 mg/m³ Methane (CH4) | **0,14** | mg/m³ | 0,00 | mg/m³ |
| 20 mg/m³ Dinitrogen oxide (N2O) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 100 mg/m³ Dinitrogen oxide (N2O) | **0,23** | mg/m³ | **0,29** | mg/m³ |
| 300 mg/m³ Nitrogen monoxide (NO) | **0,09** | mg/m³ | 0,00 | mg/m³ |
| 30 mg/m³ Nitrogen dioxide (NO2) | 0,00 | mg/m³ | **0,35** | mg/m³ |
| 20 mg/m³ Ammonia (NH3) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 200 mg/m³ Sulfur dioxide (SO2) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 1000 mg/m³ Sulfur dioxide (SO2) | **0,18** | mg/m³ | 0,00 | mg/m³ |
| 50 mg/m³ Hydrogen chloride (HCl) | | | | |
| 200 mg/m³ Hydrogen chloride (HCl) | | | | |

| | | | | |
|---|---|---|---|---|
| Sum of the positive cross-sensitivities | 0,72 | mg/m³ | 0,63 | mg/m³ |
| Sum of the negative cross-sensitivities | 0,00 | mg/m³ | 0,00 | mg/m³ |

# Calculation of measurement uncertainty

## according to EN ISO 14956, EN 14181 and EN 15267-3

Version 5.2

### Device data

| | | | |
|---|---|---|---|
| **Customer** | Vantaan Energia | | |
| **Identification** | JV1 | | |
| **Serial number** | | **Date** | 2013-03-21 |
| **Measuring system** | **MCS100FT** | **Component** | **HCl** |

### Influences of the process characteristics

| **Process characteristics** | **Largest difference according to type approval** | | | |
|---|---|---|---|---|
| | **Zero point** | | **Span point** | |
| Lack-of-fit (Linearity) | 0,30 | mg/m³ | 0,30 | mg/m³ |
| Zero drift from the field test | -0,42 | mg/m³ | 0,00 | mg/m³ |
| Span drift from the field test | 0,00 | mg/m³ | 0,45 | mg/m³ |
| Influence of ambient temperature at span point | 0,12 | mg/m³ | -0,53 | mg/m³ |
| Influence of sample gas pressure | 0,00 | mg/m³ | 0,00 | mg/m³ |
| Influence of sample gas flow | 0,00 | mg/m³ | -0,02 | mg/m³ |
| Influence of voltage | -0,08 | mg/m³ | 0,11 | mg/m³ |
| Cross-sensitivity | 0,72 | mg/m³ | 0,63 | mg/m³ |
| Repeatability at span point | 0,04 | mg/m³ | 0,15 | mg/m³ |
| Standard deviation from paired maesurements under field conditions | 0,16 | mg/m³ | 0,16 | mg/m³ |
| Uncertainty of provided reference material | 0,30 | mg/m³ | 0,30 | mg/m³ |
| Misalignment | 0,00 | mg/m³ | 0,00 | mg/m³ |
| Convertion rate of AMS for measurement of NOx | 0,00 | mg/m³ | 0,00 | mg/m³ |
| Changes of response fasctors | 0,00 | mg/m³ | 0,00 | mg/m³ |

| **Process characteristics** | | | **Standard uncertainty** | | | |
|---|---|---|---|---|---|---|
| | | | **Zero point** | | **Span point** | |
| Lack-of-fit (Linearity) | $u_{lof}$ | = | 0,1732 | mg/m³ | 0,1732 | mg/m³ |
| Zero drift from the field test | $u_{d,z}$ | = | -0,2425 | mg/m³ | 0,0000 | mg/m³ |
| Span drift from the field test | $u_{d,s}$ | = | 0,0000 | mg/m³ | 0,2598 | mg/m³ |
| Influence of ambient temperature at span point | $u_t$ | = | 0,0693 | mg/m³ | -0,3031 | mg/m³ |
| Influence of sample gas pressure | $u_p$ | = | 0,0000 | mg/m³ | 0,0000 | mg/m³ |
| Influence of sample gas flow | $u_f$ | = | 0,0000 | mg/m³ | -0,0087 | mg/m³ |
| Influence of voltage | $u_v$ | = | -0,0433 | mg/m³ | 0,0606 | mg/m³ |
| Cross-sensitivity | $u_i$ | = | 0,4157 | mg/m³ | 0,3637 | mg/m³ |
| Repeatability at span point | $u_r$ | = | 0,0231 | mg/m³ | 0,0866 | mg/m³ |
| Standard deviation from paired maesurements under field conditions | $u_D$ | = | 0,0902 | mg/m³ | 0,0902 | mg/m³ |
| Uncertainty of provided reference material | $u_{rm}$ | = | 0,1732 | mg/m³ | 0,1732 | mg/m³ |
| Misalignment | $u_{mb}$ | = | 0,0000 | mg/m³ | 0,0000 | mg/m³ |
| Convertion rate of AMS for measurement of NOx | $u_{ce}$ | = | 0,0000 | mg/m³ | 0,0000 | mg/m³ |
| Changes of response fasctors | $u_{rf}$ | = | 0,0000 | mg/m³ | 0,0000 | mg/m³ |

### Calculation of the combined standard uncertainties

| | | **Zero point** | | **Span point** | |
|---|---|---|---|---|---|
| **Combined standard uncertainty** | **s(AMS) values** | 0,5535 | mg/m³ | 0,6030 | mg/m³ |

### Verification of compliance with the requirements

| | | | |
|---|---|---|---|
| Combined standard uncertainty | 0,68 | mg/m³ | according to EN 15267-3 |
| Expanded uncertainty | 1,33 | mg/m³ | according to EN 15267-3 |
| Relative expanded uncertainty | 13,33 | % | of the emissions limit value of 10 mg/m³ |
| Allowed expanded uncertainty | 40,00 | % | of the emissions limit value of 10 mg/m³ |
| Allowed expanded uncertainty | 4,00 | mg/m³ | |

**Result** Requirements fulfilled

# Calculation of measurement uncertainty

## according to EN ISO 14956, EN 14181 and EN 15267-3

Version 5.2

### Device data

| | | | |
|---|---|---|---|
| **Customer** | Vantaan Energia | | |
| **Identification** | JV1 | | |
| **Serial number** | | **Date** | 2013-03-21 |
| **Measuring system** | **MCS100FT** | **Component** | **HF** |

### Input values

| | | | | | |
|---|---|---|---|---|---|
| Certification range | 3 | mg/m³ | Requirement to response time | 25 | % |
| Emissions limit value | 1 | mg/m³ | Averaging time of measured values | 30 | min |
| Confidence interval | 40 | % | | | |

### Genaral information

| | | | | | |
|---|---|---|---|---|---|
| **Maintenance interval** | 3 | months | **Detection limit** | 0,08 | mg/m³ |

### Required performance regarding dynamic operating conditions

| | | | |
|---|---|---|---|
| Measured response time | 3,30 | min | |
| Requirement to response time | 7,50 | min | 25% of the averaging time of 30 min |

**Result** Requirements fulfilled

### Calculation of the expanded uncertainty

| Interferent | Zero point | | Span point | |
|---|---|---|---|---|
| 3 Vol% Oxygen (O2) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 21 Vol% Oxygen (O2) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 30 Vol% Water (H2O) | **0,05** | mg/m³ | 0,00 | mg/m³ |
| 300 mg/m³ Carbon monoxide (CO) | **-0,08** | mg/m³ | **-0,08** | mg/m³ |
| 15 Vol% Carbon dioxide (CO2) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 50 mg/m³ Methane (CH4) | **0,07** | mg/m³ | 0,00 | mg/m³ |
| 20 mg/m³ Dinitrogen oxide (N2O) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 100 mg/m³ Dinitrogen oxide (N2O) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 300 mg/m³ Nitrogen monoxide (NO) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 30 mg/m³ Nitrogen dioxide (NO2) | 0,00 | mg/m³ | **0,05** | mg/m³ |
| 20 mg/m³ Ammonia (NH3) | **0,03** | mg/m³ | 0,00 | mg/m³ |
| 200 mg/m³ Sulfur dioxide (SO2) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 1000 mg/m³ Sulfur dioxide (SO2) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 50 mg/m³ Hydrogen chloride (HCl) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 200 mg/m³ Hydrogen chloride (HCl) | **0,03** | mg/m³ | **-0,03** | mg/m³ |

| | | |
|---|---|---|
| Sum of the positive cross-sensitivities | 0,17 mg/m³ | 0,05 mg/m³ |
| Sum of the negative cross-sensitivities | -0,08 mg/m³ | -0,11 mg/m³ |

# Calculation of measurement uncertainty

## according to EN ISO 14956, EN 14181 and EN 15267-3

Version 5.2

### Device data

| | | | |
|---|---|---|---|
| **Customer** | Vantaan Energia | | |
| **Identification** | JV1 | | |
| **Serial number** | | **Date** | 2013-03-21 |
| **Measuring system** | **MCS100FT** | **Component** | **HF** |

### Influences of the process characteristics

| **Process characteristics** | **Largest difference according to type approval** | | | |
|---|---|---|---|---|
| | **Zero point** | | **Span point** | |
| Lack-of-fit (Linearity) | 0,05 | mg/m³ | 0,05 | mg/m³ |
| Zero drift from the field test | -0,12 | mg/m³ | 0,00 | mg/m³ |
| Span drift from the field test | 0,00 | mg/m³ | -0,09 | mg/m³ |
| Influence of ambient temperature at span point | -0,11 | mg/m³ | 0,14 | mg/m³ |
| Influence of sample gas pressure | 0,00 | mg/m³ | 0,00 | mg/m³ |
| Influence of sample gas flow | 0,00 | mg/m³ | 0,00 | mg/m³ |
| Influence of voltage | 0,03 | mg/m³ | 0,04 | mg/m³ |
| Cross-sensitivity | 0,17 | mg/m³ | -0,11 | mg/m³ |
| Repeatability at span point | 0,04 | mg/m³ | 0,05 | mg/m³ |
| Standard deviation from paired maesurements under field conditions | 0,04 | mg/m³ | 0,04 | mg/m³ |
| Uncertainty of provided reference material | 0,06 | mg/m³ | 0,06 | mg/m³ |
| Misalignment | 0,00 | mg/m³ | 0,00 | mg/m³ |
| Convertion rate of AMS for measurement of NOx | 0,00 | mg/m³ | 0,00 | mg/m³ |
| Changes of response fasctors | 0,00 | mg/m³ | 0,00 | mg/m³ |

| **Process characteristics** | | | **Standard uncertainty** | | | |
|---|---|---|---|---|---|---|
| | | | **Zero point** | | **Span point** | |
| Lack-of-fit (Linearity) | $u_{lof}$ | = | 0,0294 | mg/m³ | 0,0294 | mg/m³ |
| Zero drift from the field test | $u_{d,z}$ | = | -0,0675 | mg/m³ | 0,0000 | mg/m³ |
| Span drift from the field test | $u_{d,s}$ | = | 0,0000 | mg/m³ | -0,0520 | mg/m³ |
| Influence of ambient temperature at span point | $u_t$ | = | -0,0641 | mg/m³ | 0,0814 | mg/m³ |
| Influence of sample gas pressure | $u_p$ | = | 0,0000 | mg/m³ | 0,0000 | mg/m³ |
| Influence of sample gas flow | $u_f$ | = | 0,0000 | mg/m³ | -0,0017 | mg/m³ |
| Influence of voltage | $u_v$ | = | 0,0173 | mg/m³ | 0,0225 | mg/m³ |
| Cross-sensitivity | $u_i$ | = | 0,1005 | mg/m³ | -0,0606 | mg/m³ |
| Repeatability at span point | $u_r$ | = | 0,0231 | mg/m³ | 0,0289 | mg/m³ |
| Standard deviation from paired maesurements under field conditions | $u_D$ | = | 0,0221 | mg/m³ | 0,0221 | mg/m³ |
| Uncertainty of provided reference material | $u_{rm}$ | = | 0,0346 | mg/m³ | 0,0346 | mg/m³ |
| Misalignment | $u_{mb}$ | = | 0,0000 | mg/m³ | 0,0000 | mg/m³ |
| Convertion rate of AMS for measurement of NOx | $u_{ce}$ | = | 0,0000 | mg/m³ | 0,0000 | mg/m³ |
| Changes of response fasctors | $u_{rf}$ | = | 0,0000 | mg/m³ | 0,0000 | mg/m³ |

### Calculation of the combined standard uncertainties

| | | **Zero point** | | **Span point** | |
|---|---|---|---|---|---|
| **Combined standard uncertainty** | **s(AMS) values** | 0,1472 | mg/m³ | 0,1281 | mg/m³ |

### Verification of compliance with the requirements

| | | | |
|---|---|---|---|
| Combined standard uncertainty | 0,17 | mg/m³ | according to EN 15267-3 |
| Expanded uncertainty | 0,32 | mg/m³ | according to EN 15267-3 |
| Relative expanded uncertainty | 32,44 | % | of the emissions limit value of 1 mg/m³ |
| Allowed expanded uncertainty | 40,00 | % | of the emissions limit value of 1 mg/m³ |
| Allowed expanded uncertainty | 0,40 | mg/m³ | |

**Result** Requirements fulfilled

# Calculation of measurement uncertainty

## according to EN ISO 14956, EN 14181 and EN 15267-3

Version 5.2

### Device data

| | | | |
|---|---|---|---|
| **Customer** | Vantaan Energia | | |
| **Identification** | JV1 | | |
| **Serial number** | | **Date** | 2013-03-21 |
| **Measuring system** | **MCS100FT** | **Component** | **NH3** |

### Input values

| | | | | | | |
|---|---|---|---|---|---|---|
| Certification range | 10 | mg/m³ | | Requirement to response time | 25 | % |
| Measuring range | 20 | mg/m³ | | Averaging time of measured values | 30 | min |
| Confidence interval | 40 | % | * | | | |

**Attention: The 2001/80/EC and 2000/76/EC gives no requirements for these components.**

### Genaral information

| | | | | | |
|---|---|---|---|---|---|
| **Maintenance interval** | 3 | months | **Detection limit** | 0,05 | mg/m³ |

### Required performance regarding dynamic operating conditions

| | | | |
|---|---|---|---|
| Measured response time | 3,32 | min | |
| Requirement to response time | 7,50 | min | 25% of the averaging time of 30 min |

**Result** Requirements fulfilled

### Calculation of the expanded uncertainty

| **Interferent** | **Zero point** | | **Span point** | |
|---|---|---|---|---|
| 3 Vol% Oxygen (O2) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 21 Vol% Oxygen (O2) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 30 Vol% Water (H2O) | **0,08** | mg/m³ | 0,00 | mg/m³ |
| 300 mg/m³ Carbon monoxide (CO) | **0,07** | mg/m³ | 0,00 | mg/m³ |
| 15 Vol% Carbon dioxide (CO2) | **0,09** | mg/m³ | **-0,10** | mg/m³ |
| 50 mg/m³ Methane (CH4) | **0,12** | mg/m³ | **-0,04** | mg/m³ |
| 20 mg/m³ Dinitrogen oxide (N2O) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 100 mg/m³ Dinitrogen oxide (N2O) | 0,00 | mg/m³ | **0,04** | mg/m³ |
| 300 mg/m³ Nitrogen monoxide (NO) | **0,13** | mg/m³ | **-0,10** | mg/m³ |
| 30 mg/m³ Nitrogen dioxide (NO2) | 0,00 | mg/m³ | **-0,05** | mg/m³ |
| 20 mg/m³ Ammonia (NH3) | | | | |
| 200 mg/m³ Sulfur dioxide (SO2) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 1000 mg/m³ Sulfur dioxide (SO2) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 50 mg/m³ Hydrogen chloride (HCl) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 200 mg/m³ Hydrogen chloride (HCl) | 0,00 | mg/m³ | 0,00 | mg/m³ |

| | | | | |
|---|---|---|---|---|
| Sum of the positive cross-sensitivities | 0,49 | mg/m³ | 0,04 | mg/m³ |
| Sum of the negative cross-sensitivities | 0,00 | mg/m³ | -0,29 | mg/m³ |

# Calculation of measurement uncertainty

## according to EN ISO 14956, EN 14181 and EN 15267-3

Version 5.2

### Device data

| | | | |
|---|---|---|---|
| **Customer** | Vantaan Energia | | |
| **Identification** | JV1 | | |
| **Serial number** | | **Date** | 2013-03-21 |
| **Measuring system** | **MCS100FT** | **Component** | **NH3** |

### Influences of the process characteristics

| **Process characteristics** | **Largest difference according to type approval** | | | |
|---|---|---|---|---|
| | **Zero point** | | **Span point** | |
| Lack-of-fit (Linearity) | -0,06 | mg/m³ | -0,06 | mg/m³ |
| Zero drift from the field test | 0,05 | mg/m³ | 0,00 | mg/m³ |
| Span drift from the field test | 0,00 | mg/m³ | 0,29 | mg/m³ |
| Influence of ambient temperature at span point | -0,05 | mg/m³ | -0,14 | mg/m³ |
| Influence of sample gas pressure | 0,00 | mg/m³ | 0,00 | mg/m³ |
| Influence of sample gas flow | 0,00 | mg/m³ | -0,01 | mg/m³ |
| Influence of voltage | -0,05 | mg/m³ | 0,07 | mg/m³ |
| Cross-sensitivity | 0,49 | mg/m³ | -0,29 | mg/m³ |
| Repeatability at span point | 0,02 | mg/m³ | 0,07 | mg/m³ |
| Standard deviation from paired maesurements under field conditions | 0,08 | mg/m³ | 0,08 | mg/m³ |
| Uncertainty of provided reference material | 0,20 | mg/m³ | 0,20 | mg/m³ |
| Misalignment | 0,00 | mg/m³ | 0,00 | mg/m³ |
| Convertion rate of AMS for measurement of NOx | 0,00 | mg/m³ | 0,00 | mg/m³ |
| Changes of response fasctors | 0,00 | mg/m³ | 0,00 | mg/m³ |

| **Process characteristics** | | | **Standard uncertainty** | | | |
|---|---|---|---|---|---|---|
| | | | **Zero point** | | **Span point** | |
| Lack-of-fit (Linearity) | $u_{lof}$ | = | -0,0346 | mg/m³ | -0,0346 | mg/m³ |
| Zero drift from the field test | $u_{d,z}$ | = | 0,0289 | mg/m³ | 0,0000 | mg/m³ |
| Span drift from the field test | $u_{d,s}$ | = | 0,0000 | mg/m³ | 0,1697 | mg/m³ |
| Influence of ambient temperature at span point | $u_t$ | = | -0,0289 | mg/m³ | -0,0808 | mg/m³ |
| Influence of sample gas pressure | $u_p$ | = | 0,0000 | mg/m³ | 0,0000 | mg/m³ |
| Influence of sample gas flow | $u_f$ | = | 0,0000 | mg/m³ | -0,0058 | mg/m³ |
| Influence of voltage | $u_v$ | = | -0,0289 | mg/m³ | 0,0404 | mg/m³ |
| Cross-sensitivity | $u_i$ | = | 0,2829 | mg/m³ | -0,1674 | mg/m³ |
| Repeatability at span point | $u_r$ | = | 0,0115 | mg/m³ | 0,0404 | mg/m³ |
| Standard deviation from paired maesurements under field conditions | $u_D$ | = | 0,0440 | mg/m³ | 0,0440 | mg/m³ |
| Uncertainty of provided reference material | $u_{rm}$ | = | 0,1155 | mg/m³ | 0,1155 | mg/m³ |
| Misalignment | $u_{mb}$ | = | 0,0000 | mg/m³ | 0,0000 | mg/m³ |
| Convertion rate of AMS for measurement of NOx | $u_{ce}$ | = | 0,0000 | mg/m³ | 0,0000 | mg/m³ |
| Changes of response fasctors | $u_{rf}$ | = | 0,0000 | mg/m³ | 0,0000 | mg/m³ |

### Calculation of the combined standard uncertainties

| | | **Zero point** | | **Span point** | |
|---|---|---|---|---|---|
| **Combined standard uncertainty** | **s(AMS) values** | 0,3146 | mg/m³ | 0,2855 | mg/m³ |

### Verification of compliance with the requirements

| | | | |
|---|---|---|---|
| Combined standard uncertainty | 0,37 | mg/m³ | according to EN 15267-3 |
| Expanded uncertainty | 0,72 | mg/m³ | according to EN 15267-3 |
| Relative expanded uncertainty | 3,59 | % | of the measuring range of 20 mg/m³ |
| Allowed expanded uncertainty | 40,00 | % | of the measuring range of 20 mg/m³ |
| Allowed expanded uncertainty | 8,00 | mg/m³ | |

**Result** Requirements fulfilled

**Attention: The 2001/80/EC and 2000/76/EC gives no requirements for these components.**

# Calculation of measurement uncertainty

## according to EN ISO 14956, EN 14181 and EN 15267-3

Version 5.2

### Device data

| | | | |
|---|---|---|---|
| **Customer** | Vantaan Energia | | |
| **Identification** | JV1 | | |
| **Serial number** | | **Date** | 2013-03-21 |
| **Measuring system** | **MCS100FT** | **Component** | **H2O** |

### Input values

| | | | | | | |
|---|---|---|---|---|---|---|
| Certification range | 40 | Vol% | | Requirement to response time | 25 | % |
| Measuring range | 20 | Vol% | | Averaging time of measured values | 30 | min |
| Confidence interval | 40 | % | * | | | |

Attention: The 2001/80/EC and 2000/76/EC gives no requirements for these components.

### Genaral information

| | | | | | |
|---|---|---|---|---|---|
| **Maintenance interval** | 6 | months | **Detection limit** | 0,04 | Vol% |

### Required performance regarding dynamic operating conditions

| | | | |
|---|---|---|---|
| Measured response time | 2,93 | min | |
| Requirement to response time | 7,50 | min | 25% of the averaging time of 30 min |

**Result** Requirements fulfilled

### Calculation of the expanded uncertainty

| Interferent | Zero point | | Span point | |
|---|---|---|---|---|
| 3 Vol% Oxygen (O2) | 0,00 | Vol% | 0,00 | Vol% |
| 21 Vol% Oxygen (O2) | 0,00 | Vol% | 0,00 | Vol% |
| 30 Vol% Water (H2O) | | | | |
| 300 mg/m³ Carbon monoxide (CO) | **0,80** | Vol% | **0,76** | Vol% |
| 15 Vol% Carbon dioxide (CO2) | 0,00 | Vol% | 0,00 | Vol% |
| 50 mg/m³ Methane (CH4) | **-0,20** | Vol% | **-0,36** | Vol% |
| 20 mg/m³ Dinitrogen oxide (N2O) | 0,00 | Vol% | 0,00 | Vol% |
| 100 mg/m³ Dinitrogen oxide (N2O) | 0,00 | Vol% | 0,00 | Vol% |
| 300 mg/m³ Nitrogen monoxide (NO) | 0,00 | Vol% | 0,00 | Vol% |
| 30 mg/m³ Nitrogen dioxide (NO2) | 0,00 | Vol% | 0,00 | Vol% |
| 20 mg/m³ Ammonia (NH3) | 0,00 | Vol% | **-0,20** | Vol% |
| 200 mg/m³ Sulfur dioxide (SO2) | 0,00 | Vol% | 0,00 | Vol% |
| 1000 mg/m³ Sulfur dioxide (SO2) | 0,00 | Vol% | 0,00 | Vol% |
| 50 mg/m³ Hydrogen chloride (HCl) | 0,00 | Vol% | 0,00 | Vol% |
| 200 mg/m³ Hydrogen chloride (HCl) | 0,00 | Vol% | **-0,20** | Vol% |

| | | |
|---|---|---|
| Sum of the positive cross-sensitivities | 0,80 Vol% | 0,76 Vol% |
| Sum of the negative cross-sensitivities | -0,20 Vol% | -0,76 Vol% |

# Calculation of measurement uncertainty

## according to EN ISO 14956, EN 14181 and EN 15267-3

Version 5.2

### Device data

| | | | |
|---|---|---|---|
| **Customer** | Vantaan Energia | | |
| **Identification** | JV1 | | |
| **Serial number** | | **Date** | 2013-03-21 |
| **Measuring system** | **MCS100FT** | **Component** | **H2O** |

### Influences of the process characteristics

| **Process characteristics** | **Largest difference according to type approval** | | | |
|---|---|---|---|---|
| | **Zero point** | | **Span point** | |
| Lack-of-fit (Linearity) | 0,64 | Vol% | 0,64 | Vol% |
| Zero drift from the field test | -1,04 | Vol% | 0,00 | Vol% |
| Span drift from the field test | 0,00 | Vol% | 1,16 | Vol% |
| Influence of ambient temperature at span point | 0,12 | Vol% | 0,48 | Vol% |
| Influence of sample gas pressure | 0,00 | Vol% | 0,00 | Vol% |
| Influence of sample gas flow | 0,00 | Vol% | -0,04 | Vol% |
| Influence of voltage | 0,08 | Vol% | 0,00 | Vol% |
| Cross-sensitivity | 0,80 | Vol% | 0,76 | Vol% |
| Repeatability at span point | 0,02 | Vol% | 0,06 | Vol% |
| Standard deviation from paired maesurements under field conditions | 0,39 | Vol% | 0,39 | Vol% |
| Uncertainty of provided reference material | 0,80 | Vol% | 0,80 | Vol% |
| Misalignment | 0,00 | Vol% | 0,00 | Vol% |
| Convertion rate of AMS for measurement of NOx | 0,00 | Vol% | 0,00 | Vol% |
| Changes of response fasctors | 0,00 | Vol% | 0,00 | Vol% |

| **Process characteristics** | | | **Standard uncertainty** | | | |
|---|---|---|---|---|---|---|
| | | | **Zero point** | | **Span point** | |
| Lack-of-fit (Linearity) | $u_{lof}$ | = | 0,3695 | Vol% | 0,3695 | Vol% |
| Zero drift from the field test | $u_{d,z}$ | = | -0,6004 | Vol% | 0,0000 | Vol% |
| Span drift from the field test | $u_{d,s}$ | = | 0,0000 | Vol% | 0,6697 | Vol% |
| Influence of ambient temperature at span point | $u_t$ | = | 0,0693 | Vol% | 0,2771 | Vol% |
| Influence of sample gas pressure | $u_p$ | = | 0,0000 | Vol% | 0,0000 | Vol% |
| Influence of sample gas flow | $u_f$ | = | 0,0000 | Vol% | -0,0231 | Vol% |
| Influence of voltage | $u_v$ | = | 0,0462 | Vol% | 0,0000 | Vol% |
| Cross-sensitivity | $u_i$ | = | 0,4619 | Vol% | 0,4388 | Vol% |
| Repeatability at span point | $u_r$ | = | 0,0115 | Vol% | 0,0346 | Vol% |
| Standard deviation from paired maesurements under field conditions | $u_D$ | = | 0,2266 | Vol% | 0,2266 | Vol% |
| Uncertainty of provided reference material | $u_{rm}$ | = | 0,4619 | Vol% | 0,4619 | Vol% |
| Misalignment | $u_{mb}$ | = | 0,0000 | Vol% | 0,0000 | Vol% |
| Convertion rate of AMS for measurement of NOx | $u_{ce}$ | = | 0,0000 | Vol% | 0,0000 | Vol% |
| Changes of response fasctors | $u_{rf}$ | = | 0,0000 | Vol% | 0,0000 | Vol% |

### Calculation of the combined standard uncertainties

| | | **Zero point** | | **Span point** | |
|---|---|---|---|---|---|
| **Combined standard uncertainty** | **s(AMS) values** | 0,9910 | Vol% | 1,0581 | Vol% |

### Verification of compliance with the requirements

| | | | |
|---|---|---|---|
| Combined standard uncertainty | 1,23 | Vol% | according to EN 15267-3 |
| Expanded uncertainty | 2,40 | Vol% | according to EN 15267-3 |
| Relative expanded uncertainty | 12,01 | % | of the measuring range of 20 Vol% |
| Allowed expanded uncertainty | 40,00 | % | of the measuring range of 20 Vol% |
| Allowed expanded uncertainty | 8,00 | Vol% | |

**Result** Requirements fulfilled

**Attention: The 2001/80/EC and 2000/76/EC gives no requirements for these components.**

# Calculation of measurement uncertainty

## according to EN ISO 14956, EN 14181 and EN 15267-3

Version 5.2

### Device data

| | | | |
|---|---|---|---|
| **Customer** | Vantaan Energia | | |
| **Identification** | JV1 | | |
| **Serial number** | | **Date** | 2013-03-21 |
| **Measuring system** | **MCS100FT** | **Component** | **CH4** |

### Input values

| | | | | | | |
|---|---|---|---|---|---|---|
| Certification range | 50 | mg/m³ | | Requirement to response time | 25 | % |
| Measuring range | 20 | mg/m³ | | Averaging time of measured values | 30 | min |
| Confidence interval | 20 | % | * | | | |

**Attention: The 2001/80/EC and 2000/76/EC gives no requirements for these components.**

### Genaral information

| | | | | | |
|---|---|---|---|---|---|
| **Maintenance interval** | 6 | months | **Detection limit** | 0,02 | mg/m³ |

### Required performance regarding dynamic operating conditions

| | | | |
|---|---|---|---|
| Measured response time | 2,95 | min | |
| Requirement to response time | 7,50 | min | 25% of the averaging time of 30 min |

**Result** | Requirements fulfilled |

### Calculation of the expanded uncertainty

| **Interferent** | **Zero point** | | **Span point** | |
|---|---|---|---|---|
| 3 Vol% Oxygen (O2) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 21 Vol% Oxygen (O2) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 30 Vol% Water (H2O) | **0,55** | mg/m³ | **0,70** | mg/m³ |
| 300 mg/m³ Carbon monoxide (CO) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 15 Vol% Carbon dioxide (CO2) | 0,00 | mg/m³ | **-0,35** | mg/m³ |
| 50 mg/m³ Methane (CH4) | | | | |
| 20 mg/m³ Dinitrogen oxide (N2O) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 100 mg/m³ Dinitrogen oxide (N2O) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 300 mg/m³ Nitrogen monoxide (NO) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 30 mg/m³ Nitrogen dioxide (NO2) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 20 mg/m³ Ammonia (NH3) | 0,00 | mg/m³ | **0,65** | mg/m³ |
| 200 mg/m³ Sulfur dioxide (SO2) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 1000 mg/m³ Sulfur dioxide (SO2) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 50 mg/m³ Hydrogen chloride (HCl) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 200 mg/m³ Hydrogen chloride (HCl) | 0,00 | mg/m³ | 0,00 | mg/m³ |

| | | |
|---|---|---|
| Sum of the positive cross-sensitivities | 0,55 mg/m³ | 1,35 mg/m³ |
| Sum of the negative cross-sensitivities | 0,00 mg/m³ | -0,35 mg/m³ |

# Calculation of measurement uncertainty

## according to EN ISO 14956, EN 14181 and EN 15267-3

Version 5.2

### Device data

| | | | |
|---|---|---|---|
| **Customer** | Vantaan Energia | | |
| **Identification** | JV1 | | |
| **Serial number** | | **Date** | 2013-03-21 |
| **Measuring system** | **MCS100FT** | **Component** | **CH4** |

### Influences of the process characteristics

| **Process characteristics** | **Largest difference according to type approval** | | | |
|---|---|---|---|---|
| | **Zero point** | | **Span point** | |
| Lack-of-fit (Linearity) | 0,85 | mg/m³ | 0,85 | mg/m³ |
| Zero drift from the field test | -1,25 | mg/m³ | 0,00 | mg/m³ |
| Span drift from the field test | 0,00 | mg/m³ | -1,50 | mg/m³ |
| Influence of ambient temperature at span point | -0,05 | mg/m³ | 0,70 | mg/m³ |
| Influence of sample gas pressure | 0,00 | mg/m³ | 0,00 | mg/m³ |
| Influence of sample gas flow | 0,00 | mg/m³ | -0,05 | mg/m³ |
| Influence of voltage | -0,05 | mg/m³ | 0,10 | mg/m³ |
| Cross-sensitivity | 0,55 | mg/m³ | 1,35 | mg/m³ |
| Repeatability at span point | 0,01 | mg/m³ | 0,05 | mg/m³ |
| Standard deviation from paired maesurements under field conditions | 0,54 | mg/m³ | 0,54 | mg/m³ |
| Uncertainty of provided reference material | 1,00 | mg/m³ | 1,00 | mg/m³ |
| Misalignment | 0,00 | mg/m³ | 0,00 | mg/m³ |
| Convertion rate of AMS for measurement of NOx | 0,00 | mg/m³ | 0,00 | mg/m³ |
| Changes of response fasctors | 0,00 | mg/m³ | 0,00 | mg/m³ |

| **Process characteristics** | | | **Standard uncertainty** | | | |
|---|---|---|---|---|---|---|
| | | | **Zero point** | | **Span point** | |
| Lack-of-fit (Linearity) | $u_{lof}$ | = | 0,4907 | mg/m³ | 0,4907 | mg/m³ |
| Zero drift from the field test | $u_{d,z}$ | = | -0,7217 | mg/m³ | 0,0000 | mg/m³ |
| Span drift from the field test | $u_{d,s}$ | = | 0,0000 | mg/m³ | -0,8660 | mg/m³ |
| Influence of ambient temperature at span point | $u_t$ | = | -0,0289 | mg/m³ | 0,4041 | mg/m³ |
| Influence of sample gas pressure | $u_p$ | = | 0,0000 | mg/m³ | 0,0000 | mg/m³ |
| Influence of sample gas flow | $u_f$ | = | 0,0000 | mg/m³ | -0,0289 | mg/m³ |
| Influence of voltage | $u_v$ | = | -0,0289 | mg/m³ | 0,0577 | mg/m³ |
| Cross-sensitivity | $u_i$ | = | 0,3175 | mg/m³ | 0,7794 | mg/m³ |
| Repeatability at span point | $u_r$ | = | 0,0058 | mg/m³ | 0,0289 | mg/m³ |
| Standard deviation from paired maesurements under field conditions | $u_D$ | = | 0,3134 | mg/m³ | 0,3134 | mg/m³ |
| Uncertainty of provided reference material | $u_{rm}$ | = | 0,5774 | mg/m³ | 0,5774 | mg/m³ |
| Misalignment | $u_{mb}$ | = | 0,0000 | mg/m³ | 0,0000 | mg/m³ |
| Convertion rate of AMS for measurement of NOx | $u_{ce}$ | = | 0,0000 | mg/m³ | 0,0000 | mg/m³ |
| Changes of response fasctors | $u_{rf}$ | = | 0,0000 | mg/m³ | 0,0000 | mg/m³ |

### Calculation of the combined standard uncertainties

| | | **Zero point** | | **Span point** | |
|---|---|---|---|---|---|
| **Combined standard uncertainty** | **s(AMS) values** | 1,1383 | mg/m³ | 1,4824 | mg/m³ |

### Verification of compliance with the requirements

| | | | |
|---|---|---|---|
| Combined standard uncertainty | 1,65 | mg/m³ | according to EN 15267-3 |
| Expanded uncertainty | 3,23 | mg/m³ | according to EN 15267-3 |
| Relative expanded uncertainty | 16,16 | % | of the measuring range of 20 mg/m³ |
| Allowed expanded uncertainty | 20,00 | % | of the measuring range of 20 mg/m³ |
| Allowed expanded uncertainty | 4,00 | mg/m³ | |

**Result** Requirements fulfilled

**Attention: The 2001/80/EC and 2000/76/EC gives no requirements for these components.**

# Calculation of measurement uncertainty

## according to EN ISO 14956, EN 14181 and EN 15267-3

Version 5.2

### Device data

| | | | |
|---|---|---|---|
| **Customer** | Vantaan Energia | | |
| **Identification** | JV1 | | |
| **Serial number** | | **Date** | 2013-03-21 |
| **Measuring system** | **MCS100FT** | **Component** | **Corg** |

### Input values

| | | | | | |
|---|---|---|---|---|---|
| Certification range | 15 | mg/m³ | Requirement to response time | 25 | % |
| Emissions limit value | 10 | mg/m³ | Averaging time of measured values | 30 | min |
| Confidence interval | 30 | % | | | |

### Genaral information

| | | | | | |
|---|---|---|---|---|---|
| **Maintenance interval** | 2 | months | **Detection limit** | 0 | mg/m³ |

### Required performance regarding dynamic operating conditions

| | | | |
|---|---|---|---|
| Measured response time | 0,82 | min | |
| Requirement to response time | 7,50 | min | 25% of the averaging time of 30 min |

**Result** | Requirements fulfilled |

### Calculation of the expanded uncertainty

| **Interferent** | **Zero point** | | **Span point** | |
|---|---|---|---|---|
| 3 Vol% Oxygen (O2) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 21 Vol% Oxygen (O2) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 30 Vol% Water (H2O) | **0,17** | mg/m³ | **0,18** | mg/m³ |
| 300 mg/m³ Carbon monoxide (CO) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 15 Vol% Carbon dioxide (CO2) | **0,13** | mg/m³ | **-0,15** | mg/m³ |
| 50 mg/m³ Methane (CH4) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 20 mg/m³ Dinitrogen oxide (N2O) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 100 mg/m³ Dinitrogen oxide (N2O) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 300 mg/m³ Nitrogen monoxide (NO) | **0,08** | mg/m³ | 0,00 | mg/m³ |
| 30 mg/m³ Nitrogen dioxide (NO2) | **0,08** | mg/m³ | 0,00 | mg/m³ |
| 20 mg/m³ Ammonia (NH3) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 200 mg/m³ Sulfur dioxide (SO2) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 1000 mg/m³ Sulfur dioxide (SO2) | 0,00 | mg/m³ | **-0,08** | mg/m³ |
| 50 mg/m³ Hydrogen chloride (HCl) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 200 mg/m³ Hydrogen chloride (HCl) | **0,08** | mg/m³ | **0,09** | mg/m³ |

| | | | | |
|---|---|---|---|---|
| Sum of the positive cross-sensitivities | 0,54 | mg/m³ | 0,27 | mg/m³ |
| Sum of the negative cross-sensitivities | 0,00 | mg/m³ | -0,23 | mg/m³ |

# Calculation of measurement uncertainty

## according to EN ISO 14956, EN 14181 and EN 15267-3

Version 5.2

### Device data

| | | | |
|---|---|---|---|
| **Customer** | Vantaan Energia | | |
| **Identification** | JV1 | | |
| **Serial number** | | **Date** | 2013-03-21 |
| **Measuring system** | **MCS100FT** | **Component** | **Corg** |

### Influences of the process characteristics

| **Process characteristics** | **Largest difference according to type approval** | | | |
|---|---|---|---|---|
| | **Zero point** | | **Span point** | |
| Lack-of-fit (Linearity) | 0,10 | mg/m³ | 0,10 | mg/m³ |
| Zero drift from the field test | 0,26 | mg/m³ | 0,00 | mg/m³ |
| Span drift from the field test | 0,00 | mg/m³ | -0,42 | mg/m³ |
| Influence of ambient temperature at span point | 0,21 | mg/m³ | -0,20 | mg/m³ |
| Influence of sample gas pressure | 0,00 | mg/m³ | 0,00 | mg/m³ |
| Influence of sample gas flow | 0,09 | mg/m³ | -0,11 | mg/m³ |
| Influence of voltage | -0,02 | mg/m³ | 0,08 | mg/m³ |
| Cross-sensitivity | 0,54 | mg/m³ | 0,27 | mg/m³ |
| Repeatability at span point | 0,00 | mg/m³ | 0,01 | mg/m³ |
| Standard deviation from paired maesurements under field conditions | 0,05 | mg/m³ | 0,05 | mg/m³ |
| Uncertainty of provided reference material | 0,30 | mg/m³ | 0,30 | mg/m³ |
| Misalignment | 0,00 | mg/m³ | 0,00 | mg/m³ |
| Convertion rate of AMS for measurement of NOx | 0,00 | mg/m³ | 0,00 | mg/m³ |
| Changes of response fasctors | 0,98 | mg/m³ | 0,98 | mg/m³ |

| **Process characteristics** | | | **Standard uncertainty** | | | |
|---|---|---|---|---|---|---|
| | | | **Zero point** | | **Span point** | |
| Lack-of-fit (Linearity) | $u_{lof}$ | = | 0,0580 | mg/m³ | 0,0580 | mg/m³ |
| Zero drift from the field test | $u_{d,z}$ | = | 0,1516 | mg/m³ | 0,0000 | mg/m³ |
| Span drift from the field test | $u_{d,s}$ | = | 0,0000 | mg/m³ | -0,2434 | mg/m³ |
| Influence of ambient temperature at span point | $u_t$ | = | 0,1212 | mg/m³ | -0,1126 | mg/m³ |
| Influence of sample gas pressure | $u_p$ | = | 0,0000 | mg/m³ | 0,0000 | mg/m³ |
| Influence of sample gas flow | $u_f$ | = | 0,0520 | mg/m³ | -0,0606 | mg/m³ |
| Influence of voltage | $u_v$ | = | -0,0087 | mg/m³ | 0,0433 | mg/m³ |
| Cross-sensitivity | $u_i$ | = | 0,3109 | mg/m³ | 0,1559 | mg/m³ |
| Repeatability at span point | $u_r$ | = | 0,0000 | mg/m³ | 0,0058 | mg/m³ |
| Standard deviation from paired maesurements under field conditions | $u_D$ | = | 0,0263 | mg/m³ | 0,0263 | mg/m³ |
| Uncertainty of provided reference material | $u_{rm}$ | = | 0,1732 | mg/m³ | 0,1732 | mg/m³ |
| Misalignment | $u_{mb}$ | = | 0,0000 | mg/m³ | 0,0000 | mg/m³ |
| Convertion rate of AMS for measurement of NOx | $u_{ce}$ | = | 0,0000 | mg/m³ | 0,0000 | mg/m³ |
| Changes of response fasctors | $u_{rf}$ | = | 0,5655 | mg/m³ | 0,5655 | mg/m³ |

### Calculation of the combined standard uncertainties

| | | **Zero point** | | **Span point** | |
|---|---|---|---|---|---|
| **Combined standard uncertainty** | **s(AMS) values** | 0,7007 | mg/m³ | 0,6750 | mg/m³ |

### Verification of compliance with the requirements

| | | | |
|---|---|---|---|
| Combined standard uncertainty | 0,74 | mg/m³ | according to EN 15267-3 |
| Expanded uncertainty | 1,45 | mg/m³ | according to EN 15267-3 |
| Relative expanded uncertainty | 14,55 | % | of the emissions limit value of 10 mg/m³ |
| Allowed expanded uncertainty | 30,00 | % | of the emissions limit value of 10 mg/m³ |
| Allowed expanded uncertainty | 3,00 | mg/m³ | |

**Result** Requirements fulfilled

# Calculation of measurement uncertainty

## according to EN ISO 14956, EN 14181 and EN 15267-3

Version 5.2

### Device data

| | | | |
|---|---|---|---|
| **Customer** | Vantaan Energia | | |
| **Identification** | JV1 | | |
| **Serial number** | | **Date** | 2013-03-21 |
| **Measuring system** | **MCS100FT** | **Component** | **O2** |

### Input values

| | | | | | | |
|---|---|---|---|---|---|---|
| Certification range | 21 | Vol% | | Requirement to response time | 25 | % |
| Measuring range | 20 | Vol% | | Averaging time of measured values | 30 | min |
| Confidence interval | 20 | % | * | | | |

**Attention: The 2001/80/EC and 2000/76/EC gives no requirements for these components.**

### Genaral information

| | | | | | |
|---|---|---|---|---|---|
| **Maintenance interval** | 4 | weeks | **Detection limit** | 0,03 | Vol% |

### Required performance regarding dynamic operating conditions

| | | | |
|---|---|---|---|
| Measured response time | 2,27 | min | |
| Requirement to response time | 7,50 | min | 25% of the averaging time of 30 min |

**Result** | **Requirements fulfilled**

### Calculation of the expanded uncertainty

| **Interferent** | **Zero point** | | **Span point** | |
|---|---|---|---|---|
| 3 Vol% Oxygen (O2) | | | | |
| 21 Vol% Oxygen (O2) | | | | |
| 30 Vol% Water (H2O) | 0,00 | Vol% | 0,00 | Vol% |
| 300 mg/m³ Carbon monoxide (CO) | 0,00 | Vol% | 0,00 | Vol% |
| 15 Vol% Carbon dioxide (CO2) | 0,00 | Vol% | 0,00 | Vol% |
| 50 mg/m³ Methane (CH4) | 0,00 | Vol% | 0,00 | Vol% |
| 20 mg/m³ Dinitrogen oxide (N2O) | 0,00 | Vol% | 0,00 | Vol% |
| 100 mg/m³ Dinitrogen oxide (N2O) | 0,00 | Vol% | 0,00 | Vol% |
| 300 mg/m³ Nitrogen monoxide (NO) | 0,00 | Vol% | 0,00 | Vol% |
| 30 mg/m³ Nitrogen dioxide (NO2) | 0,00 | Vol% | 0,00 | Vol% |
| 20 mg/m³ Ammonia (NH3) | 0,00 | Vol% | 0,00 | Vol% |
| 200 mg/m³ Sulfur dioxide (SO2) | 0,00 | Vol% | 0,00 | Vol% |
| 1000 mg/m³ Sulfur dioxide (SO2) | 0,00 | Vol% | 0,00 | Vol% |
| 50 mg/m³ Hydrogen chloride (HCl) | 0,00 | Vol% | 0,00 | Vol% |
| 200 mg/m³ Hydrogen chloride (HCl) | 0,00 | Vol% | 0,00 | Vol% |

| | | |
|---|---|---|
| Sum of the positive cross-sensitivities | 0,00 Vol% | 0,00 Vol% |
| Sum of the negative cross-sensitivities | 0,00 Vol% | 0,00 Vol% |

# Calculation of measurement uncertainty

## according to EN ISO 14956, EN 14181 and EN 15267-3

Version 5.2

### Device data

| | | | |
|---|---|---|---|
| **Customer** | Vantaan Energia | | |
| **Identification** | JV1 | | |
| **Serial number** | | **Date** | 2013-03-21 |
| **Measuring system** | **MCS100FT** | **Component** | **O2** |

### Influences of the process characteristics

| **Process characteristics** | **Largest difference according to type approval** | | | |
|---|---|---|---|---|
| | **Zero point** | | **Span point** | |
| Lack-of-fit (Linearity) | -0,14 | Vol% | -0,14 | Vol% |
| Zero drift from the field test | 0,18 | Vol% | 0,00 | Vol% |
| Span drift from the field test | 0,00 | Vol% | -0,20 | Vol% |
| Influence of ambient temperature at span point | 0,02 | Vol% | 0,24 | Vol% |
| Influence of sample gas pressure | 0,00 | Vol% | 0,00 | Vol% |
| Influence of sample gas flow | -0,02 | Vol% | 0,01 | Vol% |
| Influence of voltage | 0,01 | Vol% | -0,10 | Vol% |
| Cross-sensitivity | 0,00 | Vol% | 0,00 | Vol% |
| Repeatability at span point | 0,01 | Vol% | 0,01 | Vol% |
| Standard deviation from paired maesurements under field conditions | 0,09 | Vol% | 0,09 | Vol% |
| Uncertainty of provided reference material | 0,42 | Vol% | 0,42 | Vol% |
| Misalignment | 0,00 | Vol% | 0,00 | Vol% |
| Convertion rate of AMS for measurement of NOx | 0,00 | Vol% | 0,00 | Vol% |
| Changes of response fasctors | 0,00 | Vol% | 0,00 | Vol% |

| **Process characteristics** | | | **Standard uncertainty** | | | |
|---|---|---|---|---|---|---|
| | | | **Zero point** | | **Span point** | |
| Lack-of-fit (Linearity) | $u_{lof}$ | = | -0,0808 | Vol% | -0,0808 | Vol% |
| Zero drift from the field test | $u_{d,z}$ | = | 0,1039 | Vol% | 0,0000 | Vol% |
| Span drift from the field test | $u_{d,s}$ | = | 0,0000 | Vol% | -0,1155 | Vol% |
| Influence of ambient temperature at span point | $u_t$ | = | 0,0115 | Vol% | 0,1386 | Vol% |
| Influence of sample gas pressure | $u_p$ | = | 0,0000 | Vol% | 0,0000 | Vol% |
| Influence of sample gas flow | $u_f$ | = | -0,0115 | Vol% | 0,0058 | Vol% |
| Influence of voltage | $u_v$ | = | 0,0058 | Vol% | -0,0577 | Vol% |
| Cross-sensitivity | $u_i$ | = | 0,0000 | Vol% | 0,0000 | Vol% |
| Repeatability at span point | $u_r$ | = | 0,0058 | Vol% | 0,0058 | Vol% |
| Standard deviation from paired maesurements under field conditions | $u_D$ | = | 0,0533 | Vol% | 0,0533 | Vol% |
| Uncertainty of provided reference material | $u_{rm}$ | = | 0,2425 | Vol% | 0,2425 | Vol% |
| Misalignment | $u_{mb}$ | = | 0,0000 | Vol% | 0,0000 | Vol% |
| Convertion rate of AMS for measurement of NOx | $u_{ce}$ | = | 0,0000 | Vol% | 0,0000 | Vol% |
| Changes of response fasctors | $u_{rf}$ | = | 0,0000 | Vol% | 0,0000 | Vol% |

### Calculation of the combined standard uncertainties

| | | **Zero point** | | **Span point** | |
|---|---|---|---|---|---|
| **Combined standard uncertainty** | **s(AMS) values** | 0,2816 | Vol% | 0,3226 | Vol% |

### Verification of compliance with the requirements

| | | | |
|---|---|---|---|
| Combined standard uncertainty | 0,34 | Vol% | according to EN 15267-3 |
| Expanded uncertainty | 0,66 | Vol% | according to EN 15267-3 |
| Relative expanded uncertainty | 3,32 | % | of the measuring range of 20 Vol% |
| Allowed expanded uncertainty | 20,00 | % | of the measuring range of 20 Vol% |
| Allowed expanded uncertainty | 4,00 | Vol% | |

**Result** Requirements fulfilled

**Attention: The 2001/80/EC and 2000/76/EC gives no requirements for these components.**

# Calculation of measurement uncertainty

## according to EN ISO 14956, EN 14181 and EN 15267-3

Version 5.0

### Device data

| | | | |
|---|---|---|---|
| **Customer** | Vantaan Energia | | |
| **Identification** | JV1 at HRSG. Only NO-measurement | | |
| **Serial number** | | **Date** | 2013-03-21 |
| **Measuring system** | **GM32 GMP** | **Component** | **SO2** |

### Influences of the process characteristics

| **Process characteristics** | **Largest difference according to type approval** | | | |
|---|---|---|---|---|
| | **Zero point** | | **Span point** | |
| Lack-of-fit (Linearity) | 0,75 | mg/m³ | 0,75 | mg/m³ |
| Zero drift from the field test | 1,43 | mg/m³ | 0,00 | mg/m³ |
| Span drift from the field test | 0,00 | mg/m³ | -1,58 | mg/m³ |
| Influence of ambient temperature at span point | -0,23 | mg/m³ | 0,38 | mg/m³ |
| Influence of sample gas pressure | 0,60 | mg/m³ | 0,60 | mg/m³ |
| Influence of sample gas flow | 0,00 | mg/m³ | 0,00 | mg/m³ |
| Influence of voltage | 0,30 | mg/m³ | 0,53 | mg/m³ |
| Cross-sensitivity | -1,66 | mg/m³ | -2,55 | mg/m³ |
| Repeatability at span point | 0,00 | mg/m³ | 0,00 | mg/m³ |
| Standard deviation from paired maesurements under field conditions | 1,03 | mg/m³ | 1,03 | mg/m³ |
| Uncertainty of provided reference material | 1,50 | mg/m³ | 1,50 | mg/m³ |
| Misalignment | 0,00 | mg/m³ | 0,00 | mg/m³ |
| Convertion rate of AMS for measurement of NOx | 0,00 | mg/m³ | 0,00 | mg/m³ |
| Changes of response fasctors | 0,00 | mg/m³ | 0,00 | mg/m³ |

| **Process characteristics** | | | **Standard uncertainty** | | | |
|---|---|---|---|---|---|---|
| | | | **Zero point** | | **Span point** | |
| Lack-of-fit (Linearity) | $u_{lof}$ | = | 0,4330 | mg/m³ | 0,4330 | mg/m³ |
| Zero drift from the field test | $u_{d,z}$ | = | 0,8227 | mg/m³ | 0,0000 | mg/m³ |
| Span drift from the field test | $u_{d,s}$ | = | 0,0000 | mg/m³ | -0,9093 | mg/m³ |
| Influence of ambient temperature at span point | $u_t$ | = | -0,1299 | mg/m³ | 0,2165 | mg/m³ |
| Influence of sample gas pressure | $u_p$ | = | 0,3464 | mg/m³ | 0,3464 | mg/m³ |
| Influence of sample gas flow | $u_f$ | = | 0,0000 | mg/m³ | 0,0000 | mg/m³ |
| Influence of voltage | $u_v$ | = | 0,1732 | mg/m³ | 0,3031 | mg/m³ |
| Cross-sensitivity | $u_i$ | = | -0,9570 | mg/m³ | -1,4722 | mg/m³ |
| Repeatability at span point | $u_r$ | = | 0,0000 | mg/m³ | 0,0000 | mg/m³ |
| Standard deviation from paired maesurements under field conditions | $u_D$ | = | 0,5971 | mg/m³ | 0,5971 | mg/m³ |
| Uncertainty of provided reference material | $u_{rm}$ | = | 0,8660 | mg/m³ | 0,8660 | mg/m³ |
| Misalignment | $u_{mb}$ | = | 0,0000 | mg/m³ | 0,0000 | mg/m³ |
| Convertion rate of AMS for measurement of NOx | $u_{ce}$ | = | 0,0000 | mg/m³ | 0,0000 | mg/m³ |
| Changes of response fasctors | $u_{rf}$ | = | 0,0000 | mg/m³ | 0,0000 | mg/m³ |

### Calculation of the combined standard uncertainties

| | | **Zero point** | | **Span point** | |
|---|---|---|---|---|---|
| **Combined standard uncertainty** | **s(AMS) values** | 1,7474 | mg/m³ | 2,1324 | mg/m³ |

### Verification of compliance with the requirements

| | | | |
|---|---|---|---|
| Combined standard uncertainty | 2,29 | mg/m³ | according to EN 15267-3 |
| Expanded uncertainty | 4,48 | mg/m³ | according to EN 15267-3 |
| Relative expanded uncertainty | 4,48 | % | of the emissions limit value of 100 mg/m³ |
| Allowed expanded uncertainty | 20,00 | % | of the emissions limit value of 100 mg/m³ |
| Allowed expanded uncertainty | 20,00 | mg/m³ | |

**Result** Requirements fulfilled

# Calculation of measurement uncertainty

## according to EN ISO 14956, EN 14181 and EN 15267-3

Version 5.2

### Device data

| | |
|---|---|
| Customer | VE 87460-J0-CFC-00020 |
| Identification | J1CFC01, J1CFC02. J2CFC01, J2CFC02 |
| Serial number | |
| Date | 2013-03-21 |

**Measuring system** **MCS100FT**

### Input values

| Component | Certification range | | Emissions limit value | | | Confidence interval | |
|---|---|---|---|---|---|---|---|
| CO | 75,00 | mg/m³ | 50,00 | mg/m³ | | 10 | % |
| CO2 | 25,00 | Vol% | 20,00 | Vol% | * | 20 | % * |
| NO | 200,00 | mg/m³ | 200,00 | ** mg/m³ | | 20 | % |
| NO2 | 100,00 | mg/m³ | 200,00 | mg/m³ | | 20 | % |
| N2O | 50,00 | mg/m³ | 20,00 | mg/m³ | * | 20 | % * |
| SO2 | 75,00 | mg/m³ | 50,00 | mg/m³ | | 20 | % |
| HCl | 15,00 | mg/m³ | 10,00 | mg/m³ | | 40 | % |
| HF | 3,00 | mg/m³ | 1,00 | mg/m³ | | 40 | % |
| NH3 | 10,00 | mg/m³ | 20,00 | mg/m³ | * | 40 | % * |
| H2O | 40,00 | Vol% | 20,00 | Vol% | * | 40 | % * |
| CH4 | 50,00 | mg/m³ | 20,00 | mg/m³ | * | 20 | % * |
| Corg | 15,00 | mg/m³ | 10,00 | mg/m³ | | 30 | % |
| O2 | 21,00 | Vol% | 20,00 | Vol% | * | 20 | % * |

* For this measuring component no emission limit values and confidence intervals are defined: Therefore full scale values and exemplary confidence intervals are used here.

** The emissions limit value for NOx is give as NO2-concentration, therefore the value as NO-concentration is decreased by the factor 1.53.

| Interferent | Concentration | |
|---|---|---|
| Oxygen (O2) | 3,00 | Vol% |
| Oxygen (O2) | 21,00 | Vol% |
| Water (H2O) | 30,00 | Vol% |
| Carbon monoxide (CO) | 300,00 | mg/m³ |
| Carbon dioxide (CO2) | 15,00 | Vol% |
| Methane (CH4) | 50,00 | mg/m³ |
| Dinitrogen oxide (N2O) | 20,00 | mg/m³ |
| Dinitrogen oxide (N2O) | 100,00 | mg/m³ |
| Nitrogen monoxide (NO) | 300,00 | mg/m³ |
| Nitrogen dioxide (NO2) | 30,00 | mg/m³ |

| Interferent | Concentration | |
|---|---|---|
| Ammonia (NH3) | 20,00 | mg/m³ |
| Sulfur dioxide (SO2) | 200,00 | mg/m³ |
| Sulfur dioxide (SO2) | 1 000,00 | mg/m³ |
| Hydrogen chloride (HCl) | 50,00 | mg/m³ |
| Hydrogen chloride (HCl) | 200,00 | mg/m³ |
| | | |
| | | |
| | | |
| | | |
| | | |

**Required quality of the measurement**

| | | | |
|---|---|---|---|
| Requirement to response time | 25 | % ** | Requirement of the legislation, the customer or authority |
| Averaging time of measured values | 30 | min | |

** *Possible values are 25% for dynamic (standard) or 10 % for highly dynamic processes (EN ISO 14956, 7.2)*

### Summary of the results

| Component | Response time | s(AMS) values | | Quality of the measurement |
|---|---|---|---|---|
| | | Zero point | Span point | |
| CO | Requirements fulfilled | 1,6432 | 2,2629 | Requirements fulfilled |
| CO2 | Requirements fulfilled | 0,6360 | 0,7807 | Requirements fulfilled |
| NO | Requirements fulfilled | 5,0080 | 6,9800 | Requirements fulfilled |
| NO2 | Requirements fulfilled | 3,4784 | 3,6244 | Requirements fulfilled |
| N2O | Requirements fulfilled | 1,0292 | 1,3577 | Requirements fulfilled |
| SO2 | Requirements fulfilled | 2,0330 | 2,9414 | Requirements fulfilled |
| HCl | Requirements fulfilled | 0,5535 | 0,6030 | Requirements fulfilled |
| HF | Requirements fulfilled | 0,1472 | 0,1281 | Requirements fulfilled |
| NH3 | Requirements fulfilled | 0,3146 | 0,2855 | Requirements fulfilled |
| H2O | Requirements fulfilled | 0,9910 | 1,0581 | Requirements fulfilled |
| CH4 | Requirements fulfilled | 1,1383 | 1,4824 | Requirements fulfilled |
| Corg | Requirements fulfilled | 0,7007 | 0,6750 | Requirements fulfilled |
| O2 | Requirements fulfilled | 0,2816 | 0,3226 | Requirements fulfilled |

# Calculation of measurement uncertainty

## according to EN ISO 14956, EN 14181 and EN 15267-3

Version 5.2

### Device data

| | | | |
|---|---|---|---|
| **Customer** | Vantaan Energia | | |
| **Identification** | JV1 | | |
| **Serial number** | | **Date** | 2013-03-21 |
| **Measuring system** | **MCS100FT** | **Component** | **CO** |

### Input values

| | | | | | |
|---|---|---|---|---|---|
| Certification range | 75 | mg/m³ | Requirement to response time | 25 | % |
| Emissions limit value | 50 | mg/m³ | Averaging time of measured values | 30 | min |
| Confidence interval | 10 | % | | | |

### Genaral information

| | | | | | |
|---|---|---|---|---|---|
| **Maintenance interval** | 6 | months | **Detection limit** | 0,32 | mg/m³ |

### Required performance regarding dynamic operating conditions

| | | | |
|---|---|---|---|
| Measured response time | 2,97 | min | |
| Requirement to response time | 7,50 | min | 25% of the averaging time of 30 min |

**Result** | Requirements fulfilled |

### Calculation of the expanded uncertainty

| **Interferent** | **Zero point** | | **Span point** | |
|---|---|---|---|---|
| 3 Vol% Oxygen (O2) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 21 Vol% Oxygen (O2) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 30 Vol% Water (H2O) | 0,00 | mg/m³ | **0,75** | mg/m³ |
| 300 mg/m³ Carbon monoxide (CO) | | | | |
| 15 Vol% Carbon dioxide (CO2) | **1,20** | mg/m³ | 0,00 | mg/m³ |
| 50 mg/m³ Methane (CH4) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 20 mg/m³ Dinitrogen oxide (N2O) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 100 mg/m³ Dinitrogen oxide (N2O) | **-1,35** | mg/m³ | **-2,63** | mg/m³ |
| 300 mg/m³ Nitrogen monoxide (NO) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 30 mg/m³ Nitrogen dioxide (NO2) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 20 mg/m³ Ammonia (NH3) | 0,00 | mg/m³ | **0,53** | mg/m³ |
| 200 mg/m³ Sulfur dioxide (SO2) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 1000 mg/m³ Sulfur dioxide (SO2) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 50 mg/m³ Hydrogen chloride (HCl) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 200 mg/m³ Hydrogen chloride (HCl) | 0,00 | mg/m³ | 0,00 | mg/m³ |

| | | |
|---|---|---|
| Sum of the positive cross-sensitivities | 1,20 mg/m³ | 1,28 mg/m³ |
| Sum of the negative cross-sensitivities | -1,35 mg/m³ | -2,63 mg/m³ |

# Calculation of measurement uncertainty

## according to EN ISO 14956, EN 14181 and EN 15267-3

Version 5.2

### Device data

| | | | |
|---|---|---|---|
| **Customer** | Vantaan Energia | | |
| **Identification** | JV1 | | |
| **Serial number** | | **Date** | 2013-03-21 |
| **Measuring system** | **MCS100FT** | **Component** | **CO** |

### Influences of the process characteristics

| **Process characteristics** | **Largest difference according to type approval** | | | |
|---|---|---|---|---|
| | **Zero point** | | **Span point** | |
| Lack-of-fit (Linearity) | 1,50 | mg/m³ | 1,50 | mg/m³ |
| Zero drift from the field test | 1,13 | mg/m³ | 0,00 | mg/m³ |
| Span drift from the field test | 0,00 | mg/m³ | -1,35 | mg/m³ |
| Influence of ambient temperature at span point | 0,15 | mg/m³ | -1,28 | mg/m³ |
| Influence of sample gas pressure | 0,00 | mg/m³ | 0,00 | mg/m³ |
| Influence of sample gas flow | 0,00 | mg/m³ | -0,08 | mg/m³ |
| Influence of voltage | 0,15 | mg/m³ | 0,23 | mg/m³ |
| Cross-sensitivity | -1,35 | mg/m³ | -2,63 | mg/m³ |
| Repeatability at span point | 0,16 | mg/m³ | 0,22 | mg/m³ |
| Standard deviation from paired maesurements under field conditions | 0,68 | mg/m³ | 0,68 | mg/m³ |
| Uncertainty of provided reference material | 1,50 | mg/m³ | 1,50 | mg/m³ |
| Misalignment | 0,00 | mg/m³ | 0,00 | mg/m³ |
| Convertion rate of AMS for measurement of NOx | 0,00 | mg/m³ | 0,00 | mg/m³ |
| Changes of response fasctors | 0,00 | mg/m³ | 0,00 | mg/m³ |

| **Process characteristics** | | | **Standard uncertainty** | | | |
|---|---|---|---|---|---|---|
| | | | **Zero point** | | **Span point** | |
| Lack-of-fit (Linearity) | $u_{lof}$ | = | 0,8660 | mg/m³ | 0,8660 | mg/m³ |
| Zero drift from the field test | $u_{d,z}$ | = | 0,6495 | mg/m³ | 0,0000 | mg/m³ |
| Span drift from the field test | $u_{d,s}$ | = | 0,0000 | mg/m³ | -0,7794 | mg/m³ |
| Influence of ambient temperature at span point | $u_t$ | = | 0,0866 | mg/m³ | -0,7361 | mg/m³ |
| Influence of sample gas pressure | $u_p$ | = | 0,0000 | mg/m³ | 0,0000 | mg/m³ |
| Influence of sample gas flow | $u_f$ | = | 0,0000 | mg/m³ | -0,0433 | mg/m³ |
| Influence of voltage | $u_v$ | = | 0,0866 | mg/m³ | 0,1299 | mg/m³ |
| Cross-sensitivity | $u_i$ | = | -0,7794 | mg/m³ | -1,5155 | mg/m³ |
| Repeatability at span point | $u_r$ | = | 0,0924 | mg/m³ | 0,1270 | mg/m³ |
| Standard deviation from paired maesurements under field conditions | $u_D$ | = | 0,3945 | mg/m³ | 0,3945 | mg/m³ |
| Uncertainty of provided reference material | $u_{rm}$ | = | 0,8660 | mg/m³ | 0,8660 | mg/m³ |
| Misalignment | $u_{mb}$ | = | 0,0000 | mg/m³ | 0,0000 | mg/m³ |
| Convertion rate of AMS for measurement of NOx | $u_{ce}$ | = | 0,0000 | mg/m³ | 0,0000 | mg/m³ |
| Changes of response fasctors | $u_{rf}$ | = | 0,0000 | mg/m³ | 0,0000 | mg/m³ |

### Calculation of the combined standard uncertainties

| | | **Zero point** | | **Span point** | |
|---|---|---|---|---|---|
| **Combined standard uncertainty** | **s(AMS) values** | 1,6432 | mg/m³ | 2,2629 | mg/m³ |

### Verification of compliance with the requirements

| | | | |
|---|---|---|---|
| Combined standard uncertainty | 2,35 | mg/m³ | according to EN 15267-3 |
| Expanded uncertainty | 4,61 | mg/m³ | according to EN 15267-3 |
| Relative expanded uncertainty | 9,23 | % | of the emissions limit value of 50 mg/m³ |
| Allowed expanded uncertainty | 10,00 | % | of the emissions limit value of 50 mg/m³ |
| Allowed expanded uncertainty | 5,00 | mg/m³ | |

**Result** Requirements fulfilled

# Calculation of measurement uncertainty

## according to EN ISO 14956, EN 14181 and EN 15267-3

Version 5.2

### Device data

| | | | |
|---|---|---|---|
| **Customer** | Vantaan Energia | | |
| **Identification** | JV1 | | |
| **Serial number** | | **Date** | 2013-03-21 |
| **Measuring system** | **MCS100FT** | **Component** | **CO2** |

### Input values

| | | | | | | |
|---|---|---|---|---|---|---|
| Certification range | 25 | Vol% | | Requirement to response time | 25 | % |
| Measuring range | 20 | Vol% | | Averaging time of measured values | 30 | min |
| Confidence interval | 20 | % | * | | | |

**Attention: The 2001/80/EC and 2000/76/EC gives no requirements for these components.**

### Genaral information

| | | | | | |
|---|---|---|---|---|---|
| **Maintenance interval** | 3 | months | **Detection limit** | 0,06 | Vol% |

### Required performance regarding dynamic operating conditions

| | | | |
|---|---|---|---|
| Measured response time | 3,03 | min | |
| Requirement to response time | 7,50 | min | 25% of the averaging time of 30 min |

**Result** Requirements fulfilled

### Calculation of the expanded uncertainty

| **Interferent** | **Zero point** | | **Span point** | |
|---|---|---|---|---|
| 3 Vol% Oxygen (O2) | 0,00 | Vol% | 0,00 | Vol% |
| 21 Vol% Oxygen (O2) | 0,00 | Vol% | 0,00 | Vol% |
| 30 Vol% Water (H2O) | **-0,33** | Vol% | **0,48** | Vol% |
| 300 mg/m³ Carbon monoxide (CO) | 0,00 | Vol% | 0,00 | Vol% |
| 15 Vol% Carbon dioxide (CO2) | | | | |
| 50 mg/m³ Methane (CH4) | 0,00 | Vol% | 0,00 | Vol% |
| 20 mg/m³ Dinitrogen oxide (N2O) | 0,00 | Vol% | 0,00 | Vol% |
| 100 mg/m³ Dinitrogen oxide (N2O) | **-0,40** | Vol% | **-0,35** | Vol% |
| 300 mg/m³ Nitrogen monoxide (NO) | 0,00 | Vol% | 0,00 | Vol% |
| 30 mg/m³ Nitrogen dioxide (NO2) | 0,00 | Vol% | 0,00 | Vol% |
| 20 mg/m³ Ammonia (NH3) | 0,00 | Vol% | **-0,35** | Vol% |
| 200 mg/m³ Sulfur dioxide (SO2) | 0,00 | Vol% | 0,00 | Vol% |
| 1000 mg/m³ Sulfur dioxide (SO2) | 0,00 | Vol% | **0,33** | Vol% |
| 50 mg/m³ Hydrogen chloride (HCl) | 0,00 | Vol% | 0,00 | Vol% |
| 200 mg/m³ Hydrogen chloride (HCl) | 0,00 | Vol% | **-0,13** | Vol% |

| | | |
|---|---|---|
| Sum of the positive cross-sensitivities | 0,00 Vol% | 0,80 Vol% |
| Sum of the negative cross-sensitivities | -0,73 Vol% | -0,83 Vol% |

# Calculation of measurement uncertainty

## according to EN ISO 14956, EN 14181 and EN 15267-3

Version 5.2

### Device data

| | | | |
|---|---|---|---|
| **Customer** | Vantaan Energia | | |
| **Identification** | JV1 | | |
| **Serial number** | | **Date** | 2013-03-21 |
| **Measuring system** | **MCS100FT** | **Component** | **CO2** |

### Influences of the process characteristics

| **Process characteristics** | **Largest difference according to type approval** | | | |
|---|---|---|---|---|
| | **Zero point** | | **Span point** | |
| Lack-of-fit (Linearity) | 0,18 | Vol% | 0,18 | Vol% |
| Zero drift from the field test | 0,53 | Vol% | 0,00 | Vol% |
| Span drift from the field test | 0,00 | Vol% | 0,68 | Vol% |
| Influence of ambient temperature at span point | 0,08 | Vol% | 0,53 | Vol% |
| Influence of sample gas pressure | 0,00 | Vol% | 0,00 | Vol% |
| Influence of sample gas flow | 0,00 | Vol% | -0,03 | Vol% |
| Influence of voltage | -0,03 | Vol% | 0,10 | Vol% |
| Cross-sensitivity | -0,73 | Vol% | -0,83 | Vol% |
| Repeatability at span point | 0,03 | Vol% | 0,05 | Vol% |
| Standard deviation from paired maesurements under field conditions | 0,35 | Vol% | 0,35 | Vol% |
| Uncertainty of provided reference material | 0,50 | Vol% | 0,50 | Vol% |
| Misalignment | 0,00 | Vol% | 0,00 | Vol% |
| Convertion rate of AMS for measurement of NOx | 0,00 | Vol% | 0,00 | Vol% |
| Changes of response fasctors | 0,00 | Vol% | 0,00 | Vol% |

| **Process characteristics** | | | **Standard uncertainty** | | | |
|---|---|---|---|---|---|---|
| | | | **Zero point** | | **Span point** | |
| Lack-of-fit (Linearity) | $u_{lof}$ | = | 0,1010 | Vol% | 0,1010 | Vol% |
| Zero drift from the field test | $u_{d,z}$ | = | 0,3031 | Vol% | 0,0000 | Vol% |
| Span drift from the field test | $u_{d,s}$ | = | 0,0000 | Vol% | 0,3897 | Vol% |
| Influence of ambient temperature at span point | $u_t$ | = | 0,0433 | Vol% | 0,3031 | Vol% |
| Influence of sample gas pressure | $u_p$ | = | 0,0000 | Vol% | 0,0000 | Vol% |
| Influence of sample gas flow | $u_f$ | = | 0,0000 | Vol% | -0,0144 | Vol% |
| Influence of voltage | $u_v$ | = | -0,0144 | Vol% | 0,0577 | Vol% |
| Cross-sensitivity | $u_i$ | = | -0,4186 | Vol% | -0,4763 | Vol% |
| Repeatability at span point | $u_r$ | = | 0,0173 | Vol% | 0,0289 | Vol% |
| Standard deviation from paired maesurements under field conditions | $u_D$ | = | 0,2046 | Vol% | 0,2046 | Vol% |
| Uncertainty of provided reference material | $u_{rm}$ | = | 0,2887 | Vol% | 0,2887 | Vol% |
| Misalignment | $u_{mb}$ | = | 0,0000 | Vol% | 0,0000 | Vol% |
| Convertion rate of AMS for measurement of NOx | $u_{ce}$ | = | 0,0000 | Vol% | 0,0000 | Vol% |
| Changes of response fasctors | $u_{rf}$ | = | 0,0000 | Vol% | 0,0000 | Vol% |

### Calculation of the combined standard uncertainties

| | | **Zero point** | | **Span point** | |
|---|---|---|---|---|---|
| **Combined standard uncertainty** | **s(AMS) values** | 0,6360 | Vol% | 0,7807 | Vol% |

### Verification of compliance with the requirements

| | | | |
|---|---|---|---|
| Combined standard uncertainty | 0,84 | Vol% | according to EN 15267-3 |
| Expanded uncertainty | 1,64 | Vol% | according to EN 15267-3 |
| Relative expanded uncertainty | 8,21 | % | of the measuring range of 20 Vol% |
| Allowed expanded uncertainty | 20,00 | % | of the measuring range of 20 Vol% |
| Allowed expanded uncertainty | 4,00 | Vol% | |

**Result** Requirements fulfilled

**Attention: The 2001/80/EC and 2000/76/EC gives no requirements for these components.**

# Calculation of measurement uncertainty

## according to EN ISO 14956, EN 14181 and EN 15267-3

Version 5.2

### Device data

| | | | |
|---|---|---|---|
| **Customer** | Vantaan Energia | | |
| **Identification** | JV1 | | |
| **Serial number** | | **Date** | 2013-03-21 |
| **Measuring system** | **MCS100FT** | **Component** | **NO** |

### Input values

| | | | | | |
|---|---|---|---|---|---|
| Certification range | 200 | mg/m³ | Requirement to response time | 25 | % |
| Emissions limit value | 200 | mg/m³ | Averaging time of measured values | 30 | min |
| Confidence interval | 20 | % | | | |

### Genaral information

| | | | | | |
|---|---|---|---|---|---|
| **Maintenance interval** | 6 | months | **Detection limit** | 0,76 | mg/m³ |

### Required performance regarding dynamic operating conditions

| | | | |
|---|---|---|---|
| Measured response time | 2,93 | min | |
| Requirement to response time | 7,50 | min | 25% of the averaging time of 30 min |

**Result** | Requirements fulfilled |

### Calculation of the expanded uncertainty

| **Interferent** | **Zero point** | | **Span point** | |
|---|---|---|---|---|
| 3 Vol% Oxygen (O2) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 21 Vol% Oxygen (O2) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 30 Vol% Water (H2O) | **-5,20** | mg/m³ | **3,20** | mg/m³ |
| 300 mg/m³ Carbon monoxide (CO) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 15 Vol% Carbon dioxide (CO2) | 0,00 | mg/m³ | **-4,80** | mg/m³ |
| 50 mg/m³ Methane (CH4) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 20 mg/m³ Dinitrogen oxide (N2O) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 100 mg/m³ Dinitrogen oxide (N2O) | 0,00 | mg/m³ | **2,00** | mg/m³ |
| 300 mg/m³ Nitrogen monoxide (NO) | | | | |
| 30 mg/m³ Nitrogen dioxide (NO2) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 20 mg/m³ Ammonia (NH3) | **1,40** | mg/m³ | 0,00 | mg/m³ |
| 200 mg/m³ Sulfur dioxide (SO2) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 1000 mg/m³ Sulfur dioxide (SO2) | 0,00 | mg/m³ | **1,20** | mg/m³ |
| 50 mg/m³ Hydrogen chloride (HCl) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 200 mg/m³ Hydrogen chloride (HCl) | 0,00 | mg/m³ | **1,60** | mg/m³ |

| | | | | |
|---|---|---|---|---|
| Sum of the positive cross-sensitivities | 1,40 | mg/m³ | 8,00 | mg/m³ |
| Sum of the negative cross-sensitivities | -5,20 | mg/m³ | -4,80 | mg/m³ |

# Calculation of measurement uncertainty

## according to EN ISO 14956, EN 14181 and EN 15267-3

Version 5.2

### Device data

| | | | |
|---|---|---|---|
| **Customer** | Vantaan Energia | | |
| **Identification** | JV1 | | |
| **Serial number** | | **Date** | 2013-03-21 |
| **Measuring system** | **MCS100FT** | **Component** | **NO** |

### Influences of the process characteristics

| **Process characteristics** | **Largest difference according to type approval** | | | |
|---|---|---|---|---|
| | **Zero point** | | **Span point** | |
| Lack-of-fit (Linearity) | 3,00 | mg/m³ | 3,00 | mg/m³ |
| Zero drift from the field test | 3,60 | mg/m³ | 0,00 | mg/m³ |
| Span drift from the field test | 0,00 | mg/m³ | -6,00 | mg/m³ |
| Influence of ambient temperature at span point | -0,80 | mg/m³ | -3,00 | mg/m³ |
| Influence of sample gas pressure | 0,00 | mg/m³ | 0,00 | mg/m³ |
| Influence of sample gas flow | 0,00 | mg/m³ | -0,20 | mg/m³ |
| Influence of voltage | 0,20 | mg/m³ | -1,60 | mg/m³ |
| Cross-sensitivity | -5,20 | mg/m³ | 8,00 | mg/m³ |
| Repeatability at span point | 0,38 | mg/m³ | 0,78 | mg/m³ |
| Standard deviation from paired maesurements under field conditions | 3,09 | mg/m³ | 3,09 | mg/m³ |
| Uncertainty of provided reference material | 4,00 | mg/m³ | 4,00 | mg/m³ |
| Misalignment | 0,00 | mg/m³ | 0,00 | mg/m³ |
| Convertion rate of AMS for measurement of NOx | 0,00 | mg/m³ | 0,00 | mg/m³ |
| Changes of response fasctors | 0,00 | mg/m³ | 0,00 | mg/m³ |

| **Process characteristics** | | | **Standard uncertainty** | | | |
|---|---|---|---|---|---|---|
| | | | **Zero point** | | **Span point** | |
| Lack-of-fit (Linearity) | $u_{lof}$ | = | 1,7321 | mg/m³ | 1,7321 | mg/m³ |
| Zero drift from the field test | $u_{d,z}$ | = | 2,0785 | mg/m³ | 0,0000 | mg/m³ |
| Span drift from the field test | $u_{d,s}$ | = | 0,0000 | mg/m³ | -3,4641 | mg/m³ |
| Influence of ambient temperature at span point | $u_t$ | = | -0,4619 | mg/m³ | -1,7321 | mg/m³ |
| Influence of sample gas pressure | $u_p$ | = | 0,0000 | mg/m³ | 0,0000 | mg/m³ |
| Influence of sample gas flow | $u_f$ | = | 0,0000 | mg/m³ | -0,1155 | mg/m³ |
| Influence of voltage | $u_v$ | = | 0,1155 | mg/m³ | -0,9238 | mg/m³ |
| Cross-sensitivity | $u_i$ | = | -3,0022 | mg/m³ | 4,6188 | mg/m³ |
| Repeatability at span point | $u_r$ | = | 0,2194 | mg/m³ | 0,4503 | mg/m³ |
| Standard deviation from paired maesurements under field conditions | $u_D$ | = | 1,7853 | mg/m³ | 1,7853 | mg/m³ |
| Uncertainty of provided reference material | $u_{rm}$ | = | 2,3094 | mg/m³ | 2,3094 | mg/m³ |
| Misalignment | $u_{mb}$ | = | 0,0000 | mg/m³ | 0,0000 | mg/m³ |
| Convertion rate of AMS for measurement of NOx | $u_{ce}$ | = | 0,0000 | mg/m³ | 0,0000 | mg/m³ |
| Changes of response fasctors | $u_{rf}$ | = | 0,0000 | mg/m³ | 0,0000 | mg/m³ |

### Calculation of the combined standard uncertainties

| | | **Zero point** | | **Span point** | |
|---|---|---|---|---|---|
| **Combined standard uncertainty** | **s(AMS) values** | 5,0080 | mg/m³ | 6,9800 | mg/m³ |

### Verification of compliance with the requirements

| | | | |
|---|---|---|---|
| Combined standard uncertainty | 7,28 | mg/m³ | according to EN 15267-3 |
| Expanded uncertainty | 14,27 | mg/m³ | according to EN 15267-3 |
| Relative expanded uncertainty | 7,14 | % | of the emissions limit value of 200 mg/m³ |
| Allowed expanded uncertainty | 20,00 | % | of the emissions limit value of 200 mg/m³ |
| Allowed expanded uncertainty | 40,00 | mg/m³ | |

**Result** Requirements fulfilled

# Calculation of measurement uncertainty

## according to EN ISO 14956, EN 14181 and EN 15267-3

Version 5.2

### Device data

| | | | |
|---|---|---|---|
| **Customer** | Vantaan Energia | | |
| **Identification** | JV1 | | |
| **Serial number** | | **Date** | 2013-03-21 |
| **Measuring system** | **MCS100FT** | **Component** | **NO2** |

### Input values

| | | | | | |
|---|---|---|---|---|---|
| Certification range | 100 | mg/m³ | Requirement to response time | 25 | % |
| Emissions limit value | 200 | mg/m³ | Averaging time of measured values | 30 | min |
| Confidence interval | 20 | % | | | |

### Genaral information

| | | | | | |
|---|---|---|---|---|---|
| **Maintenance interval** | 6 | months | **Detection limit** | 0,38 | mg/m³ |

### Required performance regarding dynamic operating conditions

| | | | |
|---|---|---|---|
| Measured response time | 3,30 | min | |
| Requirement to response time | 7,50 | min | 25% of the averaging time of 30 min |

**Result** Requirements fulfilled

### Calculation of the expanded uncertainty

| Interferent | Zero point | | Span point | |
|---|---|---|---|---|
| 3 Vol% Oxygen (O2) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 21 Vol% Oxygen (O2) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 30 Vol% Water (H2O) | **-1,50** | mg/m³ | **1,00** | mg/m³ |
| 300 mg/m³ Carbon monoxide (CO) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 15 Vol% Carbon dioxide (CO2) | **0,50** | mg/m³ | **-1,10** | mg/m³ |
| 50 mg/m³ Methane (CH4) | **-0,90** | mg/m³ | 0,00 | mg/m³ |
| 20 mg/m³ Dinitrogen oxide (N2O) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 100 mg/m³ Dinitrogen oxide (N2O) | **1,00** | mg/m³ | 0,00 | mg/m³ |
| 300 mg/m³ Nitrogen monoxide (NO) | **3,20** | mg/m³ | **3,00** | mg/m³ |
| 30 mg/m³ Nitrogen dioxide (NO2) | | | | |
| 20 mg/m³ Ammonia (NH3) | 0,00 | mg/m³ | **-1,00** | mg/m³ |
| 200 mg/m³ Sulfur dioxide (SO2) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 1000 mg/m³ Sulfur dioxide (SO2) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 50 mg/m³ Hydrogen chloride (HCl) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 200 mg/m³ Hydrogen chloride (HCl) | 0,00 | mg/m³ | **-2,60** | mg/m³ |

| | | | | |
|---|---|---|---|---|
| Sum of the positive cross-sensitivities | 4,70 | mg/m³ | 4,00 | mg/m³ |
| Sum of the negative cross-sensitivities | -2,40 | mg/m³ | -4,70 | mg/m³ |

# Calculation of measurement uncertainty

## according to EN ISO 14956, EN 14181 and EN 15267-3

Version 5.2

### Device data

| | | | |
|---|---|---|---|
| **Customer** | Vantaan Energia | | |
| **Identification** | JV1 | | |
| **Serial number** | | **Date** | 2013-03-21 |
| **Measuring system** | **MCS100FT** | **Component** | **NO2** |

### Influences of the process characteristics

| **Process characteristics** | **Largest difference according to type approval** | | | |
|---|---|---|---|---|
| | **Zero point** | | **Span point** | |
| Lack-of-fit (Linearity) | 1,40 | mg/m³ | 1,40 | mg/m³ |
| Zero drift from the field test | -2,30 | mg/m³ | 0,00 | mg/m³ |
| Span drift from the field test | 0,00 | mg/m³ | 3,00 | mg/m³ |
| Influence of ambient temperature at span point | 1,30 | mg/m³ | 0,90 | mg/m³ |
| Influence of sample gas pressure | 0,00 | mg/m³ | 0,00 | mg/m³ |
| Influence of sample gas flow | 0,00 | mg/m³ | -0,10 | mg/m³ |
| Influence of voltage | 0,30 | mg/m³ | -0,60 | mg/m³ |
| Cross-sensitivity | 4,70 | mg/m³ | -4,70 | mg/m³ |
| Repeatability at span point | 0,19 | mg/m³ | 0,47 | mg/m³ |
| Standard deviation from paired maesurements under field conditions | 1,09 | mg/m³ | 1,09 | mg/m³ |
| Uncertainty of provided reference material | 2,00 | mg/m³ | 2,00 | mg/m³ |
| Misalignment | 0,00 | mg/m³ | 0,00 | mg/m³ |
| Convertion rate of AMS for measurement of NOx | 0,00 | mg/m³ | 0,00 | mg/m³ |
| Changes of response fasctors | 0,00 | mg/m³ | 0,00 | mg/m³ |

| **Process characteristics** | | | **Standard uncertainty** | | | |
|---|---|---|---|---|---|---|
| | | | **Zero point** | | **Span point** | |
| Lack-of-fit (Linearity) | $u_{lof}$ | = | 0,8083 | mg/m³ | 0,8083 | mg/m³ |
| Zero drift from the field test | $u_{d,z}$ | = | -1,3279 | mg/m³ | 0,0000 | mg/m³ |
| Span drift from the field test | $u_{d,s}$ | = | 0,0000 | mg/m³ | 1,7321 | mg/m³ |
| Influence of ambient temperature at span point | $u_t$ | = | 0,7506 | mg/m³ | 0,5196 | mg/m³ |
| Influence of sample gas pressure | $u_p$ | = | 0,0000 | mg/m³ | 0,0000 | mg/m³ |
| Influence of sample gas flow | $u_f$ | = | 0,0000 | mg/m³ | -0,0577 | mg/m³ |
| Influence of voltage | $u_v$ | = | 0,1732 | mg/m³ | -0,3464 | mg/m³ |
| Cross-sensitivity | $u_i$ | = | 2,7135 | mg/m³ | -2,7135 | mg/m³ |
| Repeatability at span point | $u_r$ | = | 0,1097 | mg/m³ | 0,2714 | mg/m³ |
| Standard deviation from paired maesurements under field conditions | $u_D$ | = | 0,6267 | mg/m³ | 0,6267 | mg/m³ |
| Uncertainty of provided reference material | $u_{rm}$ | = | 1,1547 | mg/m³ | 1,1547 | mg/m³ |
| Misalignment | $u_{mb}$ | = | 0,0000 | mg/m³ | 0,0000 | mg/m³ |
| Convertion rate of AMS for measurement of NOx | $u_{ce}$ | = | 0,0000 | mg/m³ | 0,0000 | mg/m³ |
| Changes of response fasctors | $u_{rf}$ | = | 0,0000 | mg/m³ | 0,0000 | mg/m³ |

### Calculation of the combined standard uncertainties

| | | **Zero point** | | **Span point** | |
|---|---|---|---|---|---|
| **Combined standard uncertainty** | **s(AMS) values** | 3,4784 | mg/m³ | 3,6244 | mg/m³ |

### Verification of compliance with the requirements

| | | | |
|---|---|---|---|
| Combined standard uncertainty | 3,86 | mg/m³ | according to EN 15267-3 |
| Expanded uncertainty | 7,57 | mg/m³ | according to EN 15267-3 |
| Relative expanded uncertainty | 3,78 | % | of the emissions limit value of 200 mg/m³ |
| Allowed expanded uncertainty | 20,00 | % | of the emissions limit value of 200 mg/m³ |
| Allowed expanded uncertainty | 40,00 | mg/m³ | |

**Result** Requirements fulfilled

# Calculation of measurement uncertainty

## according to EN ISO 14956, EN 14181 and EN 15267-3

Version 5.2

### Device data

| | | | |
|---|---|---|---|
| **Customer** | Vantaan Energia | | |
| **Identification** | JV1 | | |
| **Serial number** | | **Date** | 2013-03-21 |
| **Measuring system** | **MCS100FT** | **Component** | **N2O** |

### Input values

| | | | | | | |
|---|---|---|---|---|---|---|
| Certification range | 50 | mg/m³ | | Requirement to response time | 25 | % |
| Measuring range | 20 | mg/m³ | | Averaging time of measured values | 30 | min |
| Confidence interval | 20 | % | * | | | |

**Attention: The 2001/80/EC and 2000/76/EC gives no requirements for these components.**

### Genaral information

| | | | | | |
|---|---|---|---|---|---|
| **Maintenance interval** | 6 | months | **Detection limit** | 0,08 | mg/m³ |

### Required performance regarding dynamic operating conditions

| | | | |
|---|---|---|---|
| Measured response time | 2,92 | min | |
| Requirement to response time | 7,50 | min | 25% of the averaging time of 30 min |

**Result** | **Requirements fulfilled**

### Calculation of the expanded uncertainty

| **Interferent** | **Zero point** | | **Span point** | |
|---|---|---|---|---|
| 3 Vol% Oxygen (O2) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 21 Vol% Oxygen (O2) | **0,40** | mg/m³ | **0,80** | mg/m³ |
| 30 Vol% Water (H2O) | **-0,50** | mg/m³ | **-0,80** | mg/m³ |
| 300 mg/m³ Carbon monoxide (CO) | 0,00 | mg/m³ | **-0,30** | mg/m³ |
| 15 Vol% Carbon dioxide (CO2) | **-0,70** | mg/m³ | 0,00 | mg/m³ |
| 50 mg/m³ Methane (CH4) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 20 mg/m³ Dinitrogen oxide (N2O) | | | | |
| 100 mg/m³ Dinitrogen oxide (N2O) | | | | |
| 300 mg/m³ Nitrogen monoxide (NO) | **0,95** | mg/m³ | **0,95** | mg/m³ |
| 30 mg/m³ Nitrogen dioxide (NO2) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 20 mg/m³ Ammonia (NH3) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 200 mg/m³ Sulfur dioxide (SO2) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 1000 mg/m³ Sulfur dioxide (SO2) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 50 mg/m³ Hydrogen chloride (HCl) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 200 mg/m³ Hydrogen chloride (HCl) | 0,00 | mg/m³ | 0,00 | mg/m³ |

| | | | | |
|---|---|---|---|---|
| Sum of the positive cross-sensitivities | 1,35 | mg/m³ | 1,75 | mg/m³ |
| Sum of the negative cross-sensitivities | -1,20 | mg/m³ | -1,10 | mg/m³ |

# Calculation of measurement uncertainty

## according to EN ISO 14956, EN 14181 and EN 15267-3

Version 5.2

### Device data

| | | | |
|---|---|---|---|
| **Customer** | Vantaan Energia | | |
| **Identification** | JV1 | | |
| **Serial number** | | **Date** | 2013-03-21 |
| **Measuring system** | **MCS100FT** | **Component** | **N2O** |

### Influences of the process characteristics

| **Process characteristics** | **Largest difference according to type approval** | | | |
|---|---|---|---|---|
| | **Zero point** | | **Span point** | |
| Lack-of-fit (Linearity) | 0,50 | mg/m³ | 0,50 | mg/m³ |
| Zero drift from the field test | 0,25 | mg/m³ | 0,00 | mg/m³ |
| Span drift from the field test | 0,00 | mg/m³ | -0,90 | mg/m³ |
| Influence of ambient temperature at span point | 0,10 | mg/m³ | -0,55 | mg/m³ |
| Influence of sample gas pressure | 0,00 | mg/m³ | 0,00 | mg/m³ |
| Influence of sample gas flow | 0,00 | mg/m³ | -0,05 | mg/m³ |
| Influence of voltage | 0,05 | mg/m³ | 0,20 | mg/m³ |
| Cross-sensitivity | 1,35 | mg/m³ | 1,75 | mg/m³ |
| Repeatability at span point | 0,04 | mg/m³ | 0,25 | mg/m³ |
| Standard deviation from paired maesurements under field conditions | 0,17 | mg/m³ | 0,17 | mg/m³ |
| Uncertainty of provided reference material | 1,00 | mg/m³ | 1,00 | mg/m³ |
| Misalignment | 0,00 | mg/m³ | 0,00 | mg/m³ |
| Convertion rate of AMS for measurement of NOx | 0,00 | mg/m³ | 0,00 | mg/m³ |
| Changes of response fasctors | 0,00 | mg/m³ | 0,00 | mg/m³ |

| **Process characteristics** | | | **Standard uncertainty** | | | |
|---|---|---|---|---|---|---|
| | | | **Zero point** | | **Span point** | |
| Lack-of-fit (Linearity) | $u_{lof}$ | = | 0,2887 | mg/m³ | 0,2887 | mg/m³ |
| Zero drift from the field test | $u_{d,z}$ | = | 0,1443 | mg/m³ | 0,0000 | mg/m³ |
| Span drift from the field test | $u_{d,s}$ | = | 0,0000 | mg/m³ | -0,5196 | mg/m³ |
| Influence of ambient temperature at span point | $u_t$ | = | 0,0577 | mg/m³ | -0,3175 | mg/m³ |
| Influence of sample gas pressure | $u_p$ | = | 0,0000 | mg/m³ | 0,0000 | mg/m³ |
| Influence of sample gas flow | $u_f$ | = | 0,0000 | mg/m³ | -0,0289 | mg/m³ |
| Influence of voltage | $u_v$ | = | 0,0289 | mg/m³ | 0,1155 | mg/m³ |
| Cross-sensitivity | $u_i$ | = | 0,7794 | mg/m³ | 1,0104 | mg/m³ |
| Repeatability at span point | $u_r$ | = | 0,0231 | mg/m³ | 0,1443 | mg/m³ |
| Standard deviation from paired maesurements under field conditions | $u_D$ | = | 0,1009 | mg/m³ | 0,1009 | mg/m³ |
| Uncertainty of provided reference material | $u_{rm}$ | = | 0,5774 | mg/m³ | 0,5774 | mg/m³ |
| Misalignment | $u_{mb}$ | = | 0,0000 | mg/m³ | 0,0000 | mg/m³ |
| Convertion rate of AMS for measurement of NOx | $u_{ce}$ | = | 0,0000 | mg/m³ | 0,0000 | mg/m³ |
| Changes of response fasctors | $u_{rf}$ | = | 0,0000 | mg/m³ | 0,0000 | mg/m³ |

### Calculation of the combined standard uncertainties

| | | **Zero point** | | **Span point** | |
|---|---|---|---|---|---|
| **Combined standard uncertainty** | **s(AMS) values** | 1,0292 | mg/m³ | 1,3577 | mg/m³ |

### Verification of compliance with the requirements

| | | | |
|---|---|---|---|
| Combined standard uncertainty | 1,37 | mg/m³ | according to EN 15267-3 |
| Expanded uncertainty | 2,68 | mg/m³ | according to EN 15267-3 |
| Relative expanded uncertainty | 13,38 | % | of the measuring range of 20 mg/m³ |
| Allowed expanded uncertainty | 20,00 | % | of the measuring range of 20 mg/m³ |
| Allowed expanded uncertainty | 4,00 | mg/m³ | |

**Result** Requirements fulfilled

**Attention: The 2001/80/EC and 2000/76/EC gives no requirements for these components.**

# Calculation of measurement uncertainty

## according to EN ISO 14956, EN 14181 and EN 15267-3

Version 5.2

### Device data

| | | | |
|---|---|---|---|
| **Customer** | Vantaan Energia | | |
| **Identification** | JV1 | | |
| **Serial number** | | **Date** | 2013-03-21 |
| **Measuring system** | **MCS100FT** | **Component** | **SO2** |

### Input values

| | | | | | |
|---|---|---|---|---|---|
| Certification range | 75 | mg/m³ | Requirement to response time | 25 | % |
| Emissions limit value | 50 | mg/m³ | Averaging time of measured values | 30 | min |
| Confidence interval | 20 | % | | | |

### Genaral information

| | | | | | |
|---|---|---|---|---|---|
| **Maintenance interval** | 6 | months | **Detection limit** | 0,24 | mg/m³ |

### Required performance regarding dynamic operating conditions

| | | | |
|---|---|---|---|
| Measured response time | 3,05 | min | |
| Requirement to response time | 7,50 | min | 25% of the averaging time of 30 min |

**Result** Requirements fulfilled

### Calculation of the expanded uncertainty

| **Interferent** | **Zero point** | | **Span point** | |
|---|---|---|---|---|
| 3 Vol% Oxygen (O2) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 21 Vol% Oxygen (O2) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 30 Vol% Water (H2O) | **1,28** | mg/m³ | **1,65** | mg/m³ |
| 300 mg/m³ Carbon monoxide (CO) | 0,00 | mg/m³ | **0,83** | mg/m³ |
| 15 Vol% Carbon dioxide (CO2) | **0,75** | mg/m³ | **0,38** | mg/m³ |
| 50 mg/m³ Methane (CH4) | 0,00 | mg/m³ | **0,38** | mg/m³ |
| 20 mg/m³ Dinitrogen oxide (N2O) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 100 mg/m³ Dinitrogen oxide (N2O) | 0,00 | mg/m³ | **0,38** | mg/m³ |
| 300 mg/m³ Nitrogen monoxide (NO) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 30 mg/m³ Nitrogen dioxide (NO2) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 20 mg/m³ Ammonia (NH3) | 0,00 | mg/m³ | **0,38** | mg/m³ |
| 200 mg/m³ Sulfur dioxide (SO2) | | | | |
| 1000 mg/m³ Sulfur dioxide (SO2) | | | | |
| 50 mg/m³ Hydrogen chloride (HCl) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 200 mg/m³ Hydrogen chloride (HCl) | 0,00 | mg/m³ | 0,00 | mg/m³ |

| | | | | |
|---|---|---|---|---|
| Sum of the positive cross-sensitivities | 2,03 | mg/m³ | 3,98 | mg/m³ |
| Sum of the negative cross-sensitivities | 0,00 | mg/m³ | 0,00 | mg/m³ |

# Calculation of measurement uncertainty

## according to EN ISO 14956, EN 14181 and EN 15267-3

Version 5.2

### Device data

| | | | |
|---|---|---|---|
| **Customer** | Vantaan Energia | | |
| **Identification** | JV1 | | |
| **Serial number** | | **Date** | 2013-03-21 |
| **Measuring system** | **MCS100FT** | **Component** | **SO2** |

### Influences of the process characteristics

| **Process characteristics** | **Largest difference according to type approval** | | | |
|---|---|---|---|---|
| | **Zero point** | | **Span point** | |
| Lack-of-fit (Linearity) | 0,83 | mg/m³ | 0,83 | mg/m³ |
| Zero drift from the field test | -1,88 | mg/m³ | 0,00 | mg/m³ |
| Span drift from the field test | 0,00 | mg/m³ | 2,33 | mg/m³ |
| Influence of ambient temperature at span point | 0,98 | mg/m³ | -1,13 | mg/m³ |
| Influence of sample gas pressure | 0,00 | mg/m³ | 0,00 | mg/m³ |
| Influence of sample gas flow | 0,00 | mg/m³ | -0,08 | mg/m³ |
| Influence of voltage | -0,60 | mg/m³ | 0,08 | mg/m³ |
| Cross-sensitivity | 2,03 | mg/m³ | 3,98 | mg/m³ |
| Repeatability at span point | 0,12 | mg/m³ | 0,16 | mg/m³ |
| Standard deviation from paired maesurements under field conditions | 0,74 | mg/m³ | 0,74 | mg/m³ |
| Uncertainty of provided reference material | 1,50 | mg/m³ | 1,50 | mg/m³ |
| Misalignment | 0,00 | mg/m³ | 0,00 | mg/m³ |
| Convertion rate of AMS for measurement of NOx | 0,00 | mg/m³ | 0,00 | mg/m³ |
| Changes of response fasctors | 0,00 | mg/m³ | 0,00 | mg/m³ |

| **Process characteristics** | | | **Standard uncertainty** | | | |
|---|---|---|---|---|---|---|
| | | | **Zero point** | | **Span point** | |
| Lack-of-fit (Linearity) | $u_{lof}$ | = | 0,4763 | mg/m³ | 0,4763 | mg/m³ |
| Zero drift from the field test | $u_{d,z}$ | = | -1,0825 | mg/m³ | 0,0000 | mg/m³ |
| Span drift from the field test | $u_{d,s}$ | = | 0,0000 | mg/m³ | 1,3423 | mg/m³ |
| Influence of ambient temperature at span point | $u_t$ | = | 0,5629 | mg/m³ | -0,6495 | mg/m³ |
| Influence of sample gas pressure | $u_p$ | = | 0,0000 | mg/m³ | 0,0000 | mg/m³ |
| Influence of sample gas flow | $u_f$ | = | 0,0000 | mg/m³ | -0,0433 | mg/m³ |
| Influence of voltage | $u_v$ | = | -0,3464 | mg/m³ | 0,0433 | mg/m³ |
| Cross-sensitivity | $u_i$ | = | 1,1691 | mg/m³ | 2,2950 | mg/m³ |
| Repeatability at span point | $u_r$ | = | 0,0693 | mg/m³ | 0,0924 | mg/m³ |
| Standard deviation from paired maesurements under field conditions | $u_D$ | = | 0,4249 | mg/m³ | 0,4249 | mg/m³ |
| Uncertainty of provided reference material | $u_{rm}$ | = | 0,8660 | mg/m³ | 0,8660 | mg/m³ |
| Misalignment | $u_{mb}$ | = | 0,0000 | mg/m³ | 0,0000 | mg/m³ |
| Convertion rate of AMS for measurement of NOx | $u_{ce}$ | = | 0,0000 | mg/m³ | 0,0000 | mg/m³ |
| Changes of response fasctors | $u_{rf}$ | = | 0,0000 | mg/m³ | 0,0000 | mg/m³ |

### Calculation of the combined standard uncertainties

| | | **Zero point** | | **Span point** | |
|---|---|---|---|---|---|
| **Combined standard uncertainty** | **s(AMS) values** | 2,0330 | mg/m³ | 2,9414 | mg/m³ |

### Verification of compliance with the requirements

| | | | |
|---|---|---|---|
| Combined standard uncertainty | 3,15 | mg/m³ | according to EN 15267-3 |
| Expanded uncertainty | 6,18 | mg/m³ | according to EN 15267-3 |
| Relative expanded uncertainty | 12,36 | % | of the emissions limit value of 50 mg/m³ |
| Allowed expanded uncertainty | 20,00 | % | of the emissions limit value of 50 mg/m³ |
| Allowed expanded uncertainty | 10,00 | mg/m³ | |

**Result** Requirements fulfilled

# Calculation of measurement uncertainty

## according to EN ISO 14956, EN 14181 and EN 15267-3

Version 5.2

### Device data

| | | | |
|---|---|---|---|
| **Customer** | Vantaan Energia | | |
| **Identification** | JV1 | | |
| **Serial number** | | **Date** | 2013-03-21 |
| **Measuring system** | **MCS100FT** | **Component** | **HCl** |

### Input values

| | | | | | |
|---|---|---|---|---|---|
| Certification range | 15 | mg/m³ | Requirement to response time | 25 | % |
| Emissions limit value | 10 | mg/m³ | Averaging time of measured values | 30 | min |
| Confidence interval | 40 | % | | | |

### Genaral information

| | | | | | |
|---|---|---|---|---|---|
| **Maintenance interval** | 6 | months | **Detection limit** | 0,08 | mg/m³ |

### Required performance regarding dynamic operating conditions

| | | | |
|---|---|---|---|
| Measured response time | 3,18 | min | |
| Requirement to response time | 7,50 | min | 25% of the averaging time of 30 min |

**Result** | Requirements fulfilled

### Calculation of the expanded uncertainty

| **Interferent** | **Zero point** | | **Span point** | |
|---|---|---|---|---|
| 3 Vol% Oxygen (O2) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 21 Vol% Oxygen (O2) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 30 Vol% Water (H2O) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 300 mg/m³ Carbon monoxide (CO) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 15 Vol% Carbon dioxide (CO2) | **0,09** | mg/m³ | 0,00 | mg/m³ |
| 50 mg/m³ Methane (CH4) | **0,14** | mg/m³ | 0,00 | mg/m³ |
| 20 mg/m³ Dinitrogen oxide (N2O) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 100 mg/m³ Dinitrogen oxide (N2O) | **0,23** | mg/m³ | **0,29** | mg/m³ |
| 300 mg/m³ Nitrogen monoxide (NO) | **0,09** | mg/m³ | 0,00 | mg/m³ |
| 30 mg/m³ Nitrogen dioxide (NO2) | 0,00 | mg/m³ | **0,35** | mg/m³ |
| 20 mg/m³ Ammonia (NH3) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 200 mg/m³ Sulfur dioxide (SO2) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 1000 mg/m³ Sulfur dioxide (SO2) | **0,18** | mg/m³ | 0,00 | mg/m³ |
| 50 mg/m³ Hydrogen chloride (HCl) | | | | |
| 200 mg/m³ Hydrogen chloride (HCl) | | | | |

| | | | | |
|---|---|---|---|---|
| Sum of the positive cross-sensitivities | 0,72 | mg/m³ | 0,63 | mg/m³ |
| Sum of the negative cross-sensitivities | 0,00 | mg/m³ | 0,00 | mg/m³ |

# Calculation of measurement uncertainty

## according to EN ISO 14956, EN 14181 and EN 15267-3

Version 5.2

### Device data

| | | | |
|---|---|---|---|
| **Customer** | Vantaan Energia | | |
| **Identification** | JV1 | | |
| **Serial number** | | **Date** | 2013-03-21 |
| **Measuring system** | **MCS100FT** | **Component** | **HCl** |

### Influences of the process characteristics

| **Process characteristics** | **Largest difference according to type approval** | | | |
|---|---|---|---|---|
| | **Zero point** | | **Span point** | |
| Lack-of-fit (Linearity) | 0,30 | mg/m³ | 0,30 | mg/m³ |
| Zero drift from the field test | -0,42 | mg/m³ | 0,00 | mg/m³ |
| Span drift from the field test | 0,00 | mg/m³ | 0,45 | mg/m³ |
| Influence of ambient temperature at span point | 0,12 | mg/m³ | -0,53 | mg/m³ |
| Influence of sample gas pressure | 0,00 | mg/m³ | 0,00 | mg/m³ |
| Influence of sample gas flow | 0,00 | mg/m³ | -0,02 | mg/m³ |
| Influence of voltage | -0,08 | mg/m³ | 0,11 | mg/m³ |
| Cross-sensitivity | 0,72 | mg/m³ | 0,63 | mg/m³ |
| Repeatability at span point | 0,04 | mg/m³ | 0,15 | mg/m³ |
| Standard deviation from paired maesurements under field conditions | 0,16 | mg/m³ | 0,16 | mg/m³ |
| Uncertainty of provided reference material | 0,30 | mg/m³ | 0,30 | mg/m³ |
| Misalignment | 0,00 | mg/m³ | 0,00 | mg/m³ |
| Convertion rate of AMS for measurement of NOx | 0,00 | mg/m³ | 0,00 | mg/m³ |
| Changes of response fasctors | 0,00 | mg/m³ | 0,00 | mg/m³ |

| **Process characteristics** | | | **Standard uncertainty** | | | |
|---|---|---|---|---|---|---|
| | | | **Zero point** | | **Span point** | |
| Lack-of-fit (Linearity) | $u_{lof}$ | = | 0,1732 | mg/m³ | 0,1732 | mg/m³ |
| Zero drift from the field test | $u_{d,z}$ | = | -0,2425 | mg/m³ | 0,0000 | mg/m³ |
| Span drift from the field test | $u_{d,s}$ | = | 0,0000 | mg/m³ | 0,2598 | mg/m³ |
| Influence of ambient temperature at span point | $u_t$ | = | 0,0693 | mg/m³ | -0,3031 | mg/m³ |
| Influence of sample gas pressure | $u_p$ | = | 0,0000 | mg/m³ | 0,0000 | mg/m³ |
| Influence of sample gas flow | $u_f$ | = | 0,0000 | mg/m³ | -0,0087 | mg/m³ |
| Influence of voltage | $u_v$ | = | -0,0433 | mg/m³ | 0,0606 | mg/m³ |
| Cross-sensitivity | $u_i$ | = | 0,4157 | mg/m³ | 0,3637 | mg/m³ |
| Repeatability at span point | $u_r$ | = | 0,0231 | mg/m³ | 0,0866 | mg/m³ |
| Standard deviation from paired maesurements under field conditions | $u_D$ | = | 0,0902 | mg/m³ | 0,0902 | mg/m³ |
| Uncertainty of provided reference material | $u_{rm}$ | = | 0,1732 | mg/m³ | 0,1732 | mg/m³ |
| Misalignment | $u_{mb}$ | = | 0,0000 | mg/m³ | 0,0000 | mg/m³ |
| Convertion rate of AMS for measurement of NOx | $u_{ce}$ | = | 0,0000 | mg/m³ | 0,0000 | mg/m³ |
| Changes of response fasctors | $u_{rf}$ | = | 0,0000 | mg/m³ | 0,0000 | mg/m³ |

### Calculation of the combined standard uncertainties

| | | **Zero point** | | **Span point** | |
|---|---|---|---|---|---|
| **Combined standard uncertainty** | **s(AMS) values** | 0,5535 | mg/m³ | 0,6030 | mg/m³ |

### Verification of compliance with the requirements

| | | | |
|---|---|---|---|
| Combined standard uncertainty | 0,68 | mg/m³ | according to EN 15267-3 |
| Expanded uncertainty | 1,33 | mg/m³ | according to EN 15267-3 |
| Relative expanded uncertainty | 13,33 | % | of the emissions limit value of 10 mg/m³ |
| Allowed expanded uncertainty | 40,00 | % | of the emissions limit value of 10 mg/m³ |
| Allowed expanded uncertainty | 4,00 | mg/m³ | |

**Result** Requirements fulfilled

# Calculation of measurement uncertainty

## according to EN ISO 14956, EN 14181 and EN 15267-3

Version 5.2

### Device data

| | | | |
|---|---|---|---|
| **Customer** | Vantaan Energia | | |
| **Identification** | JV1 | | |
| **Serial number** | | **Date** | 2013-03-21 |
| **Measuring system** | **MCS100FT** | **Component** | **HF** |

### Input values

| | | | | | |
|---|---|---|---|---|---|
| Certification range | 3 | mg/m³ | Requirement to response time | 25 | % |
| Emissions limit value | 1 | mg/m³ | Averaging time of measured values | 30 | min |
| Confidence interval | 40 | % | | | |

### Genaral information

| | | | | | |
|---|---|---|---|---|---|
| **Maintenance interval** | 3 | months | **Detection limit** | 0,08 | mg/m³ |

### Required performance regarding dynamic operating conditions

| | | | |
|---|---|---|---|
| Measured response time | 3,30 | min | |
| Requirement to response time | 7,50 | min | 25% of the averaging time of 30 min |

**Result** Requirements fulfilled

### Calculation of the expanded uncertainty

| Interferent | Zero point | | Span point | |
|---|---|---|---|---|
| 3 Vol% Oxygen (O2) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 21 Vol% Oxygen (O2) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 30 Vol% Water (H2O) | **0,05** | mg/m³ | 0,00 | mg/m³ |
| 300 mg/m³ Carbon monoxide (CO) | **-0,08** | mg/m³ | **-0,08** | mg/m³ |
| 15 Vol% Carbon dioxide (CO2) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 50 mg/m³ Methane (CH4) | **0,07** | mg/m³ | 0,00 | mg/m³ |
| 20 mg/m³ Dinitrogen oxide (N2O) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 100 mg/m³ Dinitrogen oxide (N2O) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 300 mg/m³ Nitrogen monoxide (NO) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 30 mg/m³ Nitrogen dioxide (NO2) | 0,00 | mg/m³ | **0,05** | mg/m³ |
| 20 mg/m³ Ammonia (NH3) | **0,03** | mg/m³ | 0,00 | mg/m³ |
| 200 mg/m³ Sulfur dioxide (SO2) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 1000 mg/m³ Sulfur dioxide (SO2) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 50 mg/m³ Hydrogen chloride (HCl) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 200 mg/m³ Hydrogen chloride (HCl) | **0,03** | mg/m³ | **-0,03** | mg/m³ |

| | | | | |
|---|---|---|---|---|
| Sum of the positive cross-sensitivities | 0,17 | mg/m³ | 0,05 | mg/m³ |
| Sum of the negative cross-sensitivities | -0,08 | mg/m³ | -0,11 | mg/m³ |

# Calculation of measurement uncertainty

## according to EN ISO 14956, EN 14181 and EN 15267-3

Version 5.2

### Device data

| | | | |
|---|---|---|---|
| **Customer** | Vantaan Energia | | |
| **Identification** | JV1 | | |
| **Serial number** | | **Date** | 2013-03-21 |
| **Measuring system** | **MCS100FT** | **Component** | **HF** |

### Influences of the process characteristics

| **Process characteristics** | **Largest difference according to type approval** | | | |
|---|---|---|---|---|
| | **Zero point** | | **Span point** | |
| Lack-of-fit (Linearity) | 0,05 | mg/m³ | 0,05 | mg/m³ |
| Zero drift from the field test | -0,12 | mg/m³ | 0,00 | mg/m³ |
| Span drift from the field test | 0,00 | mg/m³ | -0,09 | mg/m³ |
| Influence of ambient temperature at span point | -0,11 | mg/m³ | 0,14 | mg/m³ |
| Influence of sample gas pressure | 0,00 | mg/m³ | 0,00 | mg/m³ |
| Influence of sample gas flow | 0,00 | mg/m³ | 0,00 | mg/m³ |
| Influence of voltage | 0,03 | mg/m³ | 0,04 | mg/m³ |
| Cross-sensitivity | 0,17 | mg/m³ | -0,11 | mg/m³ |
| Repeatability at span point | 0,04 | mg/m³ | 0,05 | mg/m³ |
| Standard deviation from paired maesurements under field conditions | 0,04 | mg/m³ | 0,04 | mg/m³ |
| Uncertainty of provided reference material | 0,06 | mg/m³ | 0,06 | mg/m³ |
| Misalignment | 0,00 | mg/m³ | 0,00 | mg/m³ |
| Convertion rate of AMS for measurement of NOx | 0,00 | mg/m³ | 0,00 | mg/m³ |
| Changes of response fasctors | 0,00 | mg/m³ | 0,00 | mg/m³ |

| **Process characteristics** | | | **Standard uncertainty** | | | |
|---|---|---|---|---|---|---|
| | | | **Zero point** | | **Span point** | |
| Lack-of-fit (Linearity) | $u_{lof}$ | = | 0,0294 | mg/m³ | 0,0294 | mg/m³ |
| Zero drift from the field test | $u_{d,z}$ | = | -0,0675 | mg/m³ | 0,0000 | mg/m³ |
| Span drift from the field test | $u_{d,s}$ | = | 0,0000 | mg/m³ | -0,0520 | mg/m³ |
| Influence of ambient temperature at span point | $u_t$ | = | -0,0641 | mg/m³ | 0,0814 | mg/m³ |
| Influence of sample gas pressure | $u_p$ | = | 0,0000 | mg/m³ | 0,0000 | mg/m³ |
| Influence of sample gas flow | $u_f$ | = | 0,0000 | mg/m³ | -0,0017 | mg/m³ |
| Influence of voltage | $u_v$ | = | 0,0173 | mg/m³ | 0,0225 | mg/m³ |
| Cross-sensitivity | $u_i$ | = | 0,1005 | mg/m³ | -0,0606 | mg/m³ |
| Repeatability at span point | $u_r$ | = | 0,0231 | mg/m³ | 0,0289 | mg/m³ |
| Standard deviation from paired maesurements under field conditions | $u_D$ | = | 0,0221 | mg/m³ | 0,0221 | mg/m³ |
| Uncertainty of provided reference material | $u_{rm}$ | = | 0,0346 | mg/m³ | 0,0346 | mg/m³ |
| Misalignment | $u_{mb}$ | = | 0,0000 | mg/m³ | 0,0000 | mg/m³ |
| Convertion rate of AMS for measurement of NOx | $u_{ce}$ | = | 0,0000 | mg/m³ | 0,0000 | mg/m³ |
| Changes of response fasctors | $u_{rf}$ | = | 0,0000 | mg/m³ | 0,0000 | mg/m³ |

### Calculation of the combined standard uncertainties

| | | **Zero point** | | **Span point** | |
|---|---|---|---|---|---|
| **Combined standard uncertainty** | **s(AMS) values** | 0,1472 | mg/m³ | 0,1281 | mg/m³ |

### Verification of compliance with the requirements

| | | | |
|---|---|---|---|
| Combined standard uncertainty | 0,17 | mg/m³ | according to EN 15267-3 |
| Expanded uncertainty | 0,32 | mg/m³ | according to EN 15267-3 |
| Relative expanded uncertainty | 32,44 | % | of the emissions limit value of 1 mg/m³ |
| Allowed expanded uncertainty | 40,00 | % | of the emissions limit value of 1 mg/m³ |
| Allowed expanded uncertainty | 0,40 | mg/m³ | |

**Result** Requirements fulfilled

# Calculation of measurement uncertainty

## according to EN ISO 14956, EN 14181 and EN 15267-3

Version 5.2

### Device data

| | | | |
|---|---|---|---|
| **Customer** | Vantaan Energia | | |
| **Identification** | JV1 | | |
| **Serial number** | | **Date** | 2013-03-21 |
| **Measuring system** | **MCS100FT** | **Component** | **NH3** |

### Input values

| | | | | | | |
|---|---|---|---|---|---|---|
| Certification range | 10 | mg/m³ | | Requirement to response time | 25 | % |
| Measuring range | 20 | mg/m³ | | Averaging time of measured values | 30 | min |
| Confidence interval | 40 | % | * | | | |

**Attention: The 2001/80/EC and 2000/76/EC gives no requirements for these components.**

### Genaral information

| | | | | | |
|---|---|---|---|---|---|
| **Maintenance interval** | 3 | months | **Detection limit** | 0,05 | mg/m³ |

### Required performance regarding dynamic operating conditions

| | | | |
|---|---|---|---|
| Measured response time | 3,32 | min | |
| Requirement to response time | 7,50 | min | 25% of the averaging time of 30 min |

**Result** | **Requirements fulfilled**

### Calculation of the expanded uncertainty

| **Interferent** | **Zero point** | | **Span point** | |
|---|---|---|---|---|
| 3 Vol% Oxygen (O2) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 21 Vol% Oxygen (O2) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 30 Vol% Water (H2O) | **0,08** | mg/m³ | 0,00 | mg/m³ |
| 300 mg/m³ Carbon monoxide (CO) | **0,07** | mg/m³ | 0,00 | mg/m³ |
| 15 Vol% Carbon dioxide (CO2) | **0,09** | mg/m³ | **-0,10** | mg/m³ |
| 50 mg/m³ Methane (CH4) | **0,12** | mg/m³ | **-0,04** | mg/m³ |
| 20 mg/m³ Dinitrogen oxide (N2O) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 100 mg/m³ Dinitrogen oxide (N2O) | 0,00 | mg/m³ | **0,04** | mg/m³ |
| 300 mg/m³ Nitrogen monoxide (NO) | **0,13** | mg/m³ | **-0,10** | mg/m³ |
| 30 mg/m³ Nitrogen dioxide (NO2) | 0,00 | mg/m³ | **-0,05** | mg/m³ |
| 20 mg/m³ Ammonia (NH3) | | | | |
| 200 mg/m³ Sulfur dioxide (SO2) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 1000 mg/m³ Sulfur dioxide (SO2) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 50 mg/m³ Hydrogen chloride (HCl) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 200 mg/m³ Hydrogen chloride (HCl) | 0,00 | mg/m³ | 0,00 | mg/m³ |

| | | |
|---|---|---|
| Sum of the positive cross-sensitivities | 0,49 mg/m³ | 0,04 mg/m³ |
| Sum of the negative cross-sensitivities | 0,00 mg/m³ | -0,29 mg/m³ |

# Calculation of measurement uncertainty

## according to EN ISO 14956, EN 14181 and EN 15267-3

Version 5.2

### Device data

| | | | |
|---|---|---|---|
| **Customer** | Vantaan Energia | | |
| **Identification** | JV1 | | |
| **Serial number** | | **Date** | 2013-03-21 |
| **Measuring system** | **MCS100FT** | **Component** | **NH3** |

### Influences of the process characteristics

| **Process characteristics** | **Largest difference according to type approval** | | | |
|---|---|---|---|---|
| | **Zero point** | | **Span point** | |
| Lack-of-fit (Linearity) | -0,06 | mg/m³ | -0,06 | mg/m³ |
| Zero drift from the field test | 0,05 | mg/m³ | 0,00 | mg/m³ |
| Span drift from the field test | 0,00 | mg/m³ | 0,29 | mg/m³ |
| Influence of ambient temperature at span point | -0,05 | mg/m³ | -0,14 | mg/m³ |
| Influence of sample gas pressure | 0,00 | mg/m³ | 0,00 | mg/m³ |
| Influence of sample gas flow | 0,00 | mg/m³ | -0,01 | mg/m³ |
| Influence of voltage | -0,05 | mg/m³ | 0,07 | mg/m³ |
| Cross-sensitivity | 0,49 | mg/m³ | -0,29 | mg/m³ |
| Repeatability at span point | 0,02 | mg/m³ | 0,07 | mg/m³ |
| Standard deviation from paired maesurements under field conditions | 0,08 | mg/m³ | 0,08 | mg/m³ |
| Uncertainty of provided reference material | 0,20 | mg/m³ | 0,20 | mg/m³ |
| Misalignment | 0,00 | mg/m³ | 0,00 | mg/m³ |
| Convertion rate of AMS for measurement of NOx | 0,00 | mg/m³ | 0,00 | mg/m³ |
| Changes of response fasctors | 0,00 | mg/m³ | 0,00 | mg/m³ |

| **Process characteristics** | | | **Standard uncertainty** | | | |
|---|---|---|---|---|---|---|
| | | | **Zero point** | | **Span point** | |
| Lack-of-fit (Linearity) | $u_{lof}$ | = | -0,0346 | mg/m³ | -0,0346 | mg/m³ |
| Zero drift from the field test | $u_{d,z}$ | = | 0,0289 | mg/m³ | 0,0000 | mg/m³ |
| Span drift from the field test | $u_{d,s}$ | = | 0,0000 | mg/m³ | 0,1697 | mg/m³ |
| Influence of ambient temperature at span point | $u_t$ | = | -0,0289 | mg/m³ | -0,0808 | mg/m³ |
| Influence of sample gas pressure | $u_p$ | = | 0,0000 | mg/m³ | 0,0000 | mg/m³ |
| Influence of sample gas flow | $u_f$ | = | 0,0000 | mg/m³ | -0,0058 | mg/m³ |
| Influence of voltage | $u_v$ | = | -0,0289 | mg/m³ | 0,0404 | mg/m³ |
| Cross-sensitivity | $u_i$ | = | 0,2829 | mg/m³ | -0,1674 | mg/m³ |
| Repeatability at span point | $u_r$ | = | 0,0115 | mg/m³ | 0,0404 | mg/m³ |
| Standard deviation from paired maesurements under field conditions | $u_D$ | = | 0,0440 | mg/m³ | 0,0440 | mg/m³ |
| Uncertainty of provided reference material | $u_{rm}$ | = | 0,1155 | mg/m³ | 0,1155 | mg/m³ |
| Misalignment | $u_{mb}$ | = | 0,0000 | mg/m³ | 0,0000 | mg/m³ |
| Convertion rate of AMS for measurement of NOx | $u_{ce}$ | = | 0,0000 | mg/m³ | 0,0000 | mg/m³ |
| Changes of response fasctors | $u_{rf}$ | = | 0,0000 | mg/m³ | 0,0000 | mg/m³ |

### Calculation of the combined standard uncertainties

| | | **Zero point** | | **Span point** | |
|---|---|---|---|---|---|
| **Combined standard uncertainty** | **s(AMS) values** | 0,3146 | mg/m³ | 0,2855 | mg/m³ |

### Verification of compliance with the requirements

| | | | |
|---|---|---|---|
| Combined standard uncertainty | 0,37 | mg/m³ | according to EN 15267-3 |
| Expanded uncertainty | 0,72 | mg/m³ | according to EN 15267-3 |
| Relative expanded uncertainty | 3,59 | % | of the measuring range of 20 mg/m³ |
| Allowed expanded uncertainty | 40,00 | % | of the measuring range of 20 mg/m³ |
| Allowed expanded uncertainty | 8,00 | mg/m³ | |

**Result** Requirements fulfilled

**Attention: The 2001/80/EC and 2000/76/EC gives no requirements for these components.**

# Calculation of measurement uncertainty

## according to EN ISO 14956, EN 14181 and EN 15267-3

Version 5.2

### Device data

| | | | |
|---|---|---|---|
| **Customer** | Vantaan Energia | | |
| **Identification** | JV1 | | |
| **Serial number** | | **Date** | 2013-03-21 |
| **Measuring system** | **MCS100FT** | **Component** | **H2O** |

### Input values

| | | | | | | |
|---|---|---|---|---|---|---|
| Certification range | 40 | Vol% | | Requirement to response time | 25 | % |
| Measuring range | 20 | Vol% | | Averaging time of measured values | 30 | min |
| Confidence interval | 40 | % | * | | | |

Attention: The 2001/80/EC and 2000/76/EC gives no requirements for these components.

### Genaral information

| | | | | | |
|---|---|---|---|---|---|
| **Maintenance interval** | 6 | months | **Detection limit** | 0,04 | Vol% |

### Required performance regarding dynamic operating conditions

| | | | |
|---|---|---|---|
| Measured response time | 2,93 | min | |
| Requirement to response time | 7,50 | min | 25% of the averaging time of 30 min |

**Result** Requirements fulfilled

### Calculation of the expanded uncertainty

| **Interferent** | **Zero point** | | **Span point** | |
|---|---|---|---|---|
| 3 Vol% Oxygen (O2) | 0,00 | Vol% | 0,00 | Vol% |
| 21 Vol% Oxygen (O2) | 0,00 | Vol% | 0,00 | Vol% |
| 30 Vol% Water (H2O) | | | | |
| 300 mg/m³ Carbon monoxide (CO) | **0,80** | Vol% | **0,76** | Vol% |
| 15 Vol% Carbon dioxide (CO2) | 0,00 | Vol% | 0,00 | Vol% |
| 50 mg/m³ Methane (CH4) | **-0,20** | Vol% | **-0,36** | Vol% |
| 20 mg/m³ Dinitrogen oxide (N2O) | 0,00 | Vol% | 0,00 | Vol% |
| 100 mg/m³ Dinitrogen oxide (N2O) | 0,00 | Vol% | 0,00 | Vol% |
| 300 mg/m³ Nitrogen monoxide (NO) | 0,00 | Vol% | 0,00 | Vol% |
| 30 mg/m³ Nitrogen dioxide (NO2) | 0,00 | Vol% | 0,00 | Vol% |
| 20 mg/m³ Ammonia (NH3) | 0,00 | Vol% | **-0,20** | Vol% |
| 200 mg/m³ Sulfur dioxide (SO2) | 0,00 | Vol% | 0,00 | Vol% |
| 1000 mg/m³ Sulfur dioxide (SO2) | 0,00 | Vol% | 0,00 | Vol% |
| 50 mg/m³ Hydrogen chloride (HCl) | 0,00 | Vol% | 0,00 | Vol% |
| 200 mg/m³ Hydrogen chloride (HCl) | 0,00 | Vol% | **-0,20** | Vol% |

| | | |
|---|---|---|
| Sum of the positive cross-sensitivities | 0,80 Vol% | 0,76 Vol% |
| Sum of the negative cross-sensitivities | -0,20 Vol% | -0,76 Vol% |

# Calculation of measurement uncertainty

## according to EN ISO 14956, EN 14181 and EN 15267-3

Version 5.2

### Device data

| | | | |
|---|---|---|---|
| **Customer** | Vantaan Energia | | |
| **Identification** | JV1 | | |
| **Serial number** | | **Date** | 2013-03-21 |
| **Measuring system** | **MCS100FT** | **Component** | **H2O** |

### Influences of the process characteristics

| **Process characteristics** | **Largest difference according to type approval** | | | |
|---|---|---|---|---|
| | **Zero point** | | **Span point** | |
| Lack-of-fit (Linearity) | 0,64 | Vol% | 0,64 | Vol% |
| Zero drift from the field test | -1,04 | Vol% | 0,00 | Vol% |
| Span drift from the field test | 0,00 | Vol% | 1,16 | Vol% |
| Influence of ambient temperature at span point | 0,12 | Vol% | 0,48 | Vol% |
| Influence of sample gas pressure | 0,00 | Vol% | 0,00 | Vol% |
| Influence of sample gas flow | 0,00 | Vol% | -0,04 | Vol% |
| Influence of voltage | 0,08 | Vol% | 0,00 | Vol% |
| Cross-sensitivity | 0,80 | Vol% | 0,76 | Vol% |
| Repeatability at span point | 0,02 | Vol% | 0,06 | Vol% |
| Standard deviation from paired maesurements under field conditions | 0,39 | Vol% | 0,39 | Vol% |
| Uncertainty of provided reference material | 0,80 | Vol% | 0,80 | Vol% |
| Misalignment | 0,00 | Vol% | 0,00 | Vol% |
| Convertion rate of AMS for measurement of NOx | 0,00 | Vol% | 0,00 | Vol% |
| Changes of response fasctors | 0,00 | Vol% | 0,00 | Vol% |

| **Process characteristics** | | | **Standard uncertainty** | | | |
|---|---|---|---|---|---|---|
| | | | **Zero point** | | **Span point** | |
| Lack-of-fit (Linearity) | $u_{lof}$ | = | 0,3695 | Vol% | 0,3695 | Vol% |
| Zero drift from the field test | $u_{d,z}$ | = | -0,6004 | Vol% | 0,0000 | Vol% |
| Span drift from the field test | $u_{d,s}$ | = | 0,0000 | Vol% | 0,6697 | Vol% |
| Influence of ambient temperature at span point | $u_t$ | = | 0,0693 | Vol% | 0,2771 | Vol% |
| Influence of sample gas pressure | $u_p$ | = | 0,0000 | Vol% | 0,0000 | Vol% |
| Influence of sample gas flow | $u_f$ | = | 0,0000 | Vol% | -0,0231 | Vol% |
| Influence of voltage | $u_v$ | = | 0,0462 | Vol% | 0,0000 | Vol% |
| Cross-sensitivity | $u_i$ | = | 0,4619 | Vol% | 0,4388 | Vol% |
| Repeatability at span point | $u_r$ | = | 0,0115 | Vol% | 0,0346 | Vol% |
| Standard deviation from paired maesurements under field conditions | $u_D$ | = | 0,2266 | Vol% | 0,2266 | Vol% |
| Uncertainty of provided reference material | $u_{rm}$ | = | 0,4619 | Vol% | 0,4619 | Vol% |
| Misalignment | $u_{mb}$ | = | 0,0000 | Vol% | 0,0000 | Vol% |
| Convertion rate of AMS for measurement of NOx | $u_{ce}$ | = | 0,0000 | Vol% | 0,0000 | Vol% |
| Changes of response fasctors | $u_{rf}$ | = | 0,0000 | Vol% | 0,0000 | Vol% |

### Calculation of the combined standard uncertainties

| | | **Zero point** | | **Span point** | |
|---|---|---|---|---|---|
| **Combined standard uncertainty** | **s(AMS) values** | 0,9910 | Vol% | 1,0581 | Vol% |

### Verification of compliance with the requirements

| | | | |
|---|---|---|---|
| Combined standard uncertainty | 1,23 | Vol% | according to EN 15267-3 |
| Expanded uncertainty | 2,40 | Vol% | according to EN 15267-3 |
| Relative expanded uncertainty | 12,01 | % | of the measuring range of 20 Vol% |
| Allowed expanded uncertainty | 40,00 | % | of the measuring range of 20 Vol% |
| Allowed expanded uncertainty | 8,00 | Vol% | |

**Result** Requirements fulfilled

**Attention: The 2001/80/EC and 2000/76/EC gives no requirements for these components.**

# Calculation of measurement uncertainty

## according to EN ISO 14956, EN 14181 and EN 15267-3

Version 5.2

### Device data

| | | | |
|---|---|---|---|
| **Customer** | Vantaan Energia | | |
| **Identification** | JV1 | | |
| **Serial number** | | **Date** | 2013-03-21 |
| **Measuring system** | **MCS100FT** | **Component** | **CH4** |

### Input values

| | | | | | |
|---|---|---|---|---|---|
| Certification range | 50 | mg/m³ | Requirement to response time | 25 | % |
| Measuring range | 20 | mg/m³ | Averaging time of measured values | 30 | min |
| Confidence interval | 20 | % * | | | |

Attention: The 2001/80/EC and 2000/76/EC gives no requirements for these components.

### Genaral information

| | | | | | |
|---|---|---|---|---|---|
| **Maintenance interval** | 6 | months | **Detection limit** | 0,02 | mg/m³ |

### Required performance regarding dynamic operating conditions

| | | | |
|---|---|---|---|
| Measured response time | 2,95 | min | |
| Requirement to response time | 7,50 | min | 25% of the averaging time of 30 min |

**Result** Requirements fulfilled

### Calculation of the expanded uncertainty

| **Interferent** | **Zero point** | | **Span point** | |
|---|---|---|---|---|
| 3 Vol% Oxygen (O2) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 21 Vol% Oxygen (O2) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 30 Vol% Water (H2O) | **0,55** | mg/m³ | **0,70** | mg/m³ |
| 300 mg/m³ Carbon monoxide (CO) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 15 Vol% Carbon dioxide (CO2) | 0,00 | mg/m³ | **-0,35** | mg/m³ |
| 50 mg/m³ Methane (CH4) | | | | |
| 20 mg/m³ Dinitrogen oxide (N2O) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 100 mg/m³ Dinitrogen oxide (N2O) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 300 mg/m³ Nitrogen monoxide (NO) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 30 mg/m³ Nitrogen dioxide (NO2) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 20 mg/m³ Ammonia (NH3) | 0,00 | mg/m³ | **0,65** | mg/m³ |
| 200 mg/m³ Sulfur dioxide (SO2) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 1000 mg/m³ Sulfur dioxide (SO2) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 50 mg/m³ Hydrogen chloride (HCl) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 200 mg/m³ Hydrogen chloride (HCl) | 0,00 | mg/m³ | 0,00 | mg/m³ |

| | | |
|---|---|---|
| Sum of the positive cross-sensitivities | 0,55 mg/m³ | 1,35 mg/m³ |
| Sum of the negative cross-sensitivities | 0,00 mg/m³ | -0,35 mg/m³ |

# Calculation of measurement uncertainty

## according to EN ISO 14956, EN 14181 and EN 15267-3

Version 5.2

### Device data

| | | | |
|---|---|---|---|
| **Customer** | Vantaan Energia | | |
| **Identification** | JV1 | | |
| **Serial number** | | **Date** | 2013-03-21 |
| **Measuring system** | **MCS100FT** | **Component** | **CH4** |

### Influences of the process characteristics

| **Process characteristics** | **Largest difference according to type approval** | | | |
|---|---|---|---|---|
| | **Zero point** | | **Span point** | |
| Lack-of-fit (Linearity) | 0,85 | mg/m³ | 0,85 | mg/m³ |
| Zero drift from the field test | -1,25 | mg/m³ | 0,00 | mg/m³ |
| Span drift from the field test | 0,00 | mg/m³ | -1,50 | mg/m³ |
| Influence of ambient temperature at span point | -0,05 | mg/m³ | 0,70 | mg/m³ |
| Influence of sample gas pressure | 0,00 | mg/m³ | 0,00 | mg/m³ |
| Influence of sample gas flow | 0,00 | mg/m³ | -0,05 | mg/m³ |
| Influence of voltage | -0,05 | mg/m³ | 0,10 | mg/m³ |
| Cross-sensitivity | 0,55 | mg/m³ | 1,35 | mg/m³ |
| Repeatability at span point | 0,01 | mg/m³ | 0,05 | mg/m³ |
| Standard deviation from paired maesurements under field conditions | 0,54 | mg/m³ | 0,54 | mg/m³ |
| Uncertainty of provided reference material | 1,00 | mg/m³ | 1,00 | mg/m³ |
| Misalignment | 0,00 | mg/m³ | 0,00 | mg/m³ |
| Convertion rate of AMS for measurement of NOx | 0,00 | mg/m³ | 0,00 | mg/m³ |
| Changes of response fasctors | 0,00 | mg/m³ | 0,00 | mg/m³ |

| **Process characteristics** | | | **Standard uncertainty** | | | |
|---|---|---|---|---|---|---|
| | | | **Zero point** | | **Span point** | |
| Lack-of-fit (Linearity) | $u_{lof}$ | = | 0,4907 | mg/m³ | 0,4907 | mg/m³ |
| Zero drift from the field test | $u_{d,z}$ | = | -0,7217 | mg/m³ | 0,0000 | mg/m³ |
| Span drift from the field test | $u_{d,s}$ | = | 0,0000 | mg/m³ | -0,8660 | mg/m³ |
| Influence of ambient temperature at span point | $u_t$ | = | -0,0289 | mg/m³ | 0,4041 | mg/m³ |
| Influence of sample gas pressure | $u_p$ | = | 0,0000 | mg/m³ | 0,0000 | mg/m³ |
| Influence of sample gas flow | $u_f$ | = | 0,0000 | mg/m³ | -0,0289 | mg/m³ |
| Influence of voltage | $u_v$ | = | -0,0289 | mg/m³ | 0,0577 | mg/m³ |
| Cross-sensitivity | $u_i$ | = | 0,3175 | mg/m³ | 0,7794 | mg/m³ |
| Repeatability at span point | $u_r$ | = | 0,0058 | mg/m³ | 0,0289 | mg/m³ |
| Standard deviation from paired maesurements under field conditions | $u_D$ | = | 0,3134 | mg/m³ | 0,3134 | mg/m³ |
| Uncertainty of provided reference material | $u_{rm}$ | = | 0,5774 | mg/m³ | 0,5774 | mg/m³ |
| Misalignment | $u_{mb}$ | = | 0,0000 | mg/m³ | 0,0000 | mg/m³ |
| Convertion rate of AMS for measurement of NOx | $u_{ce}$ | = | 0,0000 | mg/m³ | 0,0000 | mg/m³ |
| Changes of response fasctors | $u_{rf}$ | = | 0,0000 | mg/m³ | 0,0000 | mg/m³ |

### Calculation of the combined standard uncertainties

| | | **Zero point** | | **Span point** | |
|---|---|---|---|---|---|
| **Combined standard uncertainty** | **s(AMS) values** | 1,1383 | mg/m³ | 1,4824 | mg/m³ |

### Verification of compliance with the requirements

| | | | |
|---|---|---|---|
| Combined standard uncertainty | 1,65 | mg/m³ | according to EN 15267-3 |
| Expanded uncertainty | 3,23 | mg/m³ | according to EN 15267-3 |
| Relative expanded uncertainty | 16,16 | % | of the measuring range of 20 mg/m³ |
| Allowed expanded uncertainty | 20,00 | % | of the measuring range of 20 mg/m³ |
| Allowed expanded uncertainty | 4,00 | mg/m³ | |

**Result** Requirements fulfilled

**Attention: The 2001/80/EC and 2000/76/EC gives no requirements for these components.**

# Calculation of measurement uncertainty

## according to EN ISO 14956, EN 14181 and EN 15267-3

Version 5.2

### Device data

| | | | |
|---|---|---|---|
| **Customer** | Vantaan Energia | | |
| **Identification** | JV1 | | |
| **Serial number** | | **Date** | 2013-03-21 |
| **Measuring system** | **MCS100FT** | **Component** | **Corg** |

### Input values

| | | | | | |
|---|---|---|---|---|---|
| Certification range | 15 | mg/m³ | Requirement to response time | 25 | % |
| Emissions limit value | 10 | mg/m³ | Averaging time of measured values | 30 | min |
| Confidence interval | 30 | % | | | |

### Genaral information

| | | | | | |
|---|---|---|---|---|---|
| **Maintenance interval** | 2 | months | **Detection limit** | 0 | mg/m³ |

### Required performance regarding dynamic operating conditions

| | | | |
|---|---|---|---|
| Measured response time | 0,82 | min | |
| Requirement to response time | 7,50 | min | 25% of the averaging time of 30 min |

**Result** | Requirements fulfilled |

### Calculation of the expanded uncertainty

| **Interferent** | **Zero point** | | **Span point** | |
|---|---|---|---|---|
| 3 Vol% Oxygen (O2) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 21 Vol% Oxygen (O2) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 30 Vol% Water (H2O) | **0,17** | mg/m³ | **0,18** | mg/m³ |
| 300 mg/m³ Carbon monoxide (CO) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 15 Vol% Carbon dioxide (CO2) | **0,13** | mg/m³ | **-0,15** | mg/m³ |
| 50 mg/m³ Methane (CH4) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 20 mg/m³ Dinitrogen oxide (N2O) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 100 mg/m³ Dinitrogen oxide (N2O) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 300 mg/m³ Nitrogen monoxide (NO) | **0,08** | mg/m³ | 0,00 | mg/m³ |
| 30 mg/m³ Nitrogen dioxide (NO2) | **0,08** | mg/m³ | 0,00 | mg/m³ |
| 20 mg/m³ Ammonia (NH3) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 200 mg/m³ Sulfur dioxide (SO2) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 1000 mg/m³ Sulfur dioxide (SO2) | 0,00 | mg/m³ | **-0,08** | mg/m³ |
| 50 mg/m³ Hydrogen chloride (HCl) | 0,00 | mg/m³ | 0,00 | mg/m³ |
| 200 mg/m³ Hydrogen chloride (HCl) | **0,08** | mg/m³ | **0,09** | mg/m³ |

| | | |
|---|---|---|
| Sum of the positive cross-sensitivities | 0,54 mg/m³ | 0,27 mg/m³ |
| Sum of the negative cross-sensitivities | 0,00 mg/m³ | -0,23 mg/m³ |

# Calculation of measurement uncertainty

## according to EN ISO 14956, EN 14181 and EN 15267-3

Version 5.2

### Device data

| | | | |
|---|---|---|---|
| **Customer** | Vantaan Energia | | |
| **Identification** | JV1 | | |
| **Serial number** | | **Date** | 2013-03-21 |
| **Measuring system** | **MCS100FT** | **Component** | **Corg** |

### Influences of the process characteristics

| **Process characteristics** | **Largest difference according to type approval** | | | |
|---|---|---|---|---|
| | **Zero point** | | **Span point** | |
| Lack-of-fit (Linearity) | 0,10 | mg/m³ | 0,10 | mg/m³ |
| Zero drift from the field test | 0,26 | mg/m³ | 0,00 | mg/m³ |
| Span drift from the field test | 0,00 | mg/m³ | -0,42 | mg/m³ |
| Influence of ambient temperature at span point | 0,21 | mg/m³ | -0,20 | mg/m³ |
| Influence of sample gas pressure | 0,00 | mg/m³ | 0,00 | mg/m³ |
| Influence of sample gas flow | 0,09 | mg/m³ | -0,11 | mg/m³ |
| Influence of voltage | -0,02 | mg/m³ | 0,08 | mg/m³ |
| Cross-sensitivity | 0,54 | mg/m³ | 0,27 | mg/m³ |
| Repeatability at span point | 0,00 | mg/m³ | 0,01 | mg/m³ |
| Standard deviation from paired maesurements under field conditions | 0,05 | mg/m³ | 0,05 | mg/m³ |
| Uncertainty of provided reference material | 0,30 | mg/m³ | 0,30 | mg/m³ |
| Misalignment | 0,00 | mg/m³ | 0,00 | mg/m³ |
| Convertion rate of AMS for measurement of NOx | 0,00 | mg/m³ | 0,00 | mg/m³ |
| Changes of response fasctors | 0,98 | mg/m³ | 0,98 | mg/m³ |

| **Process characteristics** | | | **Standard uncertainty** | | | |
|---|---|---|---|---|---|---|
| | | | **Zero point** | | **Span point** | |
| Lack-of-fit (Linearity) | $u_{lof}$ | = | 0,0580 | mg/m³ | 0,0580 | mg/m³ |
| Zero drift from the field test | $u_{d,z}$ | = | 0,1516 | mg/m³ | 0,0000 | mg/m³ |
| Span drift from the field test | $u_{d,s}$ | = | 0,0000 | mg/m³ | -0,2434 | mg/m³ |
| Influence of ambient temperature at span point | $u_t$ | = | 0,1212 | mg/m³ | -0,1126 | mg/m³ |
| Influence of sample gas pressure | $u_p$ | = | 0,0000 | mg/m³ | 0,0000 | mg/m³ |
| Influence of sample gas flow | $u_f$ | = | 0,0520 | mg/m³ | -0,0606 | mg/m³ |
| Influence of voltage | $u_v$ | = | -0,0087 | mg/m³ | 0,0433 | mg/m³ |
| Cross-sensitivity | $u_i$ | = | 0,3109 | mg/m³ | 0,1559 | mg/m³ |
| Repeatability at span point | $u_r$ | = | 0,0000 | mg/m³ | 0,0058 | mg/m³ |
| Standard deviation from paired maesurements under field conditions | $u_D$ | = | 0,0263 | mg/m³ | 0,0263 | mg/m³ |
| Uncertainty of provided reference material | $u_{rm}$ | = | 0,1732 | mg/m³ | 0,1732 | mg/m³ |
| Misalignment | $u_{mb}$ | = | 0,0000 | mg/m³ | 0,0000 | mg/m³ |
| Convertion rate of AMS for measurement of NOx | $u_{ce}$ | = | 0,0000 | mg/m³ | 0,0000 | mg/m³ |
| Changes of response fasctors | $u_{rf}$ | = | 0,5655 | mg/m³ | 0,5655 | mg/m³ |

### Calculation of the combined standard uncertainties

| | | **Zero point** | | **Span point** | |
|---|---|---|---|---|---|
| **Combined standard uncertainty** | **s(AMS) values** | 0,7007 | mg/m³ | 0,6750 | mg/m³ |

### Verification of compliance with the requirements

| | | | |
|---|---|---|---|
| Combined standard uncertainty | 0,74 | mg/m³ | according to EN 15267-3 |
| Expanded uncertainty | 1,45 | mg/m³ | according to EN 15267-3 |
| Relative expanded uncertainty | 14,55 | % | of the emissions limit value of 10 mg/m³ |
| Allowed expanded uncertainty | 30,00 | % | of the emissions limit value of 10 mg/m³ |
| Allowed expanded uncertainty | 3,00 | mg/m³ | |

**Result** Requirements fulfilled

# Calculation of measurement uncertainty

## according to EN ISO 14956, EN 14181 and EN 15267-3

Version 5.2

### Device data

| | | | |
|---|---|---|---|
| **Customer** | Vantaan Energia | | |
| **Identification** | JV1 | | |
| **Serial number** | | **Date** | 2013-03-21 |
| **Measuring system** | **MCS100FT** | **Component** | **O2** |

### Input values

| | | | | | | |
|---|---|---|---|---|---|---|
| Certification range | 21 | Vol% | | Requirement to response time | 25 | % |
| Measuring range | 20 | Vol% | | Averaging time of measured values | 30 | min |
| Confidence interval | 20 | % | * | | | |

Attention: The 2001/80/EC and 2000/76/EC gives no requirements for these components.

### Genaral information

| | | | | | |
|---|---|---|---|---|---|
| **Maintenance interval** | 4 | weeks | **Detection limit** | 0,03 | Vol% |

### Required performance regarding dynamic operating conditions

| | | | |
|---|---|---|---|
| Measured response time | 2,27 | min | |
| Requirement to response time | 7,50 | min | 25% of the averaging time of 30 min |

**Result** Requirements fulfilled

### Calculation of the expanded uncertainty

| **Interferent** | **Zero point** | | **Span point** | |
|---|---|---|---|---|
| 3 Vol% Oxygen (O2) | | | | |
| 21 Vol% Oxygen (O2) | | | | |
| 30 Vol% Water (H2O) | 0,00 | Vol% | 0,00 | Vol% |
| 300 mg/m³ Carbon monoxide (CO) | 0,00 | Vol% | 0,00 | Vol% |
| 15 Vol% Carbon dioxide (CO2) | 0,00 | Vol% | 0,00 | Vol% |
| 50 mg/m³ Methane (CH4) | 0,00 | Vol% | 0,00 | Vol% |
| 20 mg/m³ Dinitrogen oxide (N2O) | 0,00 | Vol% | 0,00 | Vol% |
| 100 mg/m³ Dinitrogen oxide (N2O) | 0,00 | Vol% | 0,00 | Vol% |
| 300 mg/m³ Nitrogen monoxide (NO) | 0,00 | Vol% | 0,00 | Vol% |
| 30 mg/m³ Nitrogen dioxide (NO2) | 0,00 | Vol% | 0,00 | Vol% |
| 20 mg/m³ Ammonia (NH3) | 0,00 | Vol% | 0,00 | Vol% |
| 200 mg/m³ Sulfur dioxide (SO2) | 0,00 | Vol% | 0,00 | Vol% |
| 1000 mg/m³ Sulfur dioxide (SO2) | 0,00 | Vol% | 0,00 | Vol% |
| 50 mg/m³ Hydrogen chloride (HCl) | 0,00 | Vol% | 0,00 | Vol% |
| 200 mg/m³ Hydrogen chloride (HCl) | 0,00 | Vol% | 0,00 | Vol% |

| | | | | |
|---|---|---|---|---|
| Sum of the positive cross-sensitivities | 0,00 | Vol% | 0,00 | Vol% |
| Sum of the negative cross-sensitivities | 0,00 | Vol% | 0,00 | Vol% |

# Calculation of measurement uncertainty

## according to EN ISO 14956, EN 14181 and EN 15267-3

Version 5.2

### Device data

| | | | |
|---|---|---|---|
| **Customer** | Vantaan Energia | | |
| **Identification** | JV1 | | |
| **Serial number** | | **Date** | 2013-03-21 |
| **Measuring system** | **MCS100FT** | **Component** | **O2** |

### Influences of the process characteristics

| **Process characteristics** | **Largest difference according to type approval** | | | |
|---|---|---|---|---|
| | **Zero point** | | **Span point** | |
| Lack-of-fit (Linearity) | -0,14 | Vol% | -0,14 | Vol% |
| Zero drift from the field test | 0,18 | Vol% | 0,00 | Vol% |
| Span drift from the field test | 0,00 | Vol% | -0,20 | Vol% |
| Influence of ambient temperature at span point | 0,02 | Vol% | 0,24 | Vol% |
| Influence of sample gas pressure | 0,00 | Vol% | 0,00 | Vol% |
| Influence of sample gas flow | -0,02 | Vol% | 0,01 | Vol% |
| Influence of voltage | 0,01 | Vol% | -0,10 | Vol% |
| Cross-sensitivity | 0,00 | Vol% | 0,00 | Vol% |
| Repeatability at span point | 0,01 | Vol% | 0,01 | Vol% |
| Standard deviation from paired maesurements under field conditions | 0,09 | Vol% | 0,09 | Vol% |
| Uncertainty of provided reference material | 0,42 | Vol% | 0,42 | Vol% |
| Misalignment | 0,00 | Vol% | 0,00 | Vol% |
| Convertion rate of AMS for measurement of NOx | 0,00 | Vol% | 0,00 | Vol% |
| Changes of response fasctors | 0,00 | Vol% | 0,00 | Vol% |

| **Process characteristics** | | | **Standard uncertainty** | | | |
|---|---|---|---|---|---|---|
| | | | **Zero point** | | **Span point** | |
| Lack-of-fit (Linearity) | $u_{lof}$ | = | -0,0808 | Vol% | -0,0808 | Vol% |
| Zero drift from the field test | $u_{d,z}$ | = | 0,1039 | Vol% | 0,0000 | Vol% |
| Span drift from the field test | $u_{d,s}$ | = | 0,0000 | Vol% | -0,1155 | Vol% |
| Influence of ambient temperature at span point | $u_t$ | = | 0,0115 | Vol% | 0,1386 | Vol% |
| Influence of sample gas pressure | $u_p$ | = | 0,0000 | Vol% | 0,0000 | Vol% |
| Influence of sample gas flow | $u_f$ | = | -0,0115 | Vol% | 0,0058 | Vol% |
| Influence of voltage | $u_v$ | = | 0,0058 | Vol% | -0,0577 | Vol% |
| Cross-sensitivity | $u_i$ | = | 0,0000 | Vol% | 0,0000 | Vol% |
| Repeatability at span point | $u_r$ | = | 0,0058 | Vol% | 0,0058 | Vol% |
| Standard deviation from paired maesurements under field conditions | $u_D$ | = | 0,0533 | Vol% | 0,0533 | Vol% |
| Uncertainty of provided reference material | $u_{rm}$ | = | 0,2425 | Vol% | 0,2425 | Vol% |
| Misalignment | $u_{mb}$ | = | 0,0000 | Vol% | 0,0000 | Vol% |
| Convertion rate of AMS for measurement of NOx | $u_{ce}$ | = | 0,0000 | Vol% | 0,0000 | Vol% |
| Changes of response fasctors | $u_{rf}$ | = | 0,0000 | Vol% | 0,0000 | Vol% |

### Calculation of the combined standard uncertainties

| | | **Zero point** | | **Span point** | |
|---|---|---|---|---|---|
| **Combined standard uncertainty** | **s(AMS) values** | 0,2816 | Vol% | 0,3226 | Vol% |

### Verification of compliance with the requirements

| | | | |
|---|---|---|---|
| Combined standard uncertainty | 0,34 | Vol% | according to EN 15267-3 |
| Expanded uncertainty | 0,66 | Vol% | according to EN 15267-3 |
| Relative expanded uncertainty | 3,32 | % | of the measuring range of 20 Vol% |
| Allowed expanded uncertainty | 20,00 | % | of the measuring range of 20 Vol% |
| Allowed expanded uncertainty | 4,00 | Vol% | |

**Result** Requirements fulfilled

**Attention: The 2001/80/EC and 2000/76/EC gives no requirements for these components.**

SICK | MAIHAK

# Calculation of Uncertainties according to EN ISO 14956 and EN 14181 (QAL1)

## Data of measuring system

| | |
|---|---|
| **Customer** | VE 87460-J3-HNA-00024 |
| **Identification** | J3HNA02CQ012-U01 |
| **Order conformation number** | |
| **Serial number** | |

**Measuring system** **GM 35**

## Starting values

| **Emission limit value** | **Concentration** | | **95%-Confidence interval in %** | |
|---|---|---|---|---|
| Component CO | 40 | mg/m³ | *20* | *The **red values** are* |
| Component CO2 * | 20 | vol% | *20* | *examples only, because no* |
| Component H2O * | 20 | vol% | *20* | *limits are defined.* |

** Measuring range full scale. For these components are no emission limit values defined.*

| **Interferents** (formula) | **Concentration** | | |
|---|---|---|---|
| CO | 40,0 | mg/m³ | |
| CO2 | 15,6 | vol% | |
| NO | 120,0 | mg/m³ | |
| NO2 | 20,0 | mg/m³ | ***The concentrations are half-hour mean values or concentrations which are typical for large combustion plants and waste incineration plants*** |
| N2O | 10,0 | mg/m³ | |
| SO2 | 50,0 | mg/m³ | |
| H2O | 16,9 | vol% | |
| O2 | 11,0 | vol% | |
| NH3 | 5,0 | mg/m³ | |
| HCl | 5,0 | mg/m³ | |
| CH4 | 10,0 | mg/m³ | |

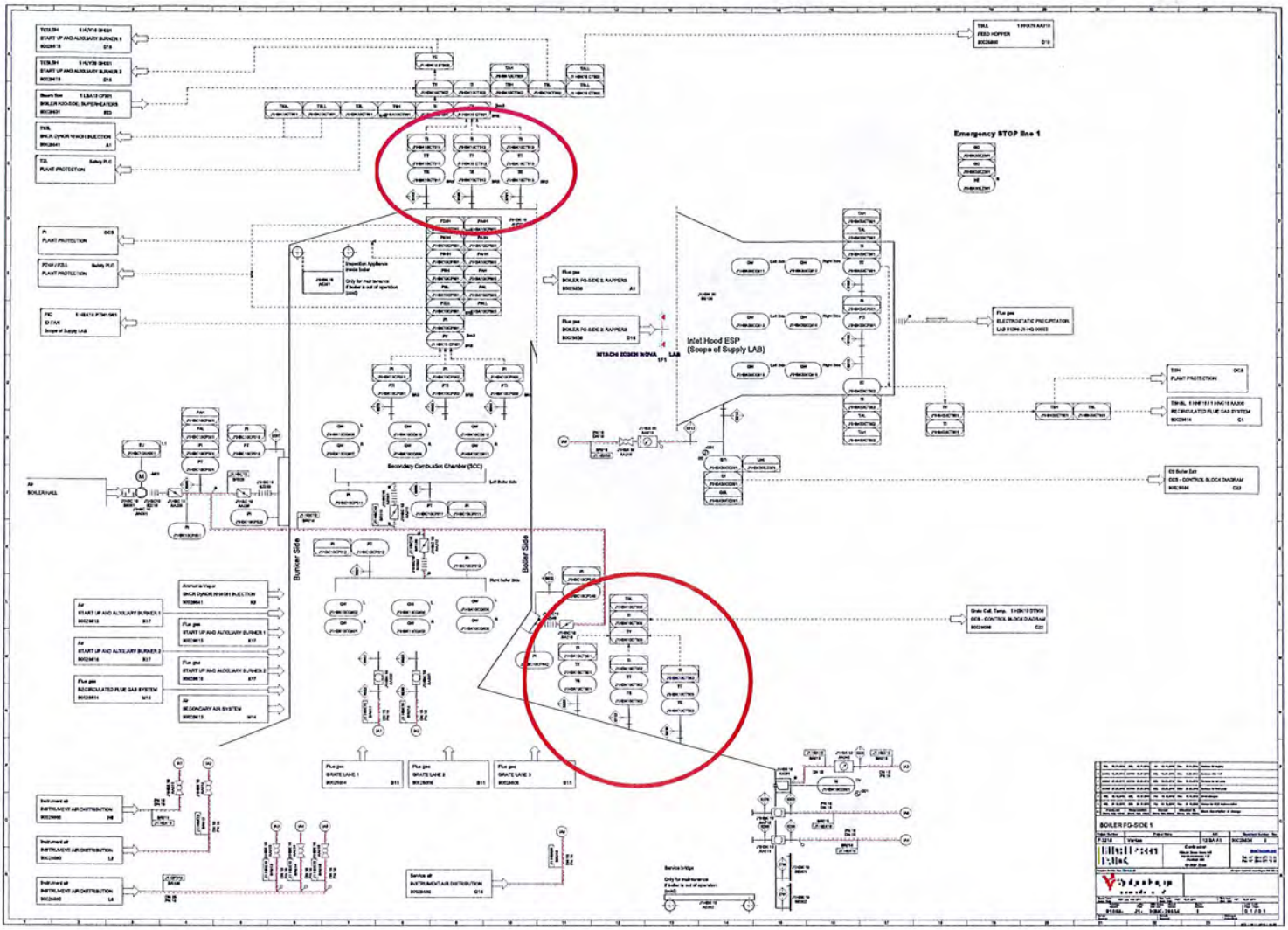
**Required quality of measurement**

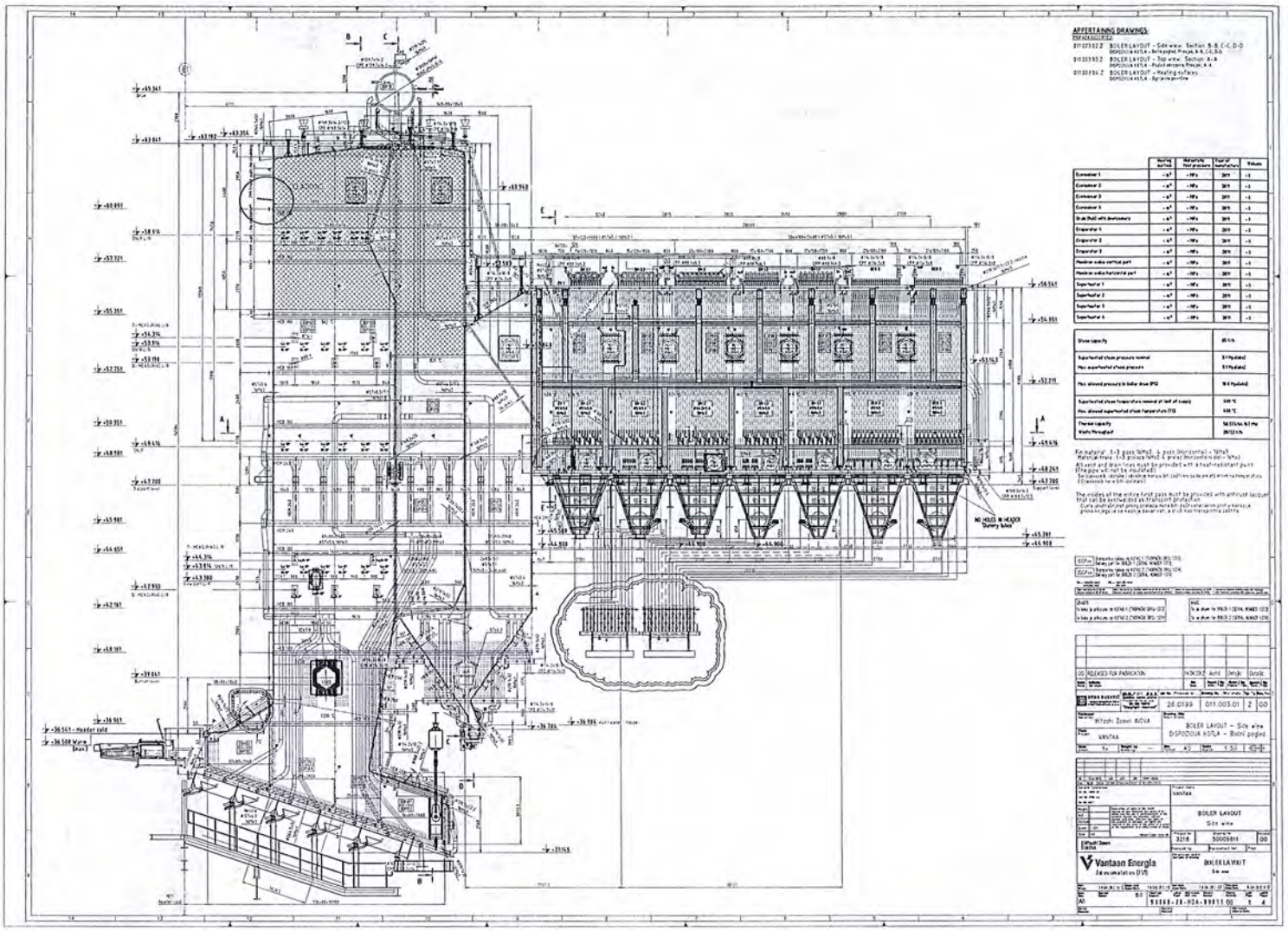
| | | | |
|---|---|---|---|
| Requirements to response time* | 25 | % | ***Requirements given by customer, regulations or authorities*** |
| Averaging time of measuring values | 30 | min | |

** Possible values are 25% for dynamic (standard) or 10% for highly dynamic processes (EN ISO 14956, 7.2).*

## Results

| **Component** | **Response time** | **$s_{AMS}$** | | **Measurement quality** |
|---|---|---|---|---|
| | | **zero** | **reference** | |
| **CO** | Requirement fulfilled | 1,6063 | 1,7499 | Requirements fulfilled |
| **CO2** | Requirement fulfilled | 0,7233 | 0,7509 | Requirements fulfilled |
| **H2O** | Requirement fulfilled | 0,9366 | 0,9485 | Requirements fulfilled |


Emergency STOP Box 1
Inlet Hood ESP
(Scope of Supply LAB)
Secondary Combustion Chamber (SCC)
Boiler Side
Burner Side
BOILER FG-SIDE 1



APPERTAINING DRAWINGS:

| | | |
|---|---|---|
| 011.003.02 Z | BOILER LAYOUT - Side view. Section B-B, C-C, D-D | DISPOZICIJA KOTLA - Bočni pogled. Presek B-B, C-C, D-D |
| 011.003.03 Z | BOILER LAYOUT - Top view. Section A-A | DISPOZICIJA KOTLA - Pogled odozgo. Presek A-A |
| 011.003.04 Z | BOILER LAYOUT - Heating surfaces | DISPOZICIJA KOTLA - Grejne površine |

| | Heating surface | Material No. Test pressure | Year of manufacture | Values |
|---|---|---|---|---|
| Economizer 1 | ... m² | ... MPa | 2019 | ... t |
| Economizer 2 | ... m² | ... MPa | 2019 | ... t |
| Economizer 3 | ... m² | ... MPa | 2019 | ... t |
| Economizer 4 | ... m² | ... MPa | 2019 | ... t |
| Drum (full with downcomers) | ... m² | ... MPa | 2019 | ... t |
| Evaporator 1 | ... m² | ... MPa | 2019 | ... t |
| Evaporator 2 | ... m² | ... MPa | 2019 | ... t |
| Evaporator 3 | ... m² | ... MPa | 2019 | ... t |
| Membrane walls vertical part | ... m² | ... MPa | 2019 | ... t |
| Membrane walls horizontal part | ... m² | ... MPa | 2019 | ... t |
| Superheater 1 | ... m² | ... MPa | 2019 | ... t |
| Superheater 2 | ... m² | ... MPa | 2019 | ... t |
| Superheater 3 | ... m² | ... MPa | 2019 | ... t |
| Superheater 4 | ... m² | ... MPa | 2019 | ... t |

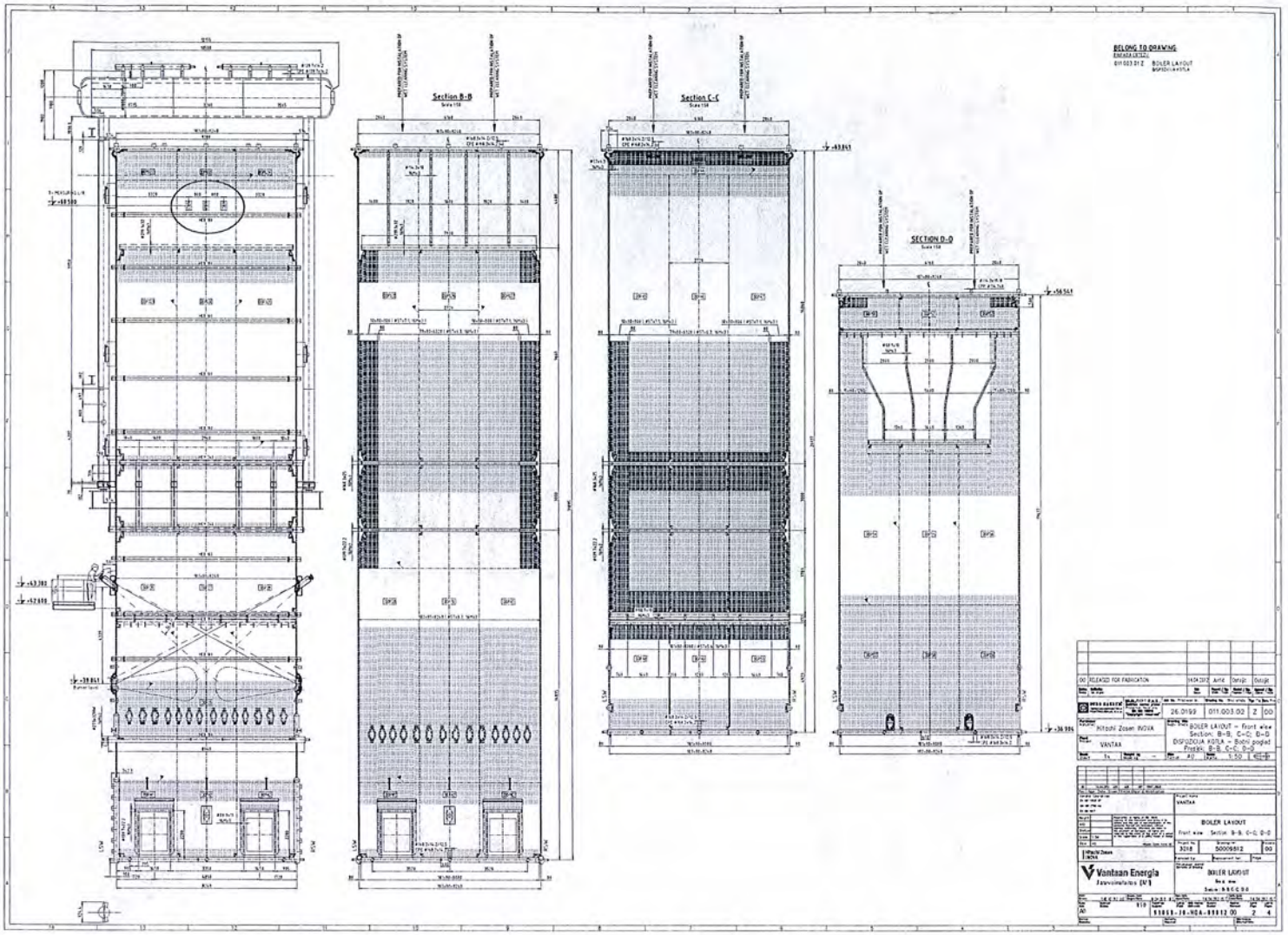
| | |
|---|---|
| Steam capacity | 65 t/h |
| Superheated steam pressure nominal | 51 Pa (abs) |
| Max. superheated steam pressure | 51 Pa (abs) |
| Max. allowed pressure in boiler drum (PS) | 60 Pa (abs) |
| Superheated steam temperature nominal at last of supply | 485 °C |
| Max. allowed superheated steam temperature (TS) | 495 °C |
| Thermal capacity | 56.33 MW, 48.7 Mcal/h |
| Water throughput | 260.22 t/h |

Fin material: 1–3 pass: 16Mo3, 4 pass (horizontal + 10%?)
Material finns: 1–3 pass: 16Mo3, 4 pass (horizontal + 10%?)
All vent and drain lines must be provided with a heat-resistant paint (the paint will not be insulated)
Set (several, single, double rows of pins to be welded on the membrane tubes (Distances not a bit optimal)
The insides of the entire first pass must be provided with anti-rust lacquer that can be washed out as the last anti-protection
Cure, protect and prevent access to each circulation pump, remove process caps at the very beginning, and do not remove the cap!

| | | | | |
|---|---|---|---|---|
| 00 | RELEASED FOR FABRICATION | 24.04.19 | Jurić | Drnjak | Đorđić |

| | | | | | |
|---|---|---|---|---|---|
| Mitsubishi Power Europe GmbH | 26.0199 | 011.003.01 | Z | 00 |
| Mitsubishi Power Europe GmbH | Mitsubishi Zosen AKOVA | BOILER LAYOUT - Side view<br>DISPOZICIJA KOTLA - Bočni pogled | | |
| Project: VARATAN | | | | |

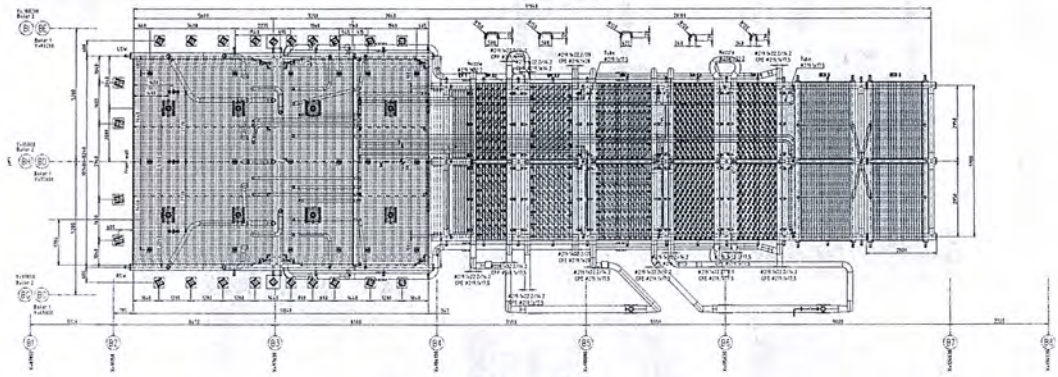
| | | | |
|---|---|---|---|
| Mitsubishi Power Europe GmbH | Project name: VARATAN | | |
| | BOILER LAYOUT<br>Side view | | |
| Mitsubishi Zosen AKOVA | 3218 | 50005811 | 00 |
| Vantaan Energia Jätevoimalaitos Oy (VE) | BOILER LAYOUT<br>Side view | | |
| A0 | 50005-28-M24-00011.00 | 1 | 4 |



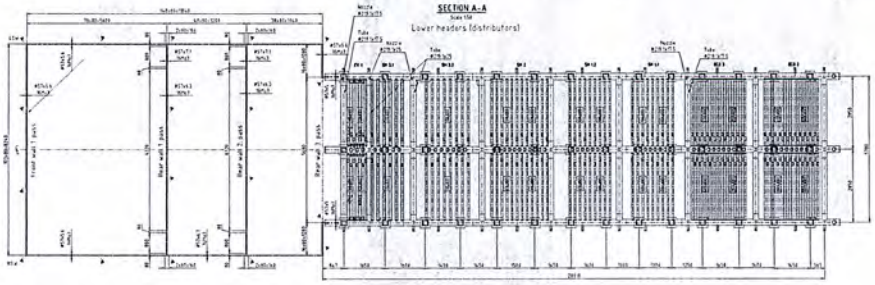
BELONG TO DRAWING
Section B-B
Section C-C
SECTION D-D
00 RELEASED FOR FABRICATION
26.01.99
011.003.02
Z
00
Mitsubishi Zosen INOVA
VANTAA
BOILER LAYOUT – Front view
Section: B-B, C-C, D-D
DISPOZICIA KOTLA – Bubni pogled
Prezisk: B-B, C-C, D-D
A0
1:50
VANTAA
BOILER LAYOUT
Front view Section: B-B, C-C, D-D
3218
50009812
00
Vantaan Energia
Jaavoimalaitos (M1)
BOILER LAYOUT
Section: B-B C-C D-D
A0
110
00 2 4

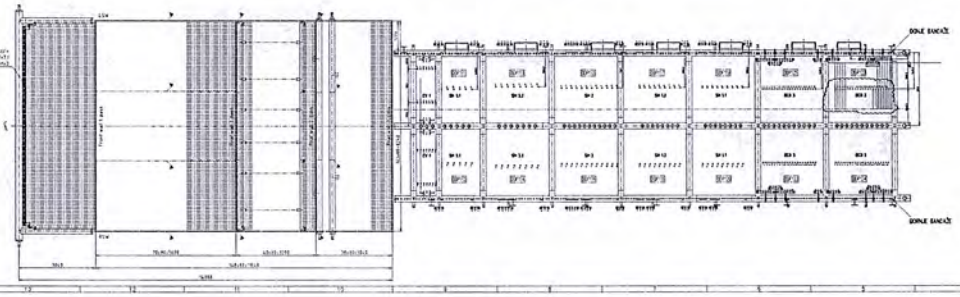
Top view
Scale 1:50
Upper headers

BELONG TO DRAWING
011.003.01.2 BOILER LAYOUT

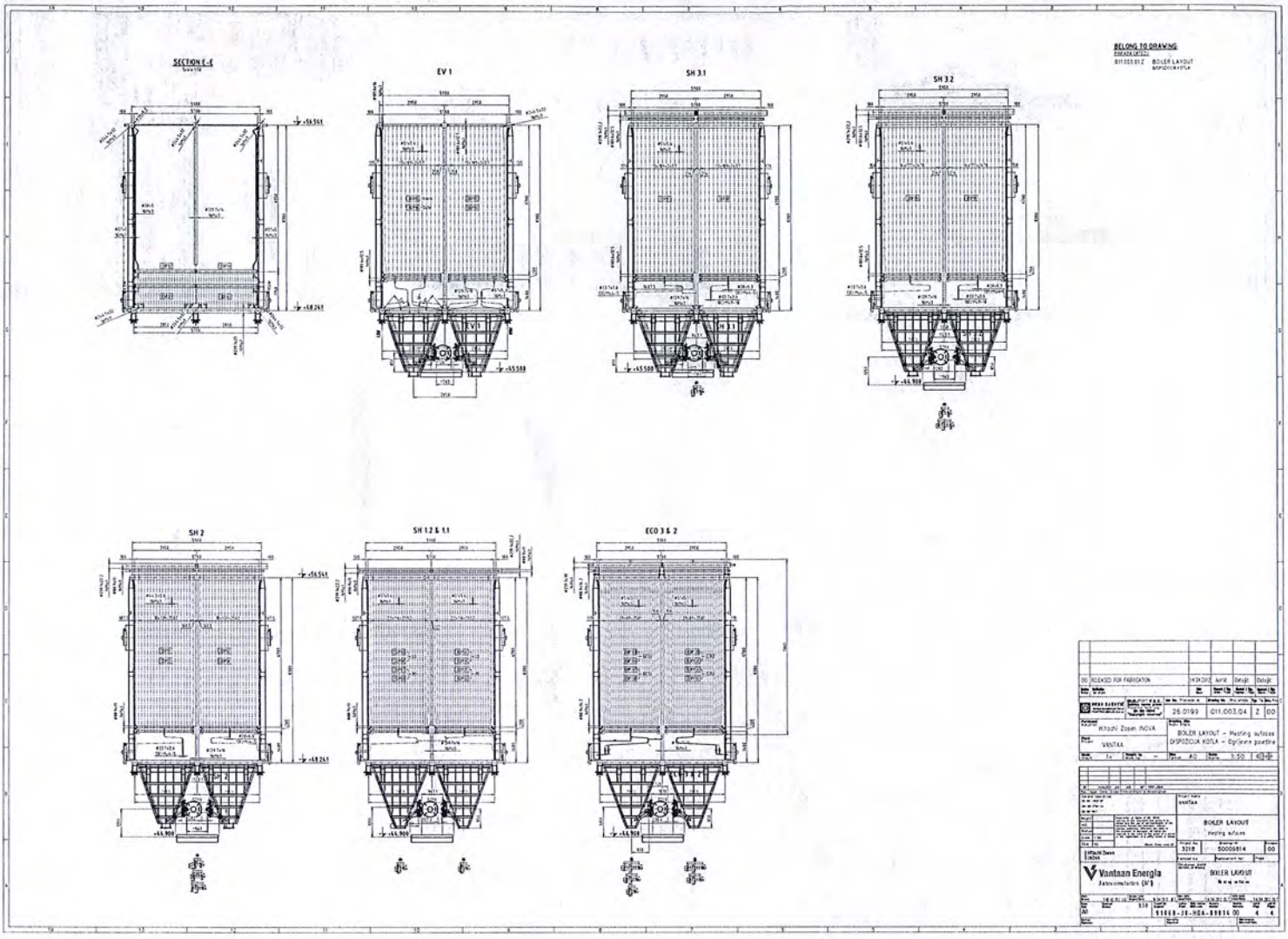


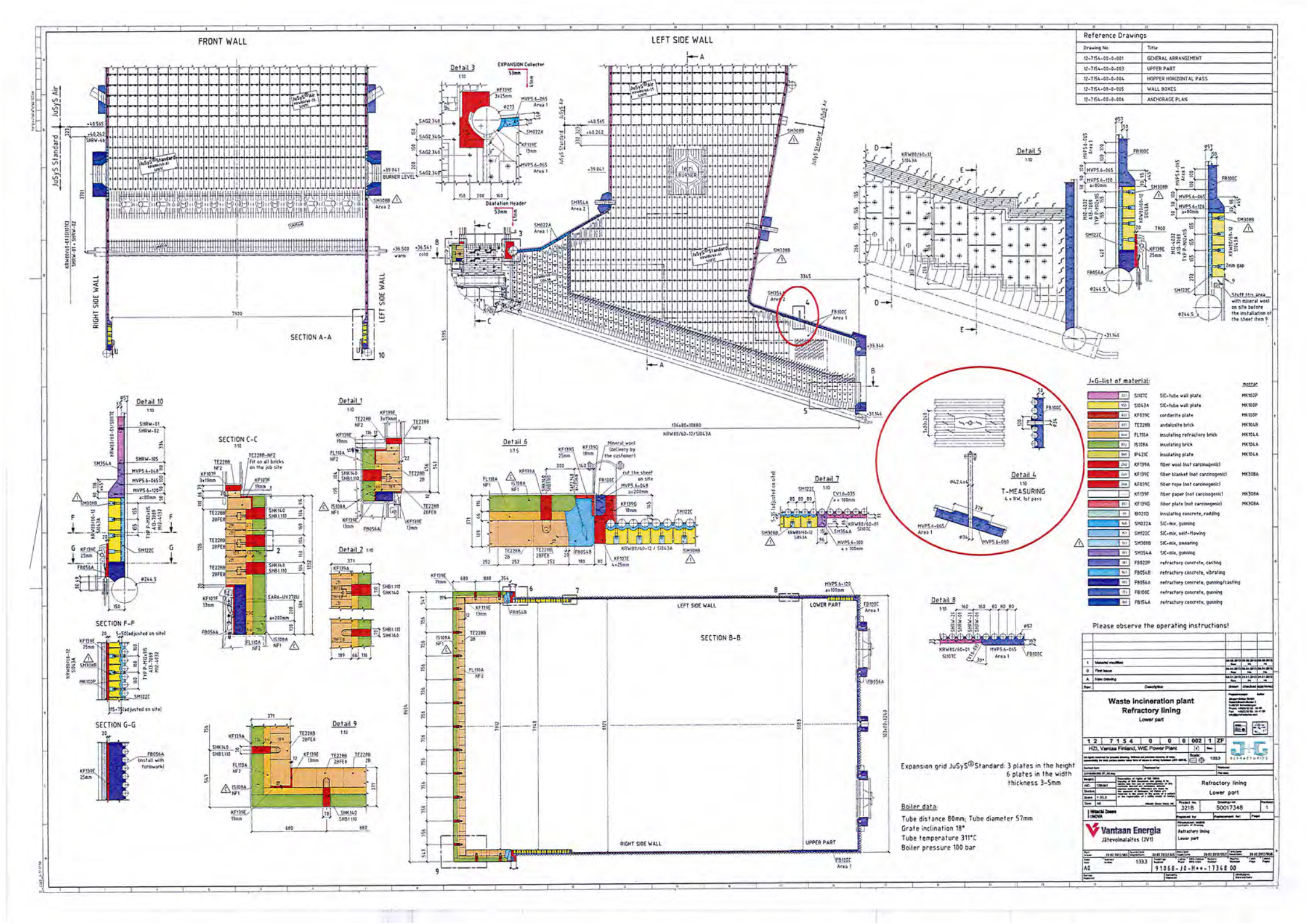
SECTION A-A
Scale 1:50
Lower headers (distributors)






| | | | | | |
|---|---|---|---|---|---|
| 00 | RELEASED FOR FABRICATION | | ADK'203 | AKK | Dmljč | Dovjč |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | |


SECTION E-E
EV 1
SH 3.1
SH 3.2
SH 2
SH 1.2 & 1.1
ECO 3 & 2
BELONG TO DRAWING
011.003.01 Z BOILER LAYOUT
00 RELEASED FOR FABRICATION
26.0199
011.003.04
Z
00
Hitachi Zosen INOVA
VANTAA
BOILER LAYOUT – Heating surfaces
DISPOZICIJA KOTLA – Ogrijevne powrtine
A0
1:50
BOILER LAYOUT
Heating surfaces
3218
50009814
00
Vantaan Energia
Jatevoimalaitos (A1)
BOILER LAYOUT
A0
00


FRONT WALL
LEFT SIDE WALL
RIGHT SIDE WALL
SECTION A-A
SECTION B-B
SECTION C-C
SECTION F-F
SECTION G-G
Detail 1
Detail 2
Detail 3
Detail 4
T-MEASURING
Detail 5
Detail 6
Detail 7
Detail 8
Detail 9
Detail 10
EXPANSION Collector
Dilatation Header
JuSyS Standard
JuSyS Air
BURNER
LEFT SIDE WALL
RIGHT SIDE WALL
LOWER PART
UPPER PART
Mineral wool (delivery by the customer)
cut the sheet on site
Fit on all bricks on the job site
Stuff this area with mineral wool on site before the installation of the sheet item 9
Reference Drawings
Drawing No
Title
12-7154-00-0-001
GENERAL ARRANGEMENT
12-7154-00-0-003
UPPER PART
12-7154-00-0-004
HOPPER HORIZONTAL PASS
12-7154-00-0-005
WALL BOXES
12-7154-00-0-006
ANCHORAGE PLAN
J-G-list of material:
SI107C SIC-tube wall plate MK100P
SI043A SIC-tube wall plate MK100P
KF039C cordierite plate MK100P
TE228B andalusite brick MK104B
FL110A insulating refractory brick MK104A
IS108A insulating brick MK104A
IP421C insulating plate MK104A
KF139A fiber wool (not carcinogenic)
KF139E fiber blanket (not carcinogenic) MK308A
KF039C fiber rope (not carcinogenic)
KF139F fiber paper (not carcinogenic) MK308A
KF139G fiber plate (not carcinogenic) MK308A
IB1020 insulating concrete, rodding
SM022A SIC-mix, gunning
SM122C SIC-mix, self-flowing
SM308B SIC-mix, smearing
SM354A SIC-mix, gunning
FB022P refractory concrete, casting
FB054B refractory concrete, vibrating
FB056A refractory concrete, gunning/casting
FB100C refractory concrete, gunning
FB154A refractory concrete, gunning
Please observe the operating instructions!
Waste incineration plant
Refractory lining
Lower part
12 7154 0 0 0 002 1 ZF
HZI, Vantaa Finland, WtE Power Plant
Refractory lining
Lower part
Project No. 3218
Drawing-no. 50017348
Revision 1
Vantaan Energia
Jätevoimalaitos (JV1)
A0
91068-J0-H**-17348 00
Expansion grid JuSyS® Standard: 3 plates in the height
6 plates in the width
thickness 3-5mm
Boiler data:
Tube distance 80mm; Tube diameter 57mm
Grate inclination 18°
Tube temperature 311°C
Boiler pressure 100 bar