

# Calculation of measurement uncertainty

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

Version 5.2

## Device data

|                  |                            |      |            |
|------------------|----------------------------|------|------------|
| Customer         | DGtek / Volund GMAB Margam |      |            |
| Identification   | ZTA-4943685                |      |            |
| Serial number    | 1628 0562                  | Date | 2016-09-14 |
| Measuring system | <b>MCS100FT</b>            |      |            |

## Input values

| Component | Certification range |       | Emissions limit value |       | Confidence interval |
|-----------|---------------------|-------|-----------------------|-------|---------------------|
| CO        | 300.00              | mg/m³ | 1,000.00              | mg/m³ | 10 %                |
| CO2       | 25.00               | Vol%  | 25.00                 | Vol%  | 20 % *              |
| NO        | 400.00              | mg/m³ | 650.00**              | mg/m³ | 20 %                |
| NO2       | 100.00              | mg/m³ | 100.00                | mg/m³ | 20 %                |
| N2O       | 50.00               | mg/m³ | 50.00                 | mg/m³ | 20 % *              |
| SO2       | 300.00              | mg/m³ | 400.00                | mg/m³ | 20 %                |
| HCl       | 90.00               | mg/m³ | 100.00                | mg/m³ | 40 %                |
| HF        | 10.00               | mg/m³ | 10.00                 | mg/m³ | 40 %                |
| NH3       | 50.00               | mg/m³ | 60.00                 | mg/m³ | 40 % *              |
| H2O       | 40.00               | Vol%  | 40.00                 | Vol%  | 40 % *              |
| CH4       | 50.00               | mg/m³ |                       | mg/m³ | 20 % *              |
| Corg      | 50.00               | mg/m³ | 100.00                | mg/m³ | 30 %                |
| O2        | 21.00               | Vol%  | 25.00                 | 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 given 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 | 6.5727        | 9.0515     | Requirements fulfilled     |
| CO2       | Requirements fulfilled | 0.6360        | 0.7807     | Requirements fulfilled     |
| NO        | Requirements fulfilled | 10.0161       | 13.9600    | Requirements fulfilled     |
| NO2       | Requirements fulfilled | 3.4784        | 3.6244     | Requirements fulfilled     |
| N2O       | Requirements fulfilled | 1.0292        | 1.3577     | Requirements fulfilled     |
| SO2       | Requirements fulfilled | 8.1319        | 11.7655    | Requirements fulfilled     |
| HCl       | Requirements fulfilled | 3.3212        | 3.6177     | Requirements fulfilled     |
| HF        | Requirements fulfilled | 0.4901        | 0.4225     | Requirements fulfilled     |
| NH3       | Requirements fulfilled | 1.5732        | 1.4275     | Requirements fulfilled     |
| H2O       | Requirements fulfilled | 0.9910        | 1.0581     | Requirements fulfilled     |
| CH4       |                        |               |            |                            |
| Corg      | Requirements fulfilled | 2.3356        | 2.2500     | 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

|                         |                            |                  |            |
|-------------------------|----------------------------|------------------|------------|
| <b>Customer</b>         | DGtek / Volund GMAB Margam |                  |            |
| <b>Identification</b>   | ZTA-4943685                |                  |            |
| <b>Serial number</b>    | 1628 0562                  | <b>Date</b>      | 2016-09-14 |
| <b>Measuring system</b> | <b>MCS100FT</b>            | <b>Component</b> | <b>CO</b>  |

## Input values

|                       |       |                   |                                   |    |     |
|-----------------------|-------|-------------------|-----------------------------------|----|-----|
| Certification range   | 300   | mg/m <sup>3</sup> | Requirement to response time      | 25 | %   |
| Emissions limit value | 1,000 | mg/m <sup>3</sup> | Averaging time of measured values | 30 | min |
| Confidence interval   | 10    | %                 |                                   |    |     |

## General information

|                             |   |        |                        |      |                   |
|-----------------------------|---|--------|------------------------|------|-------------------|
| <b>Maintenance interval</b> | 6 | months | <b>Detection limit</b> | 0.32 | mg/m <sup>3</sup> |
|-----------------------------|---|--------|------------------------|------|-------------------|

## 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 (O <sub>2</sub> )                           | 0.00 mg/m <sup>3</sup>  | 0.00 mg/m <sup>3</sup>   |
| 21 Vol% Oxygen (O <sub>2</sub> )                          | 0.00 mg/m <sup>3</sup>  | 0.00 mg/m <sup>3</sup>   |
| 30 Vol% Water (H <sub>2</sub> O)                          | 0.00 mg/m <sup>3</sup>  | 3.00 mg/m <sup>3</sup>   |
| 300 mg/m <sup>3</sup> Carbon monoxide (CO)                |                         |                          |
| 15 Vol% Carbon dioxide (CO <sub>2</sub> )                 | 4.80 mg/m <sup>3</sup>  | 0.00 mg/m <sup>3</sup>   |
| 50 mg/m <sup>3</sup> Methane (CH <sub>4</sub> )           | 0.00 mg/m <sup>3</sup>  | 0.00 mg/m <sup>3</sup>   |
| 20 mg/m <sup>3</sup> Dinitrogen oxide (N <sub>2</sub> O)  | 0.00 mg/m <sup>3</sup>  | 0.00 mg/m <sup>3</sup>   |
| 100 mg/m <sup>3</sup> Dinitrogen oxide (N <sub>2</sub> O) | -5.40 mg/m <sup>3</sup> | -10.50 mg/m <sup>3</sup> |
| 300 mg/m <sup>3</sup> Nitrogen monoxide (NO)              | 0.00 mg/m <sup>3</sup>  | 0.00 mg/m <sup>3</sup>   |
| 30 mg/m <sup>3</sup> Nitrogen dioxide (NO <sub>2</sub> )  | 0.00 mg/m <sup>3</sup>  | 0.00 mg/m <sup>3</sup>   |
| 20 mg/m <sup>3</sup> Ammonia (NH <sub>3</sub> )           | 0.00 mg/m <sup>3</sup>  | 2.10 mg/m <sup>3</sup>   |
| 200 mg/m <sup>3</sup> Sulfur dioxide (SO <sub>2</sub> )   | 0.00 mg/m <sup>3</sup>  | 0.00 mg/m <sup>3</sup>   |
| 1000 mg/m <sup>3</sup> Sulfur dioxide (SO <sub>2</sub> )  | 0.00 mg/m <sup>3</sup>  | 0.00 mg/m <sup>3</sup>   |
| 50 mg/m <sup>3</sup> Hydrogen chloride (HCl)              | 0.00 mg/m <sup>3</sup>  | 0.00 mg/m <sup>3</sup>   |
| 200 mg/m <sup>3</sup> Hydrogen chloride (HCl)             | 0.00 mg/m <sup>3</sup>  | 0.00 mg/m <sup>3</sup>   |

Sum of the positive cross-sensitivities  
Sum of the negative cross-sensitivities

|       |                   |
|-------|-------------------|
| 4.80  | mg/m <sup>3</sup> |
| -5.40 | mg/m <sup>3</sup> |

|        |                   |
|--------|-------------------|
| 5.10   | mg/m <sup>3</sup> |
| -10.50 | mg/m <sup>3</sup> |

# Calculation of measurement uncertainty

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

Version 5.2

## Device data

|                  |                            |           |            |
|------------------|----------------------------|-----------|------------|
| Customer         | DGtek / Volund GMAB Margam | Date      | 2016-09-14 |
| Identification   | ZTA-4943685                | Component | CO         |
| Serial number    | 1628 0562                  |           |            |
| Measuring system | <b>MCS100FT</b>            |           |            |

## Influences of the process characteristics

### Process characteristics

### Largest difference according to type approval

|  | Zero point              | Span point               |
|--|-------------------------|--------------------------|
| Lack-of-fit (Linearity)  | 6.00 mg/m <sup>3</sup>  | 6.00 mg/m <sup>3</sup>   |
| Zero drift from the field test                                     | 4.50 mg/m <sup>3</sup>  | 0.00 mg/m <sup>3</sup>   |
| Span drift from the field test                                     | 0.00 mg/m <sup>3</sup>  | -5.40 mg/m <sup>3</sup>  |
| Influence of ambient temperature at span point                     | 0.60 mg/m <sup>3</sup>  | -5.10 mg/m <sup>3</sup>  |
| Influence of sample gas pressure                                   | 0.00 mg/m <sup>3</sup>  | 0.00 mg/m <sup>3</sup>   |
| Influence of sample gas flow                                       | 0.00 mg/m <sup>3</sup>  | -0.30 mg/m <sup>3</sup>  |
| Influence of voltage   | 0.60 mg/m <sup>3</sup>  | 0.90 mg/m <sup>3</sup>   |
| Cross-sensitivity  | -5.40 mg/m <sup>3</sup> | -10.50 mg/m <sup>3</sup> |
| Repeatability at span point  | 0.16 mg/m <sup>3</sup>  | 0.22 mg/m <sup>3</sup>   |
| Standard deviation from paired measurements under field conditions | 2.73 mg/m <sup>3</sup>  | 2.73 mg/m <sup>3</sup>   |
| Uncertainty of provided reference material                         | 6.00 mg/m <sup>3</sup>  | 6.00 mg/m <sup>3</sup>   |
| Misalignment   | 0.00 mg/m <sup>3</sup>  | 0.00 mg/m <sup>3</sup>   |
| Conversion rate of AMS for measurement of NOx                      | 0.00 mg/m <sup>3</sup>  | 0.00 mg/m <sup>3</sup>   |
| Changes of response factors  | 0.00 mg/m <sup>3</sup>  | 0.00 mg/m <sup>3</sup>   |

### Process characteristics

### Standard uncertainty

|  |             | Zero point                | Span point                |
|--|-------------|---------------------------|---------------------------|
| Lack-of-fit (Linearity)  | $u_{lof}$ = | 3.4641 mg/m <sup>3</sup>  | 3.4641 mg/m <sup>3</sup>  |
| Zero drift from the field test                                     | $u_{d,z}$ = | 2.5981 mg/m <sup>3</sup>  | 0.0000 mg/m <sup>3</sup>  |
| Span drift from the field test                                     | $u_{d,s}$ = | 0.0000 mg/m <sup>3</sup>  | -3.1177 mg/m <sup>3</sup> |
| Influence of ambient temperature at span point                     | $u_t$ =     | 0.3464 mg/m <sup>3</sup>  | -2.9445 mg/m <sup>3</sup> |
| Influence of sample gas pressure                                   | $u_p$ =     | 0.0000 mg/m <sup>3</sup>  | 0.0000 mg/m <sup>3</sup>  |
| Influence of sample gas flow                                       | $u_f$ =     | 0.0000 mg/m <sup>3</sup>  | -0.1732 mg/m <sup>3</sup> |
| Influence of voltage   | $u_v$ =     | 0.3464 mg/m <sup>3</sup>  | 0.5196 mg/m <sup>3</sup>  |
| Cross-sensitivity  | $u_i$ =     | -3.1177 mg/m <sup>3</sup> | -6.0622 mg/m <sup>3</sup> |
| Repeatability at span point  | $u_r$ =     | 0.0924 mg/m <sup>3</sup>  | 0.1270 mg/m <sup>3</sup>  |
| Standard deviation from paired measurements under field conditions | $u_D$ =     | 1.5780 mg/m <sup>3</sup>  | 1.5780 mg/m <sup>3</sup>  |
| Uncertainty of provided reference material                         | $u_{rm}$ =  | 3.4641 mg/m <sup>3</sup>  | 3.4641 mg/m <sup>3</sup>  |
| Misalignment   | $u_{mb}$ =  | 0.0000 mg/m <sup>3</sup>  | 0.0000 mg/m <sup>3</sup>  |
| Conversion rate of AMS for measurement of NOx                      | $u_{ce}$ =  | 0.0000 mg/m <sup>3</sup>  | 0.0000 mg/m <sup>3</sup>  |
| Changes of response factors  | $u_{rf}$ =  | 0.0000 mg/m <sup>3</sup>  | 0.0000 mg/m <sup>3</sup>  |

## Calculation of the combined standard uncertainties

|                               |               | Zero point               | Span point               |
|-------------------------------|---------------|--------------------------|--------------------------|
| Combined standard uncertainty | s(AMS) values | 6.5727 mg/m <sup>3</sup> | 9.0515 mg/m <sup>3</sup> |

## Verification of compliance with the requirements

|                               |        |                   |  |
|-------------------------------|--------|-------------------|--|
| Combined standard uncertainty | 9.42   | mg/m <sup>3</sup> | according to EN 15267-3                                |
| Expanded uncertainty          | 18.46  | mg/m <sup>3</sup> | according to EN 15267-3                                |
| Relative expanded uncertainty | 1.85   | %                 | of the emissions limit value of 1000 mg/m <sup>3</sup> |
| Allowed expanded uncertainty  | 10.00  | %                 | of the emissions limit value of 1000 mg/m <sup>3</sup> |
| Allowed expanded uncertainty  | 100.00 | mg/m <sup>3</sup> |  |

## Result

Requirements fulfilled

# Calculation of measurement uncertainty

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

Version 5.2

## Device data

|                         |                            |                  |            |
|-------------------------|----------------------------|------------------|------------|
| <b>Customer</b>         | DGtek / Volund GMAB Margam |                  |            |
| <b>Identification</b>   | ZTA-4943685                |                  |            |
| <b>Serial number</b>    | 1628 0562                  | <b>Date</b>      | 2016-09-14 |
| <b>Measuring system</b> | <b>MCS100FT</b>            | <b>Component</b> | <b>CO2</b> |

## Input values

|                     |    |      |                                   |    |     |
|---------------------|----|------|-----------------------------------|----|-----|
| Certification range | 25 | Vol% | Requirement to response time      | 25 | %   |
| Measuring range     | 25 | 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.

## General information

|                             |   |        |                        |      |      |
|-----------------------------|---|--------|------------------------|------|------|
| <b>Maintenance interval</b> | 3 | months | <b>Detection limit</b> | 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  
Sum of the negative cross-sensitivities

|       |      |
|-------|------|
| 0.00  | Vol% |
| -0.73 | Vol% |

|       |      |
|-------|------|
| 0.80  | 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         | DGtek / Volund GMAB Margam | Date      | 2016-09-14 |
| Identification   | ZTA-4943685                | Component | CO2        |
| Serial number    | 1628 0562                  |           |            |
| Measuring system | <b>MCS100FT</b>            |           |            |

## 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 measurements 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%  |
| Conversion rate of AMS for measurement of NOx                      | 0.00 Vol%  | 0.00 Vol%  |
| Changes of response factors  | 0.00 Vol%  | 0.00 Vol%  |

### Process characteristics

### Standard uncertainty

|  | Zero point   | Span point   |
|--|--------------|--------------|
| Lack-of-fit (Linearity)  | 0.1010 Vol%  | 0.1010 Vol%  |
| Zero drift from the field test                                     | 0.3031 Vol%  | 0.0000 Vol%  |
| Span drift from the field test                                     | 0.0000 Vol%  | 0.3897 Vol%  |
| Influence of ambient temperature at span point                     | 0.0433 Vol%  | 0.3031 Vol%  |
| Influence of sample gas pressure                                   | 0.0000 Vol%  | 0.0000 Vol%  |
| Influence of sample gas flow                                       | 0.0000 Vol%  | -0.0144 Vol% |
| Influence of voltage   | -0.0144 Vol% | 0.0577 Vol%  |
| Cross-sensitivity  | -0.4186 Vol% | -0.4763 Vol% |
| Repeatability at span point  | 0.0173 Vol%  | 0.0289 Vol%  |
| Standard deviation from paired measurements under field conditions | 0.2046 Vol%  | 0.2046 Vol%  |
| Uncertainty of provided reference material                         | 0.2887 Vol%  | 0.2887 Vol%  |
| Misalignment   | 0.0000 Vol%  | 0.0000 Vol%  |
| Conversion rate of AMS for measurement of NOx                      | 0.0000 Vol%  | 0.0000 Vol%  |
| Changes of response factors  | 0.0000 Vol%  | 0.0000 Vol%  |

## Calculation of the combined standard uncertainties

|                               | s(AMS) values | Zero point  | Span point  |
|-------------------------------|---------------|-------------|-------------|
| Combined standard uncertainty |               | 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 | 6.57  | %    | of the measuring range of 25 Vol% |
| Allowed expanded uncertainty  | 20.00 | %    | of the measuring range of 25 Vol% |
| Allowed expanded uncertainty  | 5.00  | 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         | DGtek / Volund GMAB Margam |           |            |
| Identification   | ZTA-4943685                |           |            |
| Serial number    | 1628 0562                  | Date      | 2016-09-14 |
| Measuring system | <b>MCS100FT</b>            | Component | <b>NO</b>  |

## Input values

|                       |     |                   |                                   |    |     |
|-----------------------|-----|-------------------|-----------------------------------|----|-----|
| Certification range   | 400 | mg/m <sup>3</sup> | Requirement to response time      | 25 | %   |
| Emissions limit value | 650 | mg/m <sup>3</sup> | Averaging time of measured values | 30 | min |
| Confidence interval   | 20  | %                 |                                   |    |     |

## General information

|                      |   |        |                 |      |                   |
|----------------------|---|--------|-----------------|------|-------------------|
| Maintenance interval | 6 | months | Detection limit | 0.76 | mg/m <sup>3</sup> |
|----------------------|---|--------|-----------------|------|-------------------|

## 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 (O <sub>2</sub> )                           | 0.00 mg/m <sup>3</sup>   | 0.00 mg/m <sup>3</sup>  |
| 21 Vol% Oxygen (O <sub>2</sub> )                          | 0.00 mg/m <sup>3</sup>   | 0.00 mg/m <sup>3</sup>  |
| 30 Vol% Water (H <sub>2</sub> O)                          | -10.40 mg/m <sup>3</sup> | 6.40 mg/m <sup>3</sup>  |
| 300 mg/m <sup>3</sup> Carbon monoxide (CO)                | 0.00 mg/m <sup>3</sup>   | 0.00 mg/m <sup>3</sup>  |
| 15 Vol% Carbon dioxide (CO <sub>2</sub> )                 | 0.00 mg/m <sup>3</sup>   | -9.60 mg/m <sup>3</sup> |
| 50 mg/m <sup>3</sup> Methane (CH <sub>4</sub> )           | 0.00 mg/m <sup>3</sup>   | 0.00 mg/m <sup>3</sup>  |
| 20 mg/m <sup>3</sup> Dinitrogen oxide (N <sub>2</sub> O)  | 0.00 mg/m <sup>3</sup>   | 0.00 mg/m <sup>3</sup>  |
| 100 mg/m <sup>3</sup> Dinitrogen oxide (N <sub>2</sub> O) | 0.00 mg/m <sup>3</sup>   | 4.00 mg/m <sup>3</sup>  |
| 300 mg/m <sup>3</sup> Nitrogen monoxide (NO)              |                          |                         |
| 30 mg/m <sup>3</sup> Nitrogen dioxide (NO <sub>2</sub> )  | 0.00 mg/m <sup>3</sup>   | 0.00 mg/m <sup>3</sup>  |
| 20 mg/m <sup>3</sup> Ammonia (NH <sub>3</sub> )           | 2.80 mg/m <sup>3</sup>   | 0.00 mg/m <sup>3</sup>  |
| 200 mg/m <sup>3</sup> Sulfur dioxide (SO <sub>2</sub> )   | 0.00 mg/m <sup>3</sup>   | 0.00 mg/m <sup>3</sup>  |
| 1000 mg/m <sup>3</sup> Sulfur dioxide (SO <sub>2</sub> )  | 0.00 mg/m <sup>3</sup>   | 2.40 mg/m <sup>3</sup>  |
| 50 mg/m <sup>3</sup> Hydrogen chloride (HCl)              | 0.00 mg/m <sup>3</sup>   | 0.00 mg/m <sup>3</sup>  |
| 200 mg/m <sup>3</sup> Hydrogen chloride (HCl)             | 0.00 mg/m <sup>3</sup>   | 3.20 mg/m <sup>3</sup>  |

Sum of the positive cross-sensitivities  
Sum of the negative cross-sensitivities

|        |                   |
|--------|-------------------|
| 2.80   | mg/m <sup>3</sup> |
| -10.40 | mg/m <sup>3</sup> |

|       |                   |
|-------|-------------------|
| 16.00 | mg/m <sup>3</sup> |
| -9.60 | mg/m <sup>3</sup> |

# Calculation of measurement uncertainty

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

Version 5.2

## Device data

|                  |                            |           |            |
|------------------|----------------------------|-----------|------------|
| Customer         | DGtek / Volund GMAB Margam | Date      | 2016-09-14 |
| Identification   | ZTA-4943685                | Component | NO         |
| Serial number    | 1628 0562                  |           |            |
| Measuring system | <b>MCS100FT</b>            |           |            |

## Influences of the process characteristics

### Process characteristics

### Largest difference according to type approval

|  | Zero point               | Span point               |
|--|--------------------------|--------------------------|
| Lack-of-fit (Linearity)  | 6.00 mg/m <sup>3</sup>   | 6.00 mg/m <sup>3</sup>   |
| Zero drift from the field test                                     | 7.20 mg/m <sup>3</sup>   | 0.00 mg/m <sup>3</sup>   |
| Span drift from the field test                                     | 0.00 mg/m <sup>3</sup>   | -12.00 mg/m <sup>3</sup> |
| Influence of ambient temperature at span point                     | -1.60 mg/m <sup>3</sup>  | -6.00 mg/m <sup>3</sup>  |
| Influence of sample gas pressure                                   | 0.00 mg/m <sup>3</sup>   | 0.00 mg/m <sup>3</sup>   |
| Influence of sample gas flow                                       | 0.00 mg/m <sup>3</sup>   | -0.40 mg/m <sup>3</sup>  |
| Influence of voltage   | 0.40 mg/m <sup>3</sup>   | -3.20 mg/m <sup>3</sup>  |
| Cross-sensitivity  | -10.40 mg/m <sup>3</sup> | 16.00 mg/m <sup>3</sup>  |
| Repeatability at span point  | 0.38 mg/m <sup>3</sup>   | 0.78 mg/m <sup>3</sup>   |
| Standard deviation from paired measurements under field conditions | 6.18 mg/m <sup>3</sup>   | 6.18 mg/m <sup>3</sup>   |
| Uncertainty of provided reference material                         | 8.00 mg/m <sup>3</sup>   | 8.00 mg/m <sup>3</sup>   |
| Misalignment   | 0.00 mg/m <sup>3</sup>   | 0.00 mg/m <sup>3</sup>   |
| Conversion rate of AMS for measurement of NOx                      | 0.00 mg/m <sup>3</sup>   | 0.00 mg/m <sup>3</sup>   |
| Changes of response factors  | 0.00 mg/m <sup>3</sup>   | 0.00 mg/m <sup>3</sup>   |

### Process characteristics

### Standard uncertainty

|  |             | Zero point                | Span point                |
|--|-------------|---------------------------|---------------------------|
| Lack-of-fit (Linearity)  | $U_{lof}$ = | 3.4641 mg/m <sup>3</sup>  | 3.4641 mg/m <sup>3</sup>  |
| Zero drift from the field test                                     | $U_{d,z}$ = | 4.1569 mg/m <sup>3</sup>  | 0.0000 mg/m <sup>3</sup>  |
| Span drift from the field test                                     | $U_{d,s}$ = | 0.0000 mg/m <sup>3</sup>  | -6.9282 mg/m <sup>3</sup> |
| Influence of ambient temperature at span point                     | $U_t$ =     | -0.9238 mg/m <sup>3</sup> | -3.4641 mg/m <sup>3</sup> |
| Influence of sample gas pressure                                   | $U_p$ =     | 0.0000 mg/m <sup>3</sup>  | 0.0000 mg/m <sup>3</sup>  |
| Influence of sample gas flow                                       | $U_f$ =     | 0.0000 mg/m <sup>3</sup>  | -0.2309 mg/m <sup>3</sup> |
| Influence of voltage   | $U_v$ =     | 0.2309 mg/m <sup>3</sup>  | -1.8475 mg/m <sup>3</sup> |
| Cross-sensitivity  | $U_i$ =     | -6.0044 mg/m <sup>3</sup> | 9.2376 mg/m <sup>3</sup>  |
| Repeatability at span point  | $U_r$ =     | 0.2194 mg/m <sup>3</sup>  | 0.4503 mg/m <sup>3</sup>  |
| Standard deviation from paired measurements under field conditions | $U_D$ =     | 3.5705 mg/m <sup>3</sup>  | 3.5705 mg/m <sup>3</sup>  |
| Uncertainty of provided reference material                         | $U_{rm}$ =  | 4.6188 mg/m <sup>3</sup>  | 4.6188 mg/m <sup>3</sup>  |
| Misalignment   | $U_{mb}$ =  | 0.0000 mg/m <sup>3</sup>  | 0.0000 mg/m <sup>3</sup>  |
| Conversion rate of AMS for measurement of NOx                      | $U_{ce}$ =  | 0.0000 mg/m <sup>3</sup>  | 0.0000 mg/m <sup>3</sup>  |
| Changes of response factors  | $U_{rf}$ =  | 0.0000 mg/m <sup>3</sup>  | 0.0000 mg/m <sup>3</sup>  |

## Calculation of the combined standard uncertainties

|                               |               | Zero point                | Span point                |
|-------------------------------|---------------|---------------------------|---------------------------|
| Combined standard uncertainty | s(AMS) values | 10.0161 mg/m <sup>3</sup> | 13.9600 mg/m <sup>3</sup> |

## Verification of compliance with the requirements

|                               |        |                   |   |
|-------------------------------|--------|-------------------|---|
| Combined standard uncertainty | 14.57  | mg/m <sup>3</sup> | according to EN 15267-3                               |
| Expanded uncertainty          | 28.55  | mg/m <sup>3</sup> | according to EN 15267-3                               |
| Relative expanded uncertainty | 4.39   | %                 | of the emissions limit value of 650 mg/m <sup>3</sup> |
| Allowed expanded uncertainty  | 20.00  | %                 | of the emissions limit value of 650 mg/m <sup>3</sup> |
| Allowed expanded uncertainty  | 130.00 | mg/m <sup>3</sup> |   |

## Result

Requirements fulfilled

# Calculation of measurement uncertainty

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

Version 5.2

## Device data

|                         |                            |                  |            |
|-------------------------|----------------------------|------------------|------------|
| <b>Customer</b>         | DGtek / Volund GMAB Margam |                  |            |
| <b>Identification</b>   | ZTA-4943685                |                  |            |
| <b>Serial number</b>    | 1628 0562                  | <b>Date</b>      | 2016-09-14 |
| <b>Measuring system</b> | <b>MCS100FT</b>            | <b>Component</b> | <b>NO2</b> |

## Input values

|                       |     |                   |                                   |    |     |
|-----------------------|-----|-------------------|-----------------------------------|----|-----|
| Certification range   | 100 | mg/m <sup>3</sup> | Requirement to response time      | 25 | %   |
| Emissions limit value | 100 | mg/m <sup>3</sup> | Averaging time of measured values | 30 | min |
| Confidence interval   | 20  | %                 |                                   |    |     |

## General information

|                             |   |        |                        |      |                   |
|-----------------------------|---|--------|------------------------|------|-------------------|
| <b>Maintenance interval</b> | 6 | months | <b>Detection limit</b> | 0.38 | mg/m <sup>3</sup> |
|-----------------------------|---|--------|------------------------|------|-------------------|

## 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 (O <sub>2</sub> )                           | 0.00 mg/m <sup>3</sup>  | 0.00 mg/m <sup>3</sup>  |
| 21 Vol% Oxygen (O <sub>2</sub> )                          | 0.00 mg/m <sup>3</sup>  | 0.00 mg/m <sup>3</sup>  |
| 30 Vol% Water (H <sub>2</sub> O)                          | -1.50 mg/m <sup>3</sup> | 1.00 mg/m <sup>3</sup>  |
| 300 mg/m <sup>3</sup> Carbon monoxide (CO)                | 0.00 mg/m <sup>3</sup>  | 0.00 mg/m <sup>3</sup>  |
| 15 Vol% Carbon dioxide (CO <sub>2</sub> )                 | 0.50 mg/m <sup>3</sup>  | -1.10 mg/m <sup>3</sup> |
| 50 mg/m <sup>3</sup> Methane (CH <sub>4</sub> )           | -0.90 mg/m <sup>3</sup> | 0.00 mg/m <sup>3</sup>  |
| 20 mg/m <sup>3</sup> Dinitrogen oxide (N <sub>2</sub> O)  | 0.00 mg/m <sup>3</sup>  | 0.00 mg/m <sup>3</sup>  |
| 100 mg/m <sup>3</sup> Dinitrogen oxide (N <sub>2</sub> O) | 1.00 mg/m <sup>3</sup>  | 0.00 mg/m <sup>3</sup>  |
| 300 mg/m <sup>3</sup> Nitrogen monoxide (NO)              | 3.20 mg/m <sup>3</sup>  | 3.00 mg/m <sup>3</sup>  |
| 30 mg/m <sup>3</sup> Nitrogen dioxide (NO <sub>2</sub> )  |                         |                         |
| 20 mg/m <sup>3</sup> Ammonia (NH <sub>3</sub> )           | 0.00 mg/m <sup>3</sup>  | -1.00 mg/m <sup>3</sup> |
| 200 mg/m <sup>3</sup> Sulfur dioxide (SO <sub>2</sub> )   | 0.00 mg/m <sup>3</sup>  | 0.00 mg/m <sup>3</sup>  |
| 1000 mg/m <sup>3</sup> Sulfur dioxide (SO <sub>2</sub> )  | 0.00 mg/m <sup>3</sup>  | 0.00 mg/m <sup>3</sup>  |
| 50 mg/m <sup>3</sup> Hydrogen chloride (HCl)              | 0.00 mg/m <sup>3</sup>  | 0.00 mg/m <sup>3</sup>  |
| 200 mg/m <sup>3</sup> Hydrogen chloride (HCl)             | 0.00 mg/m <sup>3</sup>  | -2.60 mg/m <sup>3</sup> |

Sum of the positive cross-sensitivities  
Sum of the negative cross-sensitivities

|       |                   |
|-------|-------------------|
| 4.70  | mg/m <sup>3</sup> |
| -2.40 | mg/m <sup>3</sup> |

|       |                   |
|-------|-------------------|
| 4.00  | mg/m <sup>3</sup> |
| -4.70 | mg/m <sup>3</sup> |



# Calculation of measurement uncertainty

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

Version 5.2

## Device data

|                  |                            |           |            |
|------------------|----------------------------|-----------|------------|
| Customer         | DGtek / Volund GMAB Margam | Date      | 2016-09-14 |
| Identification   | ZTA-4943685                | Component | NO2        |
| Serial number    | 1628 0562                  |           |            |
| Measuring system | <b>MCS100FT</b>            |           |            |

## Influences of the process characteristics

### Process characteristics

### Largest difference according to type approval

|  | Zero point              | Span point              |
|--|-------------------------|-------------------------|
| Lack-of-fit (Linearity)  | 1.40 mg/m <sup>3</sup>  | 1.40 mg/m <sup>3</sup>  |
| Zero drift from the field test                                     | -2.30 mg/m <sup>3</sup> | 0.00 mg/m <sup>3</sup>  |
| Span drift from the field test                                     | 0.00 mg/m <sup>3</sup>  | 3.00 mg/m <sup>3</sup>  |
| Influence of ambient temperature at span point                     | 1.30 mg/m <sup>3</sup>  | 0.90 mg/m <sup>3</sup>  |
| Influence of sample gas pressure                                   | 0.00 mg/m <sup>3</sup>  | 0.00 mg/m <sup>3</sup>  |
| Influence of sample gas flow                                       | 0.00 mg/m <sup>3</sup>  | -0.10 mg/m <sup>3</sup> |
| Influence of voltage   | 0.30 mg/m <sup>3</sup>  | -0.60 mg/m <sup>3</sup> |
| Cross-sensitivity  | 4.70 mg/m <sup>3</sup>  | -4.70 mg/m <sup>3</sup> |
| Repeatability at span point  | 0.19 mg/m <sup>3</sup>  | 0.47 mg/m <sup>3</sup>  |
| Standard deviation from paired measurements under field conditions | 1.09 mg/m <sup>3</sup>  | 1.09 mg/m <sup>3</sup>  |
| Uncertainty of provided reference material                         | 2.00 mg/m <sup>3</sup>  | 2.00 mg/m <sup>3</sup>  |
| Misalignment   | 0.00 mg/m <sup>3</sup>  | 0.00 mg/m <sup>3</sup>  |
| Conversion rate of AMS for measurement of NOx                      | 0.00 mg/m <sup>3</sup>  | 0.00 mg/m <sup>3</sup>  |
| Changes of response factors  | 0.00 mg/m <sup>3</sup>  | 0.00 mg/m <sup>3</sup>  |

### Process characteristics

### Standard uncertainty

|  |             | Zero point                | Span point                |
|--|-------------|---------------------------|---------------------------|
| Lack-of-fit (Linearity)  | $U_{lof}$ = | 0.8083 mg/m <sup>3</sup>  | 0.8083 mg/m <sup>3</sup>  |
| Zero drift from the field test                                     | $U_{d,z}$ = | -1.3279 mg/m <sup>3</sup> | 0.0000 mg/m <sup>3</sup>  |
| Span drift from the field test                                     | $U_{d,s}$ = | 0.0000 mg/m <sup>3</sup>  | 1.7321 mg/m <sup>3</sup>  |
| Influence of ambient temperature at span point                     | $U_t$ =     | 0.7506 mg/m <sup>3</sup>  | 0.5196 mg/m <sup>3</sup>  |
| Influence of sample gas pressure                                   | $U_p$ =     | 0.0000 mg/m <sup>3</sup>  | 0.0000 mg/m <sup>3</sup>  |
| Influence of sample gas flow                                       | $U_f$ =     | 0.0000 mg/m <sup>3</sup>  | -0.0577 mg/m <sup>3</sup> |
| Influence of voltage   | $U_v$ =     | 0.1732 mg/m <sup>3</sup>  | -0.3464 mg/m <sup>3</sup> |
| Cross-sensitivity  | $U_i$ =     | 2.7135 mg/m <sup>3</sup>  | -2.7135 mg/m <sup>3</sup> |
| Repeatability at span point  | $U_r$ =     | 0.1097 mg/m <sup>3</sup>  | 0.2714 mg/m <sup>3</sup>  |
| Standard deviation from paired measurements under field conditions | $U_D$ =     | 0.6267 mg/m <sup>3</sup>  | 0.6267 mg/m <sup>3</sup>  |
| Uncertainty of provided reference material                         | $U_{rm}$ =  | 1.1547 mg/m <sup>3</sup>  | 1.1547 mg/m <sup>3</sup>  |
| Misalignment   | $U_{mb}$ =  | 0.0000 mg/m <sup>3</sup>  | 0.0000 mg/m <sup>3</sup>  |
| Conversion rate of AMS for measurement of NOx                      | $U_{ce}$ =  | 0.0000 mg/m <sup>3</sup>  | 0.0000 mg/m <sup>3</sup>  |
| Changes of response factors  | $U_{rf}$ =  | 0.0000 mg/m <sup>3</sup>  | 0.0000 mg/m <sup>3</sup>  |

## Calculation of the combined standard uncertainties

|                               |               | Zero point               | Span point               |
|-------------------------------|---------------|--------------------------|--------------------------|
| Combined standard uncertainty | s(AMS) values | 3.4784 mg/m <sup>3</sup> | 3.6244 mg/m <sup>3</sup> |

## Verification of compliance with the requirements

|                               |       |                   |   |
|-------------------------------|-------|-------------------|---|
| Combined standard uncertainty | 3.86  | mg/m <sup>3</sup> | according to EN 15267-3                               |
| Expanded uncertainty          | 7.57  | mg/m <sup>3</sup> | according to EN 15267-3                               |
| Relative expanded uncertainty | 7.57  | %                 | of the emissions limit value of 100 mg/m <sup>3</sup> |
| Allowed expanded uncertainty  | 20.00 | %                 | of the emissions limit value of 100 mg/m <sup>3</sup> |
| Allowed expanded uncertainty  | 20.00 | mg/m <sup>3</sup> |   |

## Result

Requirements fulfilled

# Calculation of measurement uncertainty

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

Version 5.2

## Device data

|                         |                            |                  |            |
|-------------------------|----------------------------|------------------|------------|
| <b>Customer</b>         | DGtek / Volund GMAB Margam |                  |            |
| <b>Identification</b>   | ZTA-4943685                |                  |            |
| <b>Serial number</b>    | 1628 0562                  | <b>Date</b>      | 2016-09-14 |
| <b>Measuring system</b> | <b>MCS100FT</b>            | <b>Component</b> | <b>N2O</b> |

## Input values

|                     |    |                   |                                   |    |     |
|---------------------|----|-------------------|-----------------------------------|----|-----|
| Certification range | 50 | mg/m <sup>3</sup> | Requirement to response time      | 25 | %   |
| Measuring range     | 50 | mg/m <sup>3</sup> | 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.

## General information

|                             |   |        |                        |      |                   |
|-----------------------------|---|--------|------------------------|------|-------------------|
| <b>Maintenance interval</b> | 6 | months | <b>Detection limit</b> | 0.08 | mg/m <sup>3</sup> |
|-----------------------------|---|--------|------------------------|------|-------------------|

## 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 (O <sub>2</sub> )                           | 0.00 mg/m <sup>3</sup>  | 0.00 mg/m <sup>3</sup>  |
| 21 Vol% Oxygen (O <sub>2</sub> )                          | 0.40 mg/m <sup>3</sup>  | 0.80 mg/m <sup>3</sup>  |
| 30 Vol% Water (H <sub>2</sub> O)                          | -0.50 mg/m <sup>3</sup> | -0.80 mg/m <sup>3</sup> |
| 300 mg/m <sup>3</sup> Carbon monoxide (CO)                | 0.00 mg/m <sup>3</sup>  | -0.30 mg/m <sup>3</sup> |
| 15 Vol% Carbon dioxide (CO <sub>2</sub> )                 | -0.70 mg/m <sup>3</sup> | 0.00 mg/m <sup>3</sup>  |
| 50 mg/m <sup>3</sup> Methane (CH <sub>4</sub> )           | 0.00 mg/m <sup>3</sup>  | 0.00 mg/m <sup>3</sup>  |
| 20 mg/m <sup>3</sup> Dinitrogen oxide (N <sub>2</sub> O)  |                         |                         |
| 100 mg/m <sup>3</sup> Dinitrogen oxide (N <sub>2</sub> O) |                         |                         |
| 300 mg/m <sup>3</sup> Nitrogen monoxide (NO)              | 0.95 mg/m <sup>3</sup>  | 0.95 mg/m <sup>3</sup>  |
| 30 mg/m <sup>3</sup> Nitrogen dioxide (NO <sub>2</sub> )  | 0.00 mg/m <sup>3</sup>  | 0.00 mg/m <sup>3</sup>  |
| 20 mg/m <sup>3</sup> Ammonia (NH <sub>3</sub> )           | 0.00 mg/m <sup>3</sup>  | 0.00 mg/m <sup>3</sup>  |
| 200 mg/m <sup>3</sup> Sulfur dioxide (SO <sub>2</sub> )   | 0.00 mg/m <sup>3</sup>  | 0.00 mg/m <sup>3</sup>  |
| 1000 mg/m <sup>3</sup> Sulfur dioxide (SO <sub>2</sub> )  | 0.00 mg/m <sup>3</sup>  | 0.00 mg/m <sup>3</sup>  |
| 50 mg/m <sup>3</sup> Hydrogen chloride (HCl)              | 0.00 mg/m <sup>3</sup>  | 0.00 mg/m <sup>3</sup>  |
| 200 mg/m <sup>3</sup> Hydrogen chloride (HCl)             | 0.00 mg/m <sup>3</sup>  | 0.00 mg/m <sup>3</sup>  |

Sum of the positive cross-sensitivities  
Sum of the negative cross-sensitivities

|       |                   |
|-------|-------------------|
| 1.35  | mg/m <sup>3</sup> |
| -1.20 | mg/m <sup>3</sup> |

|       |                   |
|-------|-------------------|
| 1.75  | mg/m <sup>3</sup> |
| -1.10 | mg/m <sup>3</sup> |

# Calculation of measurement uncertainty

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

Version 5.2

## Device data

|                  |                            |           |            |
|------------------|----------------------------|-----------|------------|
| Customer         | DGtek / Volund GMAB Margam | Date      | 2016-09-14 |
| Identification   | ZTA-4943685                | Component | N2O        |
| Serial number    | 1628 0562                  |           |            |
| Measuring system | <b>MCS100FT</b>            |           |            |

## Influences of the process characteristics

| Process characteristics  | Largest difference according to type approval |                   |            |                   |
|--|---|-------------------|------------|-------------------|
|  | Zero point                                    |                   | Span point |                   |
| Lack-of-fit (Linearity)  | 0.50  | mg/m <sup>3</sup> | 0.50       | mg/m <sup>3</sup> |
| Zero drift from the field test                                     | 0.25  | mg/m <sup>3</sup> | 0.00       | mg/m <sup>3</sup> |
| Span drift from the field test                                     | 0.00  | mg/m <sup>3</sup> | -0.90      | mg/m <sup>3</sup> |
| Influence of ambient temperature at span point                     | 0.10  | mg/m <sup>3</sup> | -0.55      | mg/m <sup>3</sup> |
| Influence of sample gas pressure                                   | 0.00  | mg/m <sup>3</sup> | 0.00       | mg/m <sup>3</sup> |
| Influence of sample gas flow                                       | 0.00  | mg/m <sup>3</sup> | -0.05      | mg/m <sup>3</sup> |
| Influence of voltage   | 0.05  | mg/m <sup>3</sup> | 0.20       | mg/m <sup>3</sup> |
| Cross-sensitivity  | 1.35  | mg/m <sup>3</sup> | 1.75       | mg/m <sup>3</sup> |
| Repeatability at span point  | 0.04  | mg/m <sup>3</sup> | 0.25       | mg/m <sup>3</sup> |
| Standard deviation from paired measurements under field conditions | 0.17  | mg/m <sup>3</sup> | 0.17       | mg/m <sup>3</sup> |
| Uncertainty of provided reference material                         | 1.00  | mg/m <sup>3</sup> | 1.00       | mg/m <sup>3</sup> |
| Misalignment   | 0.00  | mg/m <sup>3</sup> | 0.00       | mg/m <sup>3</sup> |
| Conversion rate of AMS for measurement of NOx                      | 0.00  | mg/m <sup>3</sup> | 0.00       | mg/m <sup>3</sup> |
| Changes of response factors  | 0.00  | mg/m <sup>3</sup> | 0.00       | mg/m <sup>3</sup> |

## Process characteristics

|  |             | Standard uncertainty |                   |            |                   |
|--|-------------|----------------------|-------------------|------------|-------------------|
|  |             | Zero point           |                   | Span point |                   |
| Lack-of-fit (Linearity)  | $U_{lof}$ = | 0.2887               | mg/m <sup>3</sup> | 0.2887     | mg/m <sup>3</sup> |
| Zero drift from the field test                                     | $U_{d,z}$ = | 0.1443               | mg/m <sup>3</sup> | 0.0000     | mg/m <sup>3</sup> |
| Span drift from the field test                                     | $U_{d,s}$ = | 0.0000               | mg/m <sup>3</sup> | -0.5196    | mg/m <sup>3</sup> |
| Influence of ambient temperature at span point                     | $U_t$ =     | 0.0577               | mg/m <sup>3</sup> | -0.3175    | mg/m <sup>3</sup> |
| Influence of sample gas pressure                                   | $U_p$ =     | 0.0000               | mg/m <sup>3</sup> | 0.0000     | mg/m <sup>3</sup> |
| Influence of sample gas flow                                       | $U_f$ =     | 0.0000               | mg/m <sup>3</sup> | -0.0289    | mg/m <sup>3</sup> |
| Influence of voltage   | $U_v$ =     | 0.0289               | mg/m <sup>3</sup> | 0.1155     | mg/m <sup>3</sup> |
| Cross-sensitivity  | $U_i$ =     | 0.7794               | mg/m <sup>3</sup> | 1.0104     | mg/m <sup>3</sup> |
| Repeatability at span point  | $U_r$ =     | 0.0231               | mg/m <sup>3</sup> | 0.1443     | mg/m <sup>3</sup> |
| Standard deviation from paired measurements under field conditions | $U_D$ =     | 0.1009               | mg/m <sup>3</sup> | 0.1009     | mg/m <sup>3</sup> |
| Uncertainty of provided reference material                         | $U_{rm}$ =  | 0.5774               | mg/m <sup>3</sup> | 0.5774     | mg/m <sup>3</sup> |
| Misalignment   | $U_{mb}$ =  | 0.0000               | mg/m <sup>3</sup> | 0.0000     | mg/m <sup>3</sup> |
| Conversion rate of AMS for measurement of NOx                      | $U_{ce}$ =  | 0.0000               | mg/m <sup>3</sup> | 0.0000     | mg/m <sup>3</sup> |
| Changes of response factors  | $U_{rf}$ =  | 0.0000               | mg/m <sup>3</sup> | 0.0000     | mg/m <sup>3</sup> |

## Calculation of the combined standard uncertainties

| Combined standard uncertainty | s(AMS) values | Zero point               | Span point               |
|-------------------------------|---------------|--------------------------|--------------------------|
|                               |               | 1.0292 mg/m <sup>3</sup> | 1.3577 mg/m <sup>3</sup> |

## Verification of compliance with the requirements

|                               |       |                   |  |
|-------------------------------|-------|-------------------|--|
| Combined standard uncertainty | 1.37  | mg/m <sup>3</sup> | according to EN 15267-3                        |
| Expanded uncertainty          | 2.68  | mg/m <sup>3</sup> | according to EN 15267-3                        |
| Relative expanded uncertainty | 5.35  | %                 | of the measuring range of 50 mg/m <sup>3</sup> |
| Allowed expanded uncertainty  | 20.00 | %                 | of the measuring range of 50 mg/m <sup>3</sup> |
| Allowed expanded uncertainty  | 10.00 | mg/m <sup>3</sup> |  |

## 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

|                         |                            |                  |            |
|-------------------------|----------------------------|------------------|------------|
| <b>Customer</b>         | DGtek / Volund GMAB Margam |                  |            |
| <b>Identification</b>   | ZTA-4943685                |                  |            |
| <b>Serial number</b>    | 1628 0562                  | <b>Date</b>      | 2016-09-14 |
| <b>Measuring system</b> | <b>MCS100FT</b>            | <b>Component</b> | <b>SO2</b> |

## Input values

|                       |     |                   |                                   |    |     |
|-----------------------|-----|-------------------|-----------------------------------|----|-----|
| Certification range   | 300 | mg/m <sup>3</sup> | Requirement to response time      | 25 | %   |
| Emissions limit value | 400 | mg/m <sup>3</sup> | Averaging time of measured values | 30 | min |
| Confidence interval   | 20  | %                 |                                   |    |     |

## General information

|                             |   |        |                        |      |                   |
|-----------------------------|---|--------|------------------------|------|-------------------|
| <b>Maintenance interval</b> | 6 | months | <b>Detection limit</b> | 0.24 | mg/m <sup>3</sup> |
|-----------------------------|---|--------|------------------------|------|-------------------|

## 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/m <sup>3</sup> | 0.00 mg/m <sup>3</sup> |
| 21 Vol% Oxygen (O2)                           | 0.00 mg/m <sup>3</sup> | 0.00 mg/m <sup>3</sup> |
| 30 Vol% Water (H2O)                           | 5.10 mg/m <sup>3</sup> | 6.60 mg/m <sup>3</sup> |
| 300 mg/m <sup>3</sup> Carbon monoxide (CO)    | 0.00 mg/m <sup>3</sup> | 3.30 mg/m <sup>3</sup> |
| 15 Vol% Carbon dioxide (CO2)                  | 3.00 mg/m <sup>3</sup> | 1.50 mg/m <sup>3</sup> |
| 50 mg/m <sup>3</sup> Methane (CH4)            | 0.00 mg/m <sup>3</sup> | 1.50 mg/m <sup>3</sup> |
| 20 mg/m <sup>3</sup> Dinitrogen oxide (N2O)   | 0.00 mg/m <sup>3</sup> | 0.00 mg/m <sup>3</sup> |
| 100 mg/m <sup>3</sup> Dinitrogen oxide (N2O)  | 0.00 mg/m <sup>3</sup> | 1.50 mg/m <sup>3</sup> |
| 300 mg/m <sup>3</sup> Nitrogen monoxide (NO)  | 0.00 mg/m <sup>3</sup> | 0.00 mg/m <sup>3</sup> |
| 30 mg/m <sup>3</sup> Nitrogen dioxide (NO2)   | 0.00 mg/m <sup>3</sup> | 0.00 mg/m <sup>3</sup> |
| 20 mg/m <sup>3</sup> Ammonia (NH3)            | 0.00 mg/m <sup>3</sup> | 1.50 mg/m <sup>3</sup> |
| 200 mg/m <sup>3</sup> Sulfur dioxide (SO2)    |                        |                        |
| 1000 mg/m <sup>3</sup> Sulfur dioxide (SO2)   |                        |                        |
| 50 mg/m <sup>3</sup> Hydrogen chloride (HCl)  | 0.00 mg/m <sup>3</sup> | 0.00 mg/m <sup>3</sup> |
| 200 mg/m <sup>3</sup> Hydrogen chloride (HCl) | 0.00 mg/m <sup>3</sup> | 0.00 mg/m <sup>3</sup> |

Sum of the positive cross-sensitivities  
Sum of the negative cross-sensitivities

|      |                   |
|------|-------------------|
| 8.10 | mg/m <sup>3</sup> |
| 0.00 | mg/m <sup>3</sup> |

|       |                   |
|-------|-------------------|
| 15.90 | mg/m <sup>3</sup> |
| 0.00  | mg/m <sup>3</sup> |

# Calculation of measurement uncertainty

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

Version 5.2

## Device data

|                  |                            |           |            |
|------------------|----------------------------|-----------|------------|
| Customer         | DGtek / Volund GMAB Margam | Date      | 2016-09-14 |
| Identification   | ZTA-4943685                | Component | SO2        |
| Serial number    | 1628 0562                  |           |            |
| Measuring system | <b>MCS100FT</b>            |           |            |

## Influences of the process characteristics

### Process characteristics

### Largest difference according to type approval

|  | Zero point              | Span point              |
|--|-------------------------|-------------------------|
| Lack-of-fit (Linearity)  | 3.30 mg/m <sup>3</sup>  | 3.30 mg/m <sup>3</sup>  |
| Zero drift from the field test                                     | -7.50 mg/m <sup>3</sup> | 0.00 mg/m <sup>3</sup>  |
| Span drift from the field test                                     | 0.00 mg/m <sup>3</sup>  | 9.30 mg/m <sup>3</sup>  |
| Influence of ambient temperature at span point                     | 3.90 mg/m <sup>3</sup>  | -4.50 mg/m <sup>3</sup> |
| Influence of sample gas pressure                                   | 0.00 mg/m <sup>3</sup>  | 0.00 mg/m <sup>3</sup>  |
| Influence of sample gas flow                                       | 0.00 mg/m <sup>3</sup>  | -0.30 mg/m <sup>3</sup> |
| Influence of voltage   | -2.40 mg/m <sup>3</sup> | 0.30 mg/m <sup>3</sup>  |
| Cross-sensitivity  | 8.10 mg/m <sup>3</sup>  | 15.90 mg/m <sup>3</sup> |
| Repeatability at span point  | 0.12 mg/m <sup>3</sup>  | 0.16 mg/m <sup>3</sup>  |
| Standard deviation from paired measurements under field conditions | 2.94 mg/m <sup>3</sup>  | 2.94 mg/m <sup>3</sup>  |
| Uncertainty of provided reference material                         | 6.00 mg/m <sup>3</sup>  | 6.00 mg/m <sup>3</sup>  |
| Misalignment   | 0.00 mg/m <sup>3</sup>  | 0.00 mg/m <sup>3</sup>  |
| Conversion rate of AMS for measurement of NOx                      | 0.00 mg/m <sup>3</sup>  | 0.00 mg/m <sup>3</sup>  |
| Changes of response factors  | 0.00 mg/m <sup>3</sup>  | 0.00 mg/m <sup>3</sup>  |

### Process characteristics

### Standard uncertainty

|  |             | Zero point                | Span point                |
|--|-------------|---------------------------|---------------------------|
| Lack-of-fit (Linearity)  | $U_{lof}$ = | 1.9053 mg/m <sup>3</sup>  | 1.9053 mg/m <sup>3</sup>  |
| Zero drift from the field test                                     | $U_{d,z}$ = | -4.3301 mg/m <sup>3</sup> | 0.0000 mg/m <sup>3</sup>  |
| Span drift from the field test                                     | $U_{d,s}$ = | 0.0000 mg/m <sup>3</sup>  | 5.3694 mg/m <sup>3</sup>  |
| Influence of ambient temperature at span point                     | $U_t$ =     | 2.2517 mg/m <sup>3</sup>  | -2.5981 mg/m <sup>3</sup> |
| Influence of sample gas pressure                                   | $U_p$ =     | 0.0000 mg/m <sup>3</sup>  | 0.0000 mg/m <sup>3</sup>  |
| Influence of sample gas flow                                       | $U_f$ =     | 0.0000 mg/m <sup>3</sup>  | -0.1732 mg/m <sup>3</sup> |
| Influence of voltage   | $U_v$ =     | -1.3856 mg/m <sup>3</sup> | 0.1732 mg/m <sup>3</sup>  |
| Cross-sensitivity  | $U_i$ =     | 4.6765 mg/m <sup>3</sup>  | 9.1799 mg/m <sup>3</sup>  |
| Repeatability at span point  | $U_r$ =     | 0.0693 mg/m <sup>3</sup>  | 0.0924 mg/m <sup>3</sup>  |
| Standard deviation from paired measurements under field conditions | $U_D$ =     | 1.6994 mg/m <sup>3</sup>  | 1.6994 mg/m <sup>3</sup>  |
| Uncertainty of provided reference material                         | $U_{rm}$ =  | 3.4641 mg/m <sup>3</sup>  | 3.4641 mg/m <sup>3</sup>  |
| Misalignment   | $U_{mb}$ =  | 0.0000 mg/m <sup>3</sup>  | 0.0000 mg/m <sup>3</sup>  |
| Conversion rate of AMS for measurement of NOx                      | $U_{ce}$ =  | 0.0000 mg/m <sup>3</sup>  | 0.0000 mg/m <sup>3</sup>  |
| Changes of response factors  | $U_{rf}$ =  | 0.0000 mg/m <sup>3</sup>  | 0.0000 mg/m <sup>3</sup>  |

## Calculation of the combined standard uncertainties

|                               |               | Zero point               | Span point                |
|-------------------------------|---------------|--------------------------|---------------------------|
| Combined standard uncertainty | s(AMS) values | 8.1319 mg/m <sup>3</sup> | 11.7655 mg/m <sup>3</sup> |

## Verification of compliance with the requirements

|                               |       |                   |   |
|-------------------------------|-------|-------------------|---|
| Combined standard uncertainty | 12.61 | mg/m <sup>3</sup> | according to EN 15267-3                               |
| Expanded uncertainty          | 24.72 | mg/m <sup>3</sup> | according to EN 15267-3                               |
| Relative expanded uncertainty | 6.18  | %                 | of the emissions limit value of 400 mg/m <sup>3</sup> |
| Allowed expanded uncertainty  | 20.00 | %                 | of the emissions limit value of 400 mg/m <sup>3</sup> |
| Allowed expanded uncertainty  | 80.00 | mg/m <sup>3</sup> |   |

## Result

Requirements fulfilled

# Calculation of measurement uncertainty

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

Version 5.2

## Device data

|                         |                            |                  |            |
|-------------------------|----------------------------|------------------|------------|
| <b>Customer</b>         | DGtek / Volund GMAB Margam |                  |            |
| <b>Identification</b>   | ZTA-4943685                |                  |            |
| <b>Serial number</b>    | 1628 0562                  | <b>Date</b>      | 2016-09-14 |
| <b>Measuring system</b> | <b>MCS100FT</b>            | <b>Component</b> | <b>HCI</b> |

## Input values

|                       |     |                   |                                   |    |     |
|-----------------------|-----|-------------------|-----------------------------------|----|-----|
| Certification range   | 90  | mg/m <sup>3</sup> | Requirement to response time      | 25 | %   |
| Emissions limit value | 100 | mg/m <sup>3</sup> | Averaging time of measured values | 30 | min |
| Confidence interval   | 40  | %                 |                                   |    |     |

## General information

|                             |   |        |                        |      |                   |
|-----------------------------|---|--------|------------------------|------|-------------------|
| <b>Maintenance interval</b> | 6 | months | <b>Detection limit</b> | 0.08 | mg/m <sup>3</sup> |
|-----------------------------|---|--------|------------------------|------|-------------------|

## 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 (O <sub>2</sub> )                           | 0.00 mg/m <sup>3</sup> | 0.00 mg/m <sup>3</sup> |
| 21 Vol% Oxygen (O <sub>2</sub> )                          | 0.00 mg/m <sup>3</sup> | 0.00 mg/m <sup>3</sup> |
| 30 Vol% Water (H <sub>2</sub> O)                          | 0.00 mg/m <sup>3</sup> | 0.00 mg/m <sup>3</sup> |
| 300 mg/m <sup>3</sup> Carbon monoxide (CO)                | 0.00 mg/m <sup>3</sup> | 0.00 mg/m <sup>3</sup> |
| 15 Vol% Carbon dioxide (CO <sub>2</sub> )                 | 0.54 mg/m <sup>3</sup> | 0.00 mg/m <sup>3</sup> |
| 50 mg/m <sup>3</sup> Methane (CH <sub>4</sub> )           | 0.81 mg/m <sup>3</sup> | 0.00 mg/m <sup>3</sup> |
| 20 mg/m <sup>3</sup> Dinitrogen oxide (N <sub>2</sub> O)  | 0.00 mg/m <sup>3</sup> | 0.00 mg/m <sup>3</sup> |
| 100 mg/m <sup>3</sup> Dinitrogen oxide (N <sub>2</sub> O) | 1.35 mg/m <sup>3</sup> | 1.71 mg/m <sup>3</sup> |
| 300 mg/m <sup>3</sup> Nitrogen monoxide (NO)              | 0.54 mg/m <sup>3</sup> | 0.00 mg/m <sup>3</sup> |
| 30 mg/m <sup>3</sup> Nitrogen dioxide (NO <sub>2</sub> )  | 0.00 mg/m <sup>3</sup> | 2.07 mg/m <sup>3</sup> |
| 20 mg/m <sup>3</sup> Ammonia (NH <sub>3</sub> )           | 0.00 mg/m <sup>3</sup> | 0.00 mg/m <sup>3</sup> |
| 200 mg/m <sup>3</sup> Sulfur dioxide (SO <sub>2</sub> )   | 0.00 mg/m <sup>3</sup> | 0.00 mg/m <sup>3</sup> |
| 1000 mg/m <sup>3</sup> Sulfur dioxide (SO <sub>2</sub> )  | 1.08 mg/m <sup>3</sup> | 0.00 mg/m <sup>3</sup> |
| 50 mg/m <sup>3</sup> Hydrogen chloride (HCl)              |                        |                        |
| 200 mg/m <sup>3</sup> Hydrogen chloride (HCl)             |                        |                        |

Sum of the positive cross-sensitivities  
Sum of the negative cross-sensitivities

|      |                   |
|------|-------------------|
| 4.32 | mg/m <sup>3</sup> |
| 0.00 | mg/m <sup>3</sup> |

|      |                   |
|------|-------------------|
| 3.78 | mg/m <sup>3</sup> |
| 0.00 | mg/m <sup>3</sup> |

# Calculation of measurement uncertainty

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

Version 5.2

## Device data

|                  |                            |           |            |
|------------------|----------------------------|-----------|------------|
| Customer         | DGtek / Volund GMAB Margam | Date      | 2016-09-14 |
| Identification   | ZTA-4943685                | Component | HCI        |
| Serial number    | 1628 0562                  |           |            |
| Measuring system | <b>MCS100FT</b>            |           |            |

## Influences of the process characteristics

### Process characteristics

|  | Largest difference according to type approval |                   |            |                   |
|--|---|-------------------|------------|-------------------|
|  | Zero point                                    |                   | Span point |                   |
| Lack-of-fit (Linearity)  | 1.80  | mg/m <sup>3</sup> | 1.80       | mg/m <sup>3</sup> |
| Zero drift from the field test                                     | -2.52   | mg/m <sup>3</sup> | 0.00       | mg/m <sup>3</sup> |
| Span drift from the field test                                     | 0.00  | mg/m <sup>3</sup> | 2.70       | mg/m <sup>3</sup> |
| Influence of ambient temperature at span point                     | 0.72  | mg/m <sup>3</sup> | -3.15      | mg/m <sup>3</sup> |
| Influence of sample gas pressure                                   | 0.00  | mg/m <sup>3</sup> | 0.00       | mg/m <sup>3</sup> |
| Influence of sample gas flow                                       | 0.00  | mg/m <sup>3</sup> | -0.09      | mg/m <sup>3</sup> |
| Influence of voltage   | -0.45   | mg/m <sup>3</sup> | 0.63       | mg/m <sup>3</sup> |
| Cross-sensitivity  | 4.32  | mg/m <sup>3</sup> | 3.78       | mg/m <sup>3</sup> |
| Repeatability at span point  | 0.04  | mg/m <sup>3</sup> | 0.15       | mg/m <sup>3</sup> |
| Standard deviation from paired measurements under field conditions | 0.94  | mg/m <sup>3</sup> | 0.94       | mg/m <sup>3</sup> |
| Uncertainty of provided reference material                         | 1.80  | mg/m <sup>3</sup> | 1.80       | mg/m <sup>3</sup> |
| Misalignment   | 0.00  | mg/m <sup>3</sup> | 0.00       | mg/m <sup>3</sup> |
| Conversion rate of AMS for measurement of NOx                      | 0.00  | mg/m <sup>3</sup> | 0.00       | mg/m <sup>3</sup> |
| Changes of response factors  | 0.00  | mg/m <sup>3</sup> | 0.00       | mg/m <sup>3</sup> |

### Process characteristics

|  |             | Standard uncertainty |                   |            |                   |
|--|-------------|----------------------|-------------------|------------|-------------------|
|  |             | Zero point           |                   | Span point |                   |
| Lack-of-fit (Linearity)  | $u_{lof}$ = | 1.0392               | mg/m <sup>3</sup> | 1.0392     | mg/m <sup>3</sup> |
| Zero drift from the field test                                     | $u_{d,z}$ = | -1.4549              | mg/m <sup>3</sup> | 0.0000     | mg/m <sup>3</sup> |
| Span drift from the field test                                     | $u_{d,s}$ = | 0.0000               | mg/m <sup>3</sup> | 1.5588     | mg/m <sup>3</sup> |
| Influence of ambient temperature at span point                     | $u_t$ =     | 0.4157               | mg/m <sup>3</sup> | -1.8187    | mg/m <sup>3</sup> |
| Influence of sample gas pressure                                   | $u_p$ =     | 0.0000               | mg/m <sup>3</sup> | 0.0000     | mg/m <sup>3</sup> |
| Influence of sample gas flow                                       | $u_f$ =     | 0.0000               | mg/m <sup>3</sup> | -0.0520    | mg/m <sup>3</sup> |
| Influence of voltage   | $u_v$ =     | -0.2598              | mg/m <sup>3</sup> | 0.3637     | mg/m <sup>3</sup> |
| Cross-sensitivity  | $u_i$ =     | 2.4942               | mg/m <sup>3</sup> | 2.1824     | mg/m <sup>3</sup> |
| Repeatability at span point  | $u_r$ =     | 0.0231               | mg/m <sup>3</sup> | 0.0866     | mg/m <sup>3</sup> |
| Standard deviation from paired measurements under field conditions | $u_D$ =     | 0.5410               | mg/m <sup>3</sup> | 0.5410     | mg/m <sup>3</sup> |
| Uncertainty of provided reference material                         | $u_{rm}$ =  | 1.0392               | mg/m <sup>3</sup> | 1.0392     | mg/m <sup>3</sup> |
| Misalignment   | $u_{mb}$ =  | 0.0000               | mg/m <sup>3</sup> | 0.0000     | mg/m <sup>3</sup> |
| Conversion rate of AMS for measurement of NOx                      | $u_{ce}$ =  | 0.0000               | mg/m <sup>3</sup> | 0.0000     | mg/m <sup>3</sup> |
| Changes of response factors  | $u_{rf}$ =  | 0.0000               | mg/m <sup>3</sup> | 0.0000     | mg/m <sup>3</sup> |

## Calculation of the combined standard uncertainties

|                               |               | Zero point               | Span point               |
|-------------------------------|---------------|--------------------------|--------------------------|
| Combined standard uncertainty | s(AMS) values | 3.3212 mg/m <sup>3</sup> | 3.6177 mg/m <sup>3</sup> |

## Verification of compliance with the requirements

|                               |       |                   |   |
|-------------------------------|-------|-------------------|---|
| Combined standard uncertainty | 4.08  | mg/m <sup>3</sup> | according to EN 15267-3                               |
| Expanded uncertainty          | 8.00  | mg/m <sup>3</sup> | according to EN 15267-3                               |
| Relative expanded uncertainty | 8.00  | %                 | of the emissions limit value of 100 mg/m <sup>3</sup> |
| Allowed expanded uncertainty  | 40.00 | %                 | of the emissions limit value of 100 mg/m <sup>3</sup> |
| Allowed expanded uncertainty  | 40.00 | mg/m <sup>3</sup> |   |

## Result

Requirements fulfilled

# Calculation of measurement uncertainty

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

Version 5.2

## Device data

|                         |                            |                  |            |
|-------------------------|----------------------------|------------------|------------|
| <b>Customer</b>         | DGtek / Volund GMAB Margam |                  |            |
| <b>Identification</b>   | ZTA-4943685                |                  |            |
| <b>Serial number</b>    | 1628 0562                  | <b>Date</b>      | 2016-09-14 |
| <b>Measuring system</b> | <b>MCS100FT</b>            | <b>Component</b> | <b>HF</b>  |

## Input values

|                       |    |                   |                                   |    |     |
|-----------------------|----|-------------------|-----------------------------------|----|-----|
| Certification range   | 10 | mg/m <sup>3</sup> | Requirement to response time      | 25 | %   |
| Emissions limit value | 10 | mg/m <sup>3</sup> | Averaging time of measured values | 30 | min |
| Confidence interval   | 40 | %                 |                                   |    |     |

## General information

|                             |   |        |                        |      |                   |
|-----------------------------|---|--------|------------------------|------|-------------------|
| <b>Maintenance interval</b> | 3 | months | <b>Detection limit</b> | 0.08 | mg/m <sup>3</sup> |
|-----------------------------|---|--------|------------------------|------|-------------------|

## 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 (O <sub>2</sub> )                           | 0.00 mg/m <sup>3</sup>  | 0.00 mg/m <sup>3</sup>  |
| 21 Vol% Oxygen (O <sub>2</sub> )                          | 0.00 mg/m <sup>3</sup>  | 0.00 mg/m <sup>3</sup>  |
| 30 Vol% Water (H <sub>2</sub> O)                          | 0.15 mg/m <sup>3</sup>  | 0.00 mg/m <sup>3</sup>  |
| 300 mg/m <sup>3</sup> Carbon monoxide (CO)                | -0.28 mg/m <sup>3</sup> | -0.25 mg/m <sup>3</sup> |
| 15 Vol% Carbon dioxide (CO <sub>2</sub> )                 | 0.00 mg/m <sup>3</sup>  | 0.00 mg/m <sup>3</sup>  |
| 50 mg/m <sup>3</sup> Methane (CH <sub>4</sub> )           | 0.23 mg/m <sup>3</sup>  | 0.00 mg/m <sup>3</sup>  |
| 20 mg/m <sup>3</sup> Dinitrogen oxide (N <sub>2</sub> O)  | 0.00 mg/m <sup>3</sup>  | 0.00 mg/m <sup>3</sup>  |
| 100 mg/m <sup>3</sup> Dinitrogen oxide (N <sub>2</sub> O) | 0.00 mg/m <sup>3</sup>  | 0.00 mg/m <sup>3</sup>  |
| 300 mg/m <sup>3</sup> Nitrogen monoxide (NO)              | 0.00 mg/m <sup>3</sup>  | 0.00 mg/m <sup>3</sup>  |
| 30 mg/m <sup>3</sup> Nitrogen dioxide (NO <sub>2</sub> )  | 0.00 mg/m <sup>3</sup>  | 0.15 mg/m <sup>3</sup>  |
| 20 mg/m <sup>3</sup> Ammonia (NH <sub>3</sub> )           | 0.10 mg/m <sup>3</sup>  | 0.00 mg/m <sup>3</sup>  |
| 200 mg/m <sup>3</sup> Sulfur dioxide (SO <sub>2</sub> )   | 0.00 mg/m <sup>3</sup>  | 0.00 mg/m <sup>3</sup>  |
| 1000 mg/m <sup>3</sup> Sulfur dioxide (SO <sub>2</sub> )  | 0.00 mg/m <sup>3</sup>  | 0.00 mg/m <sup>3</sup>  |
| 50 mg/m <sup>3</sup> Hydrogen chloride (HCl)              | 0.00 mg/m <sup>3</sup>  | 0.00 mg/m <sup>3</sup>  |
| 200 mg/m <sup>3</sup> Hydrogen chloride (HCl)             | 0.10 mg/m <sup>3</sup>  | -0.10 mg/m <sup>3</sup> |

Sum of the positive cross-sensitivities  
Sum of the negative cross-sensitivities

|       |                   |
|-------|-------------------|
| 0.58  | mg/m <sup>3</sup> |
| -0.28 | mg/m <sup>3</sup> |

|       |                   |
|-------|-------------------|
| 0.15  | mg/m <sup>3</sup> |
| -0.35 | mg/m <sup>3</sup> |



# Calculation of measurement uncertainty

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

Version 5.2

## Device data

|                  |                            |           |            |
|------------------|----------------------------|-----------|------------|
| Customer         | DGtek / Volund GMAB Margam | Date      | 2016-09-14 |
| Identification   | ZTA-4943685                | Component | HF         |
| Serial number    | 1628 0562                  |           |            |
| Measuring system | <b>MCS100FT</b>            |           |            |

## Influences of the process characteristics

### Process characteristics

|  | Largest difference according to type approval |                   |            |                   |
|--|---|-------------------|------------|-------------------|
|  | Zero point                                    |                   | Span point |                   |
| Lack-of-fit (Linearity)  | 0.17  | mg/m <sup>3</sup> | 0.17       | mg/m <sup>3</sup> |
| Zero drift from the field test                                     | -0.39   | mg/m <sup>3</sup> | 0.00       | mg/m <sup>3</sup> |
| Span drift from the field test                                     | 0.00  | mg/m <sup>3</sup> | -0.30      | mg/m <sup>3</sup> |
| Influence of ambient temperature at span point                     | -0.37   | mg/m <sup>3</sup> | 0.47       | mg/m <sup>3</sup> |
| Influence of sample gas pressure                                   | 0.00  | mg/m <sup>3</sup> | 0.00       | mg/m <sup>3</sup> |
| Influence of sample gas flow                                       | 0.00  | mg/m <sup>3</sup> | -0.01      | mg/m <sup>3</sup> |
| Influence of voltage   | 0.10  | mg/m <sup>3</sup> | 0.13       | mg/m <sup>3</sup> |
| Cross-sensitivity  | 0.58  | mg/m <sup>3</sup> | -0.35      | mg/m <sup>3</sup> |
| Repeatability at span point  | 0.04  | mg/m <sup>3</sup> | 0.05       | mg/m <sup>3</sup> |
| Standard deviation from paired measurements under field conditions | 0.13  | mg/m <sup>3</sup> | 0.13       | mg/m <sup>3</sup> |
| Uncertainty of provided reference material                         | 0.20  | mg/m <sup>3</sup> | 0.20       | mg/m <sup>3</sup> |
| Misalignment   | 0.00  | mg/m <sup>3</sup> | 0.00       | mg/m <sup>3</sup> |
| Conversion rate of AMS for measurement of NOx                      | 0.00  | mg/m <sup>3</sup> | 0.00       | mg/m <sup>3</sup> |
| Changes of response factors  | 0.00  | mg/m <sup>3</sup> | 0.00       | mg/m <sup>3</sup> |

### Process characteristics

|  |           | Standard uncertainty |                           |            |                   |
|--|-----------|----------------------|---------------------------|------------|-------------------|
|  |           | Zero point           |                           | Span point |                   |
| Lack-of-fit (Linearity)  | $U_{lof}$ | =                    | 0.0981 mg/m <sup>3</sup>  | 0.0981     | mg/m <sup>3</sup> |
| Zero drift from the field test                                     | $U_{d,z}$ | =                    | -0.2252 mg/m <sup>3</sup> | 0.0000     | mg/m <sup>3</sup> |
| Span drift from the field test                                     | $U_{d,s}$ | =                    | 0.0000 mg/m <sup>3</sup>  | -0.1732    | mg/m <sup>3</sup> |
| Influence of ambient temperature at span point                     | $U_t$     | =                    | -0.2136 mg/m <sup>3</sup> | 0.2714     | mg/m <sup>3</sup> |
| Influence of sample gas pressure                                   | $U_p$     | =                    | 0.0000 mg/m <sup>3</sup>  | 0.0000     | mg/m <sup>3</sup> |
| Influence of sample gas flow                                       | $U_f$     | =                    | 0.0000 mg/m <sup>3</sup>  | -0.0058    | mg/m <sup>3</sup> |
| Influence of voltage   | $U_v$     | =                    | 0.0577 mg/m <sup>3</sup>  | 0.0751     | mg/m <sup>3</sup> |
| Cross-sensitivity  | $U_i$     | =                    | 0.3349 mg/m <sup>3</sup>  | -0.2021    | mg/m <sup>3</sup> |
| Repeatability at span point  | $U_r$     | =                    | 0.0231 mg/m <sup>3</sup>  | 0.0289     | mg/m <sup>3</sup> |
| Standard deviation from paired measurements under field conditions | $U_D$     | =                    | 0.0736 mg/m <sup>3</sup>  | 0.0736     | mg/m <sup>3</sup> |
| Uncertainty of provided reference material                         | $U_{rm}$  | =                    | 0.1155 mg/m <sup>3</sup>  | 0.1155     | mg/m <sup>3</sup> |
| Misalignment   | $U_{mb}$  | =                    | 0.0000 mg/m <sup>3</sup>  | 0.0000     | mg/m <sup>3</sup> |
| Conversion rate of AMS for measurement of NOx                      | $U_{ce}$  | =                    | 0.0000 mg/m <sup>3</sup>  | 0.0000     | mg/m <sup>3</sup> |
| Changes of response factors  | $U_{rf}$  | =                    | 0.0000 mg/m <sup>3</sup>  | 0.0000     | mg/m <sup>3</sup> |

## Calculation of the combined standard uncertainties

| Combined standard uncertainty | s(AMS) values | Zero point               | Span point               |
|-------------------------------|---------------|--------------------------|--------------------------|
|                               |               | 0.4901 mg/m <sup>3</sup> | 0.4225 mg/m <sup>3</sup> |

## Verification of compliance with the requirements

|                               |       |                   |  |
|-------------------------------|-------|-------------------|--|
| Combined standard uncertainty | 0.55  | mg/m <sup>3</sup> | according to EN 15267-3                              |
| Expanded uncertainty          | 1.07  | mg/m <sup>3</sup> | according to EN 15267-3                              |
| Relative expanded uncertainty | 10.74 | %                 | of the emissions limit value of 10 mg/m <sup>3</sup> |
| Allowed expanded uncertainty  | 40.00 | %                 | of the emissions limit value of 10 mg/m <sup>3</sup> |
| Allowed expanded uncertainty  | 4.00  | mg/m <sup>3</sup> |  |

## Result

Requirements fulfilled

# Calculation of measurement uncertainty

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

Version 5.2

## Device data

|                  |                            |           |            |
|------------------|----------------------------|-----------|------------|
| Customer         | DGtek / Volund GMAB Margam |           |            |
| Identification   | ZTA-4943685                |           |            |
| Serial number    | 1628 0562                  | Date      | 2016-09-14 |
| Measuring system | <b>MCS100FT</b>            | Component | <b>NH3</b> |

## Input values

|                     |    |                   |                                   |    |     |
|---------------------|----|-------------------|-----------------------------------|----|-----|
| Certification range | 50 | mg/m <sup>3</sup> | Requirement to response time      | 25 | %   |
| Measuring range     | 60 | mg/m <sup>3</sup> | 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.

## General information

|                      |   |        |                 |      |                   |
|----------------------|---|--------|-----------------|------|-------------------|
| Maintenance interval | 3 | months | Detection limit | 0.05 | mg/m <sup>3</sup> |
|----------------------|---|--------|-----------------|------|-------------------|

## 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/m <sup>3</sup> | 0.00 mg/m <sup>3</sup>  |
| 21 Vol% Oxygen (O2)                           | 0.00 mg/m <sup>3</sup> | 0.00 mg/m <sup>3</sup>  |
| 30 Vol% Water (H2O)                           | 0.40 mg/m <sup>3</sup> | 0.00 mg/m <sup>3</sup>  |
| 300 mg/m <sup>3</sup> Carbon monoxide (CO)    | 0.35 mg/m <sup>3</sup> | 0.00 mg/m <sup>3</sup>  |
| 15 Vol% Carbon dioxide (CO2)                  | 0.45 mg/m <sup>3</sup> | -0.50 mg/m <sup>3</sup> |
| 50 mg/m <sup>3</sup> Methane (CH4)            | 0.60 mg/m <sup>3</sup> | -0.20 mg/m <sup>3</sup> |
| 20 mg/m <sup>3</sup> Dinitrogen oxide (N2O)   | 0.00 mg/m <sup>3</sup> | 0.00 mg/m <sup>3</sup>  |
| 100 mg/m <sup>3</sup> Dinitrogen oxide (N2O)  | 0.00 mg/m <sup>3</sup> | 0.20 mg/m <sup>3</sup>  |
| 300 mg/m <sup>3</sup> Nitrogen monoxide (NO)  | 0.65 mg/m <sup>3</sup> | -0.50 mg/m <sup>3</sup> |
| 30 mg/m <sup>3</sup> Nitrogen dioxide (NO2)   | 0.00 mg/m <sup>3</sup> | -0.25 mg/m <sup>3</sup> |
| 20 mg/m <sup>3</sup> Ammonia (NH3)            |                        |                         |
| 200 mg/m <sup>3</sup> Sulfur dioxide (SO2)    | 0.00 mg/m <sup>3</sup> | 0.00 mg/m <sup>3</sup>  |
| 1000 mg/m <sup>3</sup> Sulfur dioxide (SO2)   | 0.00 mg/m <sup>3</sup> | 0.00 mg/m <sup>3</sup>  |
| 50 mg/m <sup>3</sup> Hydrogen chloride (HCl)  | 0.00 mg/m <sup>3</sup> | 0.00 mg/m <sup>3</sup>  |
| 200 mg/m <sup>3</sup> Hydrogen chloride (HCl) | 0.00 mg/m <sup>3</sup> | 0.00 mg/m <sup>3</sup>  |

Sum of the positive cross-sensitivities  
Sum of the negative cross-sensitivities

|      |                   |
|------|-------------------|
| 2.45 | mg/m <sup>3</sup> |
| 0.00 | mg/m <sup>3</sup> |

|       |                   |
|-------|-------------------|
| 0.20  | mg/m <sup>3</sup> |
| -1.45 | mg/m <sup>3</sup> |

# Calculation of measurement uncertainty

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

Version 5.2

## Device data

|                  |                            |           |            |
|------------------|----------------------------|-----------|------------|
| Customer         | DGtek / Volund GMAB Margam | Date      | 2016-09-14 |
| Identification   | ZTA-4943685                | Component | NH3        |
| Serial number    | 1628 0562                  |           |            |
| Measuring system | <b>MCS100FT</b>            |           |            |

## Influences of the process characteristics

### Process characteristics

|  | Largest difference according to type approval |                   |            |                   |
|--|---|-------------------|------------|-------------------|
|  | Zero point                                    |                   | Span point |                   |
| Lack-of-fit (Linearity)  | -0.30   | mg/m <sup>3</sup> | -0.30      | mg/m <sup>3</sup> |
| Zero drift from the field test                                     | 0.25  | mg/m <sup>3</sup> | 0.00       | mg/m <sup>3</sup> |
| Span drift from the field test                                     | 0.00  | mg/m <sup>3</sup> | 1.47       | mg/m <sup>3</sup> |
| Influence of ambient temperature at span point                     | -0.25   | mg/m <sup>3</sup> | -0.70      | mg/m <sup>3</sup> |
| Influence of sample gas pressure                                   | 0.00  | mg/m <sup>3</sup> | 0.00       | mg/m <sup>3</sup> |
| Influence of sample gas flow                                       | 0.00  | mg/m <sup>3</sup> | -0.05      | mg/m <sup>3</sup> |
| Influence of voltage   | -0.25   | mg/m <sup>3</sup> | 0.35       | mg/m <sup>3</sup> |
| Cross-sensitivity  | 2.45  | mg/m <sup>3</sup> | -1.45      | mg/m <sup>3</sup> |
| Repeatability at span point  | 0.02  | mg/m <sup>3</sup> | 0.07       | mg/m <sup>3</sup> |
| Standard deviation from paired measurements under field conditions | 0.38  | mg/m <sup>3</sup> | 0.38       | mg/m <sup>3</sup> |
| Uncertainty of provided reference material                         | 1.00  | mg/m <sup>3</sup> | 1.00       | mg/m <sup>3</sup> |
| Misalignment   | 0.00  | mg/m <sup>3</sup> | 0.00       | mg/m <sup>3</sup> |
| Conversion rate of AMS for measurement of NOx                      | 0.00  | mg/m <sup>3</sup> | 0.00       | mg/m <sup>3</sup> |
| Changes of response factors  | 0.00  | mg/m <sup>3</sup> | 0.00       | mg/m <sup>3</sup> |

### Process characteristics

|  |             | Standard uncertainty |                   |            |                   |
|--|-------------|----------------------|-------------------|------------|-------------------|
|  |             | Zero point           |                   | Span point |                   |
| Lack-of-fit (Linearity)  | $U_{lof}$ = | -0.1732              | mg/m <sup>3</sup> | -0.1732    | mg/m <sup>3</sup> |
| Zero drift from the field test                                     | $U_{d,z}$ = | 0.1443               | mg/m <sup>3</sup> | 0.0000     | mg/m <sup>3</sup> |
| Span drift from the field test                                     | $U_{d,s}$ = | 0.0000               | mg/m <sup>3</sup> | 0.8487     | mg/m <sup>3</sup> |
| Influence of ambient temperature at span point                     | $U_t$ =     | -0.1443              | mg/m <sup>3</sup> | -0.4041    | mg/m <sup>3</sup> |
| Influence of sample gas pressure                                   | $U_p$ =     | 0.0000               | mg/m <sup>3</sup> | 0.0000     | mg/m <sup>3</sup> |
| Influence of sample gas flow                                       | $U_f$ =     | 0.0000               | mg/m <sup>3</sup> | -0.0289    | mg/m <sup>3</sup> |
| Influence of voltage   | $U_v$ =     | -0.1443              | mg/m <sup>3</sup> | 0.2021     | mg/m <sup>3</sup> |
| Cross-sensitivity  | $U_i$ =     | 1.4145               | mg/m <sup>3</sup> | -0.8372    | mg/m <sup>3</sup> |
| Repeatability at span point  | $U_r$ =     | 0.0115               | mg/m <sup>3</sup> | 0.0404     | mg/m <sup>3</sup> |
| Standard deviation from paired measurements under field conditions | $U_D$ =     | 0.2198               | mg/m <sup>3</sup> | 0.2198     | mg/m <sup>3</sup> |
| Uncertainty of provided reference material                         | $U_{rm}$ =  | 0.5774               | mg/m <sup>3</sup> | 0.5774     | mg/m <sup>3</sup> |
| Misalignment   | $U_{mb}$ =  | 0.0000               | mg/m <sup>3</sup> | 0.0000     | mg/m <sup>3</sup> |
| Conversion rate of AMS for measurement of NOx                      | $U_{ce}$ =  | 0.0000               | mg/m <sup>3</sup> | 0.0000     | mg/m <sup>3</sup> |
| Changes of response factors  | $U_{rf}$ =  | 0.0000               | mg/m <sup>3</sup> | 0.0000     | mg/m <sup>3</sup> |

## Calculation of the combined standard uncertainties

|                               |               | Zero point               | Span point               |
|-------------------------------|---------------|--------------------------|--------------------------|
| Combined standard uncertainty | s(AMS) values | 1.5732 mg/m <sup>3</sup> | 1.4275 mg/m <sup>3</sup> |

## Verification of compliance with the requirements

|                               |       |                   |  |
|-------------------------------|-------|-------------------|--|
| Combined standard uncertainty | 1.83  | mg/m <sup>3</sup> | according to EN 15267-3                        |
| Expanded uncertainty          | 3.59  | mg/m <sup>3</sup> | according to EN 15267-3                        |
| Relative expanded uncertainty | 5.99  | %                 | of the measuring range of 60 mg/m <sup>3</sup> |
| Allowed expanded uncertainty  | 40.00 | %                 | of the measuring range of 60 mg/m <sup>3</sup> |
| Allowed expanded uncertainty  | 24.00 | mg/m <sup>3</sup> |  |

## 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         | DGtek / Volund GMAB Margam |           |            |
| Identification   | ZTA-4943685                |           |            |
| Serial number    | 1628 0562                  | Date      | 2016-09-14 |
| Measuring system | <b>MCS100FT</b>            | Component | <b>H2O</b> |

## Input values

|                     |    |      |                                   |    |     |
|---------------------|----|------|-----------------------------------|----|-----|
| Certification range | 40 | Vol% | Requirement to response time      | 25 | %   |
| Measuring range     | 40 | 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.

## General 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)    | <b>0.80</b> Vol%  | <b>0.76</b> Vol%  |
| 15 Vol% Carbon dioxide (CO2)      | 0.00 Vol%         | 0.00 Vol%         |
| 50 mg/m³ Methane (CH4)            | <b>-0.20</b> Vol% | <b>-0.36</b> 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%         | <b>-0.20</b> 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%         | <b>-0.20</b> Vol% |

Sum of the positive cross-sensitivities  
Sum of the negative cross-sensitivities

|       |      |
|-------|------|
| 0.80  | Vol% |
| -0.20 | Vol% |

|       |      |
|-------|------|
| 0.76  | 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         | DGtek / Volund GMAB Margam | Date      | 2016-09-14 |
| Identification   | ZTA-4943685                | Component | H2O        |
| Serial number    | 1628 0562                  |           |            |
| Measuring system | <b>MCS100FT</b>            |           |            |

## 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 measurements 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%  |
| Conversion rate of AMS for measurement of NOx                      | 0.00 Vol%  | 0.00 Vol%  |
| Changes of response factors  | 0.00 Vol%  | 0.00 Vol%  |

### Process characteristics

### Standard uncertainty

|  | Zero point   | Span point   |
|--|--------------|--------------|
| Lack-of-fit (Linearity)  | 0.3695 Vol%  | 0.3695 Vol%  |
| Zero drift from the field test                                     | -0.6004 Vol% | 0.0000 Vol%  |
| Span drift from the field test                                     | 0.0000 Vol%  | 0.6697 Vol%  |
| Influence of ambient temperature at span point                     | 0.0693 Vol%  | 0.2771 Vol%  |
| Influence of sample gas pressure                                   | 0.0000 Vol%  | 0.0000 Vol%  |
| Influence of sample gas flow                                       | 0.0000 Vol%  | -0.0231 Vol% |
| Influence of voltage   | 0.0462 Vol%  | 0.0000 Vol%  |
| Cross-sensitivity  | 0.4619 Vol%  | 0.4388 Vol%  |
| Repeatability at span point  | 0.0115 Vol%  | 0.0346 Vol%  |
| Standard deviation from paired measurements under field conditions | 0.2266 Vol%  | 0.2266 Vol%  |
| Uncertainty of provided reference material                         | 0.4619 Vol%  | 0.4619 Vol%  |
| Misalignment   | 0.0000 Vol%  | 0.0000 Vol%  |
| Conversion rate of AMS for measurement of NOx                      | 0.0000 Vol%  | 0.0000 Vol%  |
| Changes of response factors  | 0.0000 Vol%  | 0.0000 Vol%  |

## Calculation of the combined standard uncertainties

|                               | s(AMS) values | Zero point  | Span point  |
|-------------------------------|---------------|-------------|-------------|
| Combined standard uncertainty |               | 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 | 6.01  | %    | of the measuring range of 40 Vol% |
| Allowed expanded uncertainty  | 40.00 | %    | of the measuring range of 40 Vol% |
| Allowed expanded uncertainty  | 16.00 | 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

|                         |                            |                  |             |
|-------------------------|----------------------------|------------------|-------------|
| <b>Customer</b>         | DGtek / Volund GMAB Margam |                  |             |
| <b>Identification</b>   | ZTA-4943685                |                  |             |
| <b>Serial number</b>    | 1628 0562                  | <b>Date</b>      | 2016-09-14  |
| <b>Measuring system</b> | <b>MCS100FT</b>            | <b>Component</b> | <b>Corg</b> |

## Input values

|                       |     |                   |                                   |    |     |
|-----------------------|-----|-------------------|-----------------------------------|----|-----|
| Certification range   | 50  | mg/m <sup>3</sup> | Requirement to response time      | 25 | %   |
| Emissions limit value | 100 | mg/m <sup>3</sup> | Averaging time of measured values | 30 | min |
| Confidence interval   | 30  | %                 |                                   |    |     |

## General information

|                             |   |        |                        |   |                   |
|-----------------------------|---|--------|------------------------|---|-------------------|
| <b>Maintenance interval</b> | 2 | months | <b>Detection limit</b> | 0 | mg/m <sup>3</sup> |
|-----------------------------|---|--------|------------------------|---|-------------------|

## 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 (O <sub>2</sub> )                           | 0.00 mg/m <sup>3</sup> | 0.00 mg/m <sup>3</sup>  |
| 21 Vol% Oxygen (O <sub>2</sub> )                          | 0.00 mg/m <sup>3</sup> | 0.00 mg/m <sup>3</sup>  |
| 30 Vol% Water (H <sub>2</sub> O)                          | 0.57 mg/m <sup>3</sup> | 0.60 mg/m <sup>3</sup>  |
| 300 mg/m <sup>3</sup> Carbon monoxide (CO)                | 0.00 mg/m <sup>3</sup> | 0.00 mg/m <sup>3</sup>  |
| 15 Vol% Carbon dioxide (CO <sub>2</sub> )                 | 0.44 mg/m <sup>3</sup> | -0.50 mg/m <sup>3</sup> |
| 50 mg/m <sup>3</sup> Methane (CH <sub>4</sub> )           | 0.00 mg/m <sup>3</sup> | 0.00 mg/m <sup>3</sup>  |
| 20 mg/m <sup>3</sup> Dinitrogen oxide (N <sub>2</sub> O)  | 0.00 mg/m <sup>3</sup> | 0.00 mg/m <sup>3</sup>  |
| 100 mg/m <sup>3</sup> Dinitrogen oxide (N <sub>2</sub> O) | 0.00 mg/m <sup>3</sup> | 0.00 mg/m <sup>3</sup>  |
| 300 mg/m <sup>3</sup> Nitrogen monoxide (NO)              | 0.27 mg/m <sup>3</sup> | 0.00 mg/m <sup>3</sup>  |
| 30 mg/m <sup>3</sup> Nitrogen dioxide (NO <sub>2</sub> )  | 0.27 mg/m <sup>3</sup> | 0.00 mg/m <sup>3</sup>  |
| 20 mg/m <sup>3</sup> Ammonia (NH <sub>3</sub> )           | 0.00 mg/m <sup>3</sup> | 0.00 mg/m <sup>3</sup>  |
| 200 mg/m <sup>3</sup> Sulfur dioxide (SO <sub>2</sub> )   | 0.00 mg/m <sup>3</sup> | 0.00 mg/m <sup>3</sup>  |
| 1000 mg/m <sup>3</sup> Sulfur dioxide (SO <sub>2</sub> )  | 0.00 mg/m <sup>3</sup> | -0.27 mg/m <sup>3</sup> |
| 50 mg/m <sup>3</sup> Hydrogen chloride (HCl)              | 0.00 mg/m <sup>3</sup> | 0.00 mg/m <sup>3</sup>  |
| 200 mg/m <sup>3</sup> Hydrogen chloride (HCl)             | 0.27 mg/m <sup>3</sup> | 0.30 mg/m <sup>3</sup>  |

Sum of the positive cross-sensitivities  
Sum of the negative cross-sensitivities

|      |                   |
|------|-------------------|
| 1.80 | mg/m <sup>3</sup> |
| 0.00 | mg/m <sup>3</sup> |

|       |                   |
|-------|-------------------|
| 0.90  | mg/m <sup>3</sup> |
| -0.77 | mg/m <sup>3</sup> |

# Calculation of measurement uncertainty

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

Version 5.2

## Device data

|                  |                            |           |            |
|------------------|----------------------------|-----------|------------|
| Customer         | DGtek / Volund GMAB Margam | Date      | 2016-09-14 |
| Identification   | ZTA-4943685                | Component | Corg       |
| Serial number    | 1628 0562                  |           |            |
| Measuring system | <b>MCS100FT</b>            |           |            |

## Influences of the process characteristics

### Process characteristics

### Largest difference according to type approval

|  | Zero point              | Span point              |
|--|-------------------------|-------------------------|
| Lack-of-fit (Linearity)  | 0.34 mg/m <sup>3</sup>  | 0.34 mg/m <sup>3</sup>  |
| Zero drift from the field test                                     | 0.88 mg/m <sup>3</sup>  | 0.00 mg/m <sup>3</sup>  |
| Span drift from the field test                                     | 0.00 mg/m <sup>3</sup>  | -1.41 mg/m <sup>3</sup> |
| Influence of ambient temperature at span point                     | 0.70 mg/m <sup>3</sup>  | -0.65 mg/m <sup>3</sup> |
| Influence of sample gas pressure                                   | 0.00 mg/m <sup>3</sup>  | 0.00 mg/m <sup>3</sup>  |
| Influence of sample gas flow                                       | 0.30 mg/m <sup>3</sup>  | -0.35 mg/m <sup>3</sup> |
| Influence of voltage   | -0.05 mg/m <sup>3</sup> | 0.25 mg/m <sup>3</sup>  |
| Cross-sensitivity  | 1.80 mg/m <sup>3</sup>  | 0.90 mg/m <sup>3</sup>  |
| Repeatability at span point  | 0.00 mg/m <sup>3</sup>  | 0.01 mg/m <sup>3</sup>  |
| Standard deviation from paired measurements under field conditions | 0.15 mg/m <sup>3</sup>  | 0.15 mg/m <sup>3</sup>  |
| Uncertainty of provided reference material                         | 1.00 mg/m <sup>3</sup>  | 1.00 mg/m <sup>3</sup>  |
| Misalignment   | 0.00 mg/m <sup>3</sup>  | 0.00 mg/m <sup>3</sup>  |
| Conversion rate of AMS for measurement of NOx                      | 0.00 mg/m <sup>3</sup>  | 0.00 mg/m <sup>3</sup>  |
| Changes of response factors  | 3.27 mg/m <sup>3</sup>  | 3.27 mg/m <sup>3</sup>  |

### Process characteristics

### Standard uncertainty

|  | Zero point                | Span point                |
|--|---------------------------|---------------------------|
| Lack-of-fit (Linearity)  | 0.1934 mg/m <sup>3</sup>  | 0.1934 mg/m <sup>3</sup>  |
| Zero drift from the field test                                     | 0.5052 mg/m <sup>3</sup>  | 0.0000 mg/m <sup>3</sup>  |
| Span drift from the field test                                     | 0.0000 mg/m <sup>3</sup>  | -0.8112 mg/m <sup>3</sup> |
| Influence of ambient temperature at span point                     | 0.4041 mg/m <sup>3</sup>  | -0.3753 mg/m <sup>3</sup> |
| Influence of sample gas pressure                                   | 0.0000 mg/m <sup>3</sup>  | 0.0000 mg/m <sup>3</sup>  |
| Influence of sample gas flow                                       | 0.1732 mg/m <sup>3</sup>  | -0.2021 mg/m <sup>3</sup> |
| Influence of voltage   | -0.0289 mg/m <sup>3</sup> | 0.1443 mg/m <sup>3</sup>  |
| Cross-sensitivity  | 1.0363 mg/m <sup>3</sup>  | 0.5196 mg/m <sup>3</sup>  |
| Repeatability at span point  | 0.0000 mg/m <sup>3</sup>  | 0.0058 mg/m <sup>3</sup>  |
| Standard deviation from paired measurements under field conditions | 0.0877 mg/m <sup>3</sup>  | 0.0877 mg/m <sup>3</sup>  |
| Uncertainty of provided reference material                         | 0.5774 mg/m <sup>3</sup>  | 0.5774 mg/m <sup>3</sup>  |
| Misalignment   | 0.0000 mg/m <sup>3</sup>  | 0.0000 mg/m <sup>3</sup>  |
| Conversion rate of AMS for measurement of NOx                      | 0.0000 mg/m <sup>3</sup>  | 0.0000 mg/m <sup>3</sup>  |
| Changes of response factors  | 1.8850 mg/m <sup>3</sup>  | 1.8850 mg/m <sup>3</sup>  |

## Calculation of the combined standard uncertainties

|                               | s(AMS) values | Zero point               | Span point               |
|-------------------------------|---------------|--------------------------|--------------------------|
| Combined standard uncertainty |               | 2.3356 mg/m <sup>3</sup> | 2.2500 mg/m <sup>3</sup> |

## Verification of compliance with the requirements

|                               |       |                   |   |
|-------------------------------|-------|-------------------|---|
| Combined standard uncertainty | 2.47  | mg/m <sup>3</sup> | according to EN 15267-3                               |
| Expanded uncertainty          | 4.85  | mg/m <sup>3</sup> | according to EN 15267-3                               |
| Relative expanded uncertainty | 4.85  | %                 | of the emissions limit value of 100 mg/m <sup>3</sup> |
| Allowed expanded uncertainty  | 30.00 | %                 | of the emissions limit value of 100 mg/m <sup>3</sup> |
| Allowed expanded uncertainty  | 30.00 | mg/m <sup>3</sup> |   |

## Result

Requirements fulfilled

# Calculation of measurement uncertainty

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

Version 5.2

## Device data

|                         |                            |                  |            |
|-------------------------|----------------------------|------------------|------------|
| <b>Customer</b>         | DGtek / Volund GMAB Margam |                  |            |
| <b>Identification</b>   | ZTA-4943685                |                  |            |
| <b>Serial number</b>    | 1628 0562                  | <b>Date</b>      | 2016-09-14 |
| <b>Measuring system</b> | <b>MCS100FT</b>            | <b>Component</b> | <b>O2</b>  |

## Input values

|                     |    |      |                                   |    |     |
|---------------------|----|------|-----------------------------------|----|-----|
| Certification range | 21 | Vol% | Requirement to response time      | 25 | %   |
| Measuring range     | 25 | 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.

## General information

|                             |   |       |                        |      |      |
|-----------------------------|---|-------|------------------------|------|------|
| <b>Maintenance interval</b> | 4 | weeks | <b>Detection limit</b> | 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)                | 0.00       | Vol% | 0.00       | Vol% |
| 21 Vol% Oxygen (O2)               | 0.00       | Vol% | 0.00       | Vol% |
| 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  
Sum of the negative cross-sensitivities

|      |      |
|------|------|
| 0.00 | Vol% |
| 0.00 | Vol% |

|      |      |
|------|------|
| 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         | DGtek / Volund GMAB Margam | Date      | 2016-09-14 |
| Identification   | ZTA-4943685                | Component | O2         |
| Serial number    | 1628 0562                  |           |            |
| Measuring system | <b>MCS100FT</b>            |           |            |

## Influences of the process characteristics

### Process characteristics

Lack-of-fit (Linearity)  
Zero drift from the field test  
Span drift from the field test  
Influence of ambient temperature at span point  
Influence of sample gas pressure  
Influence of sample gas flow  
Influence of voltage  
Cross-sensitivity  
Repeatability at span point  
Standard deviation from paired measurements under field conditions  
Uncertainty of provided reference material  
Misalignment  
Conversion rate of AMS for measurement of NOx  
Changes of response factors

### Largest difference according to type approval

| Zero point | Span point |
|------------|------------|
| -0.14 Vol% | -0.14 Vol% |
| 0.18 Vol%  | 0.00 Vol%  |
| 0.00 Vol%  | -0.20 Vol% |
| 0.02 Vol%  | 0.24 Vol%  |
| 0.00 Vol%  | 0.00 Vol%  |
| -0.02 Vol% | 0.01 Vol%  |
| 0.01 Vol%  | -0.10 Vol% |
| 0.00 Vol%  | 0.00 Vol%  |
| 0.01 Vol%  | 0.01 Vol%  |
| 0.09 Vol%  | 0.09 Vol%  |
| 0.42 Vol%  | 0.42 Vol%  |
| 0.00 Vol%  | 0.00 Vol%  |
| 0.00 Vol%  | 0.00 Vol%  |
| 0.00 Vol%  | 0.00 Vol%  |

### Process characteristics

Lack-of-fit (Linearity)  
Zero drift from the field test  
Span drift from the field test  
Influence of ambient temperature at span point  
Influence of sample gas pressure  
Influence of sample gas flow  
Influence of voltage  
Cross-sensitivity  
Repeatability at span point  
Standard deviation from paired measurements under field conditions  
Uncertainty of provided reference material  
Misalignment  
Conversion rate of AMS for measurement of NOx  
Changes of response factors

### Standard uncertainty

| Zero point   | Span point   |
|--------------|--------------|
| -0.0808 Vol% | -0.0808 Vol% |
| 0.1039 Vol%  | 0.0000 Vol%  |
| 0.0000 Vol%  | -0.1155 Vol% |
| 0.0115 Vol%  | 0.1386 Vol%  |
| 0.0000 Vol%  | 0.0000 Vol%  |
| -0.0115 Vol% | 0.0058 Vol%  |
| 0.0058 Vol%  | -0.0577 Vol% |
| 0.0000 Vol%  | 0.0000 Vol%  |
| 0.0058 Vol%  | 0.0058 Vol%  |
| 0.0533 Vol%  | 0.0533 Vol%  |
| 0.2425 Vol%  | 0.2425 Vol%  |
| 0.0000 Vol%  | 0.0000 Vol%  |
| 0.0000 Vol%  | 0.0000 Vol%  |
| 0.0000 Vol%  | 0.0000 Vol%  |

## Calculation of the combined standard uncertainties

| Combined standard uncertainty | s(AMS) values | Zero point  | Span point  |
|-------------------------------|---------------|-------------|-------------|
|                               |               | 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 | 2.66  | %    | of the measuring range of 25 Vol% |
| Allowed expanded uncertainty  | 20.00 | %    | of the measuring range of 25 Vol% |
| Allowed expanded uncertainty  | 5.00  | Vol% |                                   |

## Result

**Requirements fulfilled**

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