| INDOFARMA | **Catatan Hasil Kalibrasi Internal**<br>*Internal Calibration Record*<br>**Spuit / Syringe** | *No.* : F-PM-01-38<br>*Rev.* : 00<br>*Date* : 3 September 2014 |
|---|---|---|

| | |
|---|---|
| **Merek** :<br>*Brand* | **Bidang/Lokasi** :<br>*Department/Location* |
| **Type** :<br>*Type* | **Suhu ruang** : °C<br>*Room temperature* |
| **Kode kalibrasi** :<br>*Calibration code* | **Kelembaban** : % RH<br>*Humidity* |
| **Kapasitas** : ml<br>*Capacity* | **No. Protap** : PKVK054<br>*SOP No.* |
| **Resolusi** : ml<br>*Subdivision (Resolution)* | **Petugas** :<br>*Operator* |
| **Syarat** : ml<br>*Requirement* | **Tanggal kalibrasi** :<br>*Calibration date* |

| **Kalibrator yang digunakan**<br>*Calibrator used* | **Kode Kalibrasi**<br>*Calibration Code* | **Tanggal kalibrasi Kalibrator**<br>*Cal. date of Calibrator* |
|---|---|---|
| *1. Neraca Analitik*<br>*2. Termometer* | | |

**Catatan**/Note :

$T_{Air}$ = 24.0 °C
$\rho_{Udara}$ = 0.0012 g/ml
$\rho_{Air}$ = 0.99729 g/ml
$\gamma_{plastik}$ = 2.5.E-04 /°C
$U_{Sert\ Termometer}$ = 0.7 °C
$\rho_{air\ 20°C}$ = 998.202 kg/m³
$\gamma_{glass\ soda\ lime}$ = 2.5.E-05 /°C
$\Delta\rho/\Delta T$ = -0,00026 g/ml°C
ρAT = 8 g/ml
$LOP_{Neraca}$ = 0.0026 gram
Δ Suhu = 24.0 °C

**A. Data**

**1. $V_{nominal}$ = ml**

| Ulangan *Rep.* | $W_{kosong}$ *$W_{Empty}$* (g) | $W_{Isi(air)}$ *$W_{Water}$* (g) | ΔR *ΔR* (g) |
|---|---|---|---|
| 1 | 0.0000 | | 0.0000 |
| 2 | 0.0000 | | 0.0000 |
| 3 | 0.0000 | | 0.0000 |
| 4 | 0.0000 | | 0.0000 |
| 5 | 0.0000 | | 0.0000 |
| $\Delta R_{rata\text{-}rata/average}$ | | 0.0000 g | |
| **SD ($\sigma_{n-1}$)** | | 0.0000 g | |
| **Isi / Volume, $V_{T20\,°C}$** | | 0.0000 ml | |

**2. $V_{nominal}$ = ml**

| Ulangan *Rep.* | $W_{kosong}$ *$W_{Empty}$* (g) | $W_{Isi(air)}$ *$W_{Water}$* (g) | ΔR *ΔR* (g) |
|---|---|---|---|
| 1 | 0.0000 | | 0.0000 |
| 2 | 0.0000 | | 0.0000 |
| 3 | 0.0000 | | 0.0000 |
| 4 | 0.0000 | | 0.0000 |
| 5 | 0.0000 | | 0.0000 |
| $\Delta R_{rata\text{-}rata/average}$ | | 0.0000 g | |
| **SD ($\sigma_{n-1}$)** | | 0.0000 g | |
| **Isi / Volume, $V_{T20\,°C}$** | | 0.0000 ml | |

**3. $V_{nominal}$ = ml**

| Ulangan *Rep.* | $W_{kosong}$ *$W_{Empty}$* (g) | $W_{Isi(air)}$ *$W_{Water}$* (g) | ΔR *ΔR* (g) |
|---|---|---|---|
| 1 | 0.0000 | | 0.0000 |
| 2 | 0.0000 | | 0.0000 |
| 3 | 0.0000 | | 0.0000 |
| 4 | 0.0000 | | 0.0000 |
| 5 | 0.0000 | | 0.0000 |
| $\Delta R_{rata\text{-}rata/average}$ | | 0.0000 g | |
| **SD ($\sigma_{n-1}$)** | | 0.0000 g | |
| **Isi / Volume, $V_{T20\,°C}$** | | 0.0000 ml | |

**4. $V_{nominal}$ = ml**

| Ulangan *Rep.* | $W_{kosong}$ *$W_{Empty}$* (g) | $W_{Isi(air)}$ *$W_{Water}$* (g) | ΔR *ΔR* (g) |
|---|---|---|---|
| 1 | 0.0000 | | 0.0000 |
| 2 | 0.0000 | | 0.0000 |
| 3 | 0.0000 | | 0.0000 |
| 4 | 0.0000 | | 0.0000 |
| 5 | 0.0000 | | 0.0000 |
| $\Delta R_{rata\text{-}rata/average}$ | | 0.0000 g | |
| **SD ($\sigma_{n-1}$)** | | 0.0000 g | |
| **Isi / Volume, $V_{T20\,°C}$** | | 0.0000 ml | |

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|---|---|---|

**5. $V_{nominal}$ = ml**

| Ulangan *Rep.* | $W_{kosong}$ $W_{Empty}$ (g) | $W_{Isi(air)}$ $W_{Water}$ (g) | ΔR ΔR (g) |
|---|---|---|---|
| 1 | 0.0000 | | 0.0000 |
| 2 | 0.0000 | | 0.0000 |
| 3 | 0.0000 | | 0.0000 |
| 4 | 0.0000 | | 0.0000 |
| 5 | 0.0000 | | 0.0000 |
| $\Delta R_{rata\text{-}rata/average}$ | | 0.0000 g | |
| **SD ($\sigma_{n-1}$)** | | 0.0000 g | |
| **Isi / Volume, $V_{T20\,°C}$** | | 0.0000 ml | |

**B. Perhitungan Ketidakpastian**

*Calculation of ucertainty*

**1. Perhitungan ketidakpastian volume nominal = 0 ml**

*Uncertainty calculation of nominal volume*

| No. *No.* | Sumber Ketidakpastian *Source of Uncertainty* | Satuan *Unit* | Distribusi *Distribution* | Nilai $U_t$ $U_t$ *value* | Pembagi *Divisor* | $u_i$ | Coeff. Ci *Coeff.* | *Ci* | ui Ci $u_i\ C_i$ | V *V* |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | *Reproducibility, $U_{Rep.} = \sigma_{n-1}$* | gram | Normal | 0.0000 | √5 | 0.0000 | 1.003 | 1.003 | 0.00000 | 4 |
| 2 | *LOP of Balance, $U_{Sert.}$ = LOP* | gram | Normal | 0.0026 | 2.0 | 0.0013 | 1.003 | 1.003 | 0.00130 | ∞ |
| 3 | *Density of Air ($\rho_{Air}$) =10% x0,0012* | g/ml | Rectangular | 0.00012 | √3 | 0.00007 | 1,003 ΔR | 0.00.E+00 | 0.00000 | ∞ |
| 4 | *Density of Water , $U(\rho_{H2O})=T_{sert}\,x\Delta\rho/\Delta T$* | g/ml | Normal | -0.00018 | 1.0 | -0.00018 | -1,003 ΔR | 0.00.E+00 | 0.000000 | ∞ |
| 5 | *Density of Weights, $U_{Weights}$ =10%x$\rho_{Weights}$* | g/ml | Rectangular | 0.8 | √3 | 0.46 | 1,88E-5ΔR | 0.00E+00 | 0.0.E+00 | ∞ |
| 6 | *Temp. of water, $U_{(TH2O)} = U_{\Delta T\,room}$* | °C | Normal | 24.00 | √3 | 13.8564 | 1,003E-6ΔR | 0.00E+00 | 0.000000 | ∞ |
| 7 | *Coef. thermal, (Uγ) = 10% x γ* | /°C | Rectangular | 2.5.E-05 | √3 | 1.E-05 | -5,015 ΔR | 0.00E+00 | 0.00000 | ∞ |
| 8 | *Resolution, $U_{Res}$ = 1/2 x Resolution* | ml | Rectangular | 0.000 | √3 | 0.0000 | 1.00 | 1.00 | 0.0000 | ∞ |
| 9 | *Drift of Balance, $U_{Drift}$ = 10% x LOP* | gram | Rectangular | 0.00026 | √3 | 1.50E-04 | 1.003 | 1.003 | 0.00015 | ∞ |
| **Ketidakpastian baku gabungan** / *Combined Uncertainty*, **$u$ (D) = SQRT ($\sum (u_i C_i)^2$)** | | | | | | | | | 0.00131 | |
| **Derajat kebebasan efektif** / *Effective degree of freedom*, **$V_{eff}$** | | | | | | | | | #DIV/0! | |
| **Faktor cakupan pada tingkat kepercayaan 95 %** / Coverage *Factor on uncertainty 95%*, **$K_{95\%}$** | | | | | | | | | 2 | |
| **Ketidakpastian gabungan perluasan** / *Expanded Uncertainty*, **$U$ (D) = $u$ (D) x $K_{95\%}$ , dalam** / *in* **ml** | | | | | | | | | **0.003** | |

**2. Perhitungan ketidakpastian volume nominal = 0 ml**

*Uncertainty calculation of nominal volume*

| No. *No.* | Sumber Ketidakpastian *Source of Uncertainty* | Satuan *Unit* | Distribusi *Distribution* | Nilai $U_t$ $U_t$ *value* | Pembagi *Divisor* | $u_i$ | Coeff. Ci *Coeff.* | *Ci* | ui Ci $u_i\ C_i$ | V *V* |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | *Reproducibility, $U_{Rep.} = \sigma_{n-1}$* | gram | Normal | 0.0000 | √5 | 0.0000 | 1.003 | 1.003 | 0.00000 | 4 |
| 2 | *LOP of Balance, $U_{Sert.}$ = LOP* | gram | Normal | 0.0026 | 2.0 | 0.0013 | 1.003 | 1.003 | 0.00130 | ∞ |
| 3 | *Density of Air ($\rho_{Air}$) =10% x0,0012* | g/ml | Rectangular | 0.00012 | √3 | 0.00007 | 1,003 ΔR | 0.00.E+00 | 0.00000 | ∞ |
| 4 | *Density of Water , $U(\rho_{H2O})=T_{sert}\,x\Delta\rho/\Delta T$* | g/ml | Normal | -0.00018 | 1.0 | -0.00018 | -1,003 ΔR | 0.00.E+00 | 0.000000 | ∞ |
| 5 | *Density of Weights, $U_{Weights}$ =10%x$\rho_{Weights}$* | g/ml | Rectangular | 0.8 | √3 | 0.46 | 1,88E-5ΔR | 0.00E+00 | 0.0.E+00 | ∞ |
| 6 | *Temp. of water, $u_{(TH2O)} = U_{\Delta T\,room}$* | °C | Normal | 24.00 | √3 | 13.8564 | 1,003E-6ΔR | 0.00E+00 | 0.000000 | ∞ |
| 7 | *Coef. thermal, (Uγ) = 10% x γ* | /°C | Rectangular | 2.5.E-05 | √3 | 1.E-05 | -5,015 ΔR | 0.00E+00 | 0.00000 | ∞ |
| 8 | *Resolution, $U_{Res}$ = 1/2 x Resolution* | ml | Rectangular | 0.000 | √3 | 0.0000 | 1.00 | 1.00 | 0.0000 | ∞ |
| 9 | *Drift of Balance, $U_{Drift}$ = 10% x LOP* | gram | Rectangular | 0.00026 | √3 | 1.50E-04 | 1.003 | 1.003 | 0.00015 | ∞ |
| **Ketidakpastian baku gabungan** / *Combined Uncertainty*, **$u$ (D) = SQRT ($\sum (u_i C_i)^2$)** | | | | | | | | | 0.00131 | |
| **Derajat kebebasan efektif** / *Effective degree of freedom*, **$V_{eff}$** | | | | | | | | | #DIV/0! | |
| **Faktor cakupan pada tingkat kepercayaan 95 %** / Coverage *Factor on uncertainty 95%*, **$K_{95\%}$** | | | | | | | | | 2 | |

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|---|---|---|

| | | |
|---|---|---|
| **Ketidakpastian gabungan perluasan** / *Expanded Uncertainty*, **U (D) = u (D) x $K_{95\%}$ , dalam** / *in* **ml** | **0.003** | |

**3. Perhitungan ketidakpastian volume nominal = 0 ml**

*Uncertainty calculation of nominal volume*

| No. / *No.* | Sumber Ketidakpastian / *Source of Uncertainty* | Satuan / *Unit* | Distribusi / *Distribution* | Nilai $U_t$ / *$U_t$ value* | Pembagi / *Divisor* | $u_i$ | Coeff. Ci / *Coeff.* | Coeff. Ci / *Ci* | ui Ci / *$u_i$ $C_i$* | V / *V* |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | *Reproducibility, $U_{Rep.} = \sigma_{n-1}$* | gram | Normal | 0.0000 | √5 | 0.0000 | 1.003 | 1.003 | 0.00000 | 4 |
| 2 | *LOP of Balance, $U_{Sert.}$ = LOP* | gram | Normal | 0.0026 | 2.0 | 0.0013 | 1.003 | 1.003 | 0.00130 | ∞ |
| 3 | *Density of Air ($\rho_{Air}$) =10% x0,0012* | g/ml | Rectangular | 0.00012 | √3 | 0.00007 | 1,003 ΔR | 0.00.E+00 | 0.00000 | ∞ |
| 4 | *Density of Water , $U(\rho_{H2O})=T_{sert} x\Delta\rho/\Delta T$* | g/ml | Normal | -0.00018 | 1.0 | -0.00018 | -1,003 ΔR | 0.00.E+00 | 0.000000 | ∞ |
| 5 | *Density of Weights, $U_{Weights}$ =10%x$\rho_{Weights}$* | g/ml | Rectangular | 0.8 | √3 | 0.46 | 1,88E-5ΔR | 0.00E+00 | 0.0.E+00 | ∞ |
| 6 | *Temp. of water, $u_{(TH2O)} = U_{\Delta T\ room}$* | °C | Normal | 24.00 | √3 | 13.8564 | 1,003E-6ΔR | 0.00E+00 | 0.000000 | ∞ |
| 7 | *Coef. thermal, (Uγ) = 10% x γ* | /°C | Rectangular | 2.5.E-05 | √3 | 1.E-05 | -5,015 ΔR | 0.00E+00 | 0.00000 | ∞ |
| 8 | *Resolution, $U_{Res}$ = 1/2 x Resolution* | ml | Rectangular | 0.000 | √3 | 0.0000 | 1.00 | 1.00 | 0.0000 | ∞ |
| 9 | *Drift of Balance, $U_{Drift}$ = 10% x LOP* | gram | Rectangular | 0.00026 | √3 | 1.50E-04 | 1.003 | 1.003 | 0.00015 | ∞ |

| | | |
|---|---|---|
| **Ketidakpastian baku gabungan** / *Combined Uncertainty*, **u (D) = SQRT ($\sum (u_i C_i)^2$)** | 0.00131 | |
| **Derajat kebebasan efektif** / *Effective degree of freedom*, **$V_{eff}$** | #DIV/0! | |
| **Faktor cakupan pada tingkat kepercayaan 95 %** / Coverage *Factor on uncertainty 95%*, **$K_{95\%}$** | 2 | |
| **Ketidakpastian gabungan perluasan** / *Expanded Uncertainty*, **U (D) = u (D) x $K_{95\%}$ , dalam** / *in* **ml** | **0.003** | |

**4. Perhitungan ketidakpastian volume nominal = 0 ml**

*Uncertainty calculation of nominal volume*

| No. / *No.* | Sumber Ketidakpastian / *Source of Uncertainty* | Satuan / *Unit* | Distribusi / *Distribution* | Nilai $U_t$ / *$U_t$ value* | Pembagi / *Divisor* | $u_i$ | Coeff. Ci / *Coeff.* | Coeff. Ci / *Ci* | ui Ci / *$u_i$ $C_i$* | V / *V* |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | *Reproducibility, $U_{Rep.} = \sigma_{n-1}$* | gram | Normal | 0.0000 | √5 | 0.0000 | 1.003 | 1.003 | 0.00000 | 4 |
| 2 | *LOP of Balance, $U_{Sert.}$ = LOP* | gram | Normal | 0.0026 | 2.0 | 0.0013 | 1.003 | 1.003 | 0.00130 | ∞ |
| 3 | *Density of Air ($\rho_{Air}$) =10% x0,0012* | g/ml | Rectangular | 0.00012 | √3 | 0.00007 | 1,003 ΔR | 0.00.E+00 | 0.00000 | ∞ |
| 4 | *Density of Water , $U(\rho_{H2O})=T_{sert} x\Delta\rho/\Delta T$* | g/ml | Normal | -0.00018 | 1.0 | -0.00018 | -1,003 ΔR | 0.00.E+00 | 0.000000 | ∞ |
| 5 | *Density of Weights, $U_{Weights}$ =10%x$\rho_{Weights}$* | g/ml | Rectangular | 0.8 | √3 | 0.46 | 1,88E-5ΔR | 0.00E+00 | 0.0.E+00 | ∞ |
| 6 | *Temp. of water, $u_{(TH2O)} = U_{\Delta T\ room}$* | °C | Normal | 24.00 | √3 | 13.8564 | 1,003E-6ΔR | 0.00E+00 | 0.000000 | ∞ |
| 7 | *Coef. thermal, (Uγ) = 10% x γ* | /°C | Rectangular | 2.5.E-05 | √3 | 1.E-05 | -5,015 ΔR | 0.00E+00 | 0.00000 | ∞ |
| 8 | *Resolution, $U_{Res}$ = 1/2 x Resolution* | ml | Rectangular | 0.000 | √3 | 0.0000 | 1.00 | 1.00 | 0.0000 | ∞ |
| 9 | *Drift of Balance, $U_{Drift}$ = 10% x LOP* | gram | Rectangular | 0.00026 | √3 | 1.50E-04 | 1.003 | 1.003 | 0.00015 | ∞ |

| | | |
|---|---|---|
| **Ketidakpastian baku gabungan** / *Combined Uncertainty*, **u (D) = SQRT ($\sum (u_i C_i)^2$)** | 0.00131 | |
| **Derajat kebebasan efektif** / *Effective degree of freedom*, **$V_{eff}$** | #DIV/0! | |
| **Faktor cakupan pada tingkat kepercayaan 95 %** / Coverage *Factor on uncertainty 95%*, **$K_{95\%}$** | 2 | |
| **Ketidakpastian gabungan perluasan** / *Expanded Uncertainty*, **U (D) = u (D) x $K_{95\%}$ , dalam** / *in* **ml** | **0.003** | |

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|---|---|---|

**5. Perhitungan ketidakpastian volume nominal = 0 ml**

*Uncertainty calculation of nominal volume*

| No.<br>*No.* | Sumber Ketidakpastian<br>*Source of Uncertainty* | Satuan<br>*Unit* | Distribusi<br>*Distribution* | Nilai $U_t$<br>$U_t$ *value* | Pembagi<br>*Divisor* | $u_i$ | Coeff. Ci<br>*Coeff.* | <br>*Ci* | ui Ci<br>$u_i C_i$ | V<br>*V* |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | *Reproducibility,* $U_{Rep.} = \sigma_{n-1}$ | gram | Normal | 0.0000 | √5 | 0.0000 | 1.003 | 1.003 | 0.00000 | 4 |
| 2 | *LOP of Balance,* $U_{Sert.}$ = *LOP* | gram | Normal | 0.0026 | 2.0 | 0.0013 | 1.003 | 1.003 | 0.00130 | ∞ |
| 3 | *Density of Air* ($\rho_{Air}$) *=10% x0,0012* | g/ml | Rectangular | 0.00012 | √3 | 0.00007 | 1,003 ΔR | 0.00.E+00 | 0.00000 | ∞ |
| 4 | *Density of Water ,* $U(\rho_{H2O}) = T_{sert} x \Delta\rho/\Delta T$ | g/ml | Normal | -0.00018 | 1.0 | -0.00018 | -1,003 ΔR | 0.00.E+00 | 0.000000 | ∞ |
| 5 | *Density of Weights,* $U_{Weights} = 10\% x \rho_{Weights}$ | g/ml | Rectangular | 0.8 | √3 | 0.46 | 1,88E-5ΔR | 0.00E+00 | 0.0.E+00 | ∞ |
| 6 | *Temp. of water,* $u_{(TH2O)} = U_{\Delta T\ room}$ | °C | Normal | 24.00 | √3 | 13.8564 | 1,003E-6ΔR | 0.00E+00 | 0.000000 | ∞ |
| 7 | *Coef. thermal, (Uγ) = 10% x γ* | /°C | Rectangular | 2.5.E-05 | √3 | 1.E-05 | -5,015 ΔR | 0.00E+00 | 0.00000 | ∞ |
| 8 | *Resolution,* $U_{Res}$ = *1/2 x Resolution* | ml | Rectangular | 0.000 | √3 | 0.0000 | 1.00 | 1.00 | 0.0000 | ∞ |
| 9 | *Drift of Balance,* $U_{Drift}$ = *10% x LOP* | gram | Rectangular | 0.00026 | √3 | 1.50E-04 | 1.003 | 1.003 | 0.00015 | ∞ |
| **Ketidakpastian baku gabungan** / *Combined Uncertainty* , $u$ **(D) = SQRT** $(\sum (u_i C_i)^2)$ | | | | | | | | | 0.00131 | |
| **Derajat kebebasan efektif** / *Effective degree of freedom* , $V_{eff}$ | | | | | | | | | #DIV/0! | |
| **Faktor cakupan pada tingkat kepercayaan 95 %** / Coverage *Factor on uncertainty 95%* , $K_{95\%}$ | | | | | | | | | 2 | |
| **Ketidakpastian gabungan perluasan** / *Expanded Uncertainty* , $U$ **(D) =** $u$ **(D) x** $K_{95\%}$ , **dalam** / *in* **ml** | | | | | | | | | **0.003** | |

**C. Hasil Kalibrasi**

*Calibration Results*

| No. | $V_{Nominal}$<br>$V_{Nominal}$<br>( °C ) | $V_{Kalibrasi}$<br>$V_{Calibration}$<br>( °C ) | Koreksi<br>*Correction*<br>( °C ) | Ketidakpastian, $U_{95\%}$<br>*Uncertainty,* $U_{95\%}$<br>( °C ) |
|---|---|---|---|---|
| 1 | 0.0 | 0.00 | 0.00 | 0.00 |
| 2 | 0.0 | 0.00 | 0.00 | 0.00 |
| 3 | 0.0 | 0.00 | 0.00 | 0.00 |
| 4 | 0.0 | 0.00 | 0.00 | 0.00 |
| 5 | 0.0 | 0.00 | 0.00 | 0.00 |

| **Dihitung Oleh**<br>*Calculated by* | **Tanggal**<br>*Date* | **Diperiksa oleh**<br>*Checked by* | **Tanggal**<br>*Date* | **Catatan / Kesimpulan**<br>*Note / Conclusion* |
|---|---|---|---|---|
| | | | | |