**Table 2. Uncertainties for measurement of gas holdup.**

| System | Mean×$10^2$ | No. of run | Standard Deviation×$10^3$ | Standard uncertainty×$10^3$ | % relative uncertainty |
|---|---|---|---|---|---|
| Air-water | 42.70 | 6 | 1.41 | 0.58 | 0.14 |
| Air-SDS 5 ppm sol. | 41.10 | 6 | 0.89 | 0.36 | 0.08 |
| Air-SDS 7 ppm sol. | 40.90 | 6 | 3.52 | 1.44 | 0.35 |
| Air-SDS 10 ppm sol. | 40.30 | 6 | 2.50 | 1.02 | 0.25 |
| Air-SDS 12 ppm sol | 39.60 | 6 | 3.31 | 1.35 | 0.34 |
| Air-SDS 15 ppm sol. | 39.20 | 6 | 2.93 | 1.19 | 0.30 |
| Air-SDS 20 ppm sol. | 38.80 | 6 | 2.50 | 1.02 | 0.26 |

**Table 3. Uncertainties for measurement of pressure drop.**

| Surfactant concentration (ppm) | Pipe diameter (m) | Flow rate $\times 10^6$ ($m^3/s$) | Range of mean $\times 10^2$ | Range of standard deviation $\times 10^3$ | Range of standard uncertainty $\times 10^4$ | Range of (%) relative uncertainty |
|---|---|---|---|---|---|---|
| 0 | 0.003 | 1.05 – 7.38 | 1.39 – 14.00 | 4.93 – 17.30 | 4.90 – 21.60 | 0.46 –12.5 |
| 5 | 0.003 | 1.05 – 7.38 | 1.44 – 15.00 | 4.84 – 8.37 | 3.89 –12.00 | 0.40 – 4.24 |
| 10 | 0.003 | 1.05 – 7.38 | 2.06 – 14.91 | 5.18 – 8.49 | 3.50 – 7.50 | 0.017 – 3.23 |
| 15 | 0.003 | 1.05 – 7.38 | 1.17 – 15.12 | 3.29 – 6.40 | 2.95 – 6.54 | 0.27 – 3.23 |
| 0 | 0.006 | 4.21 – 42.16 | 1.20 – 13.22 | 2.29 – 10.32 | 5.26 – 32.60 | 1.11 – 8.91 |
| 5 | 0.006 | 4.21 – 42.16 | 1.38 – 12.96 | 4.78 – 9.20 | 8.33 – 20.00 | 0.86 – 7.08 |
| 10 | 0.006 | 4.21 – 42.16 | 1.44 – 14.18 | 4.70 – 10.20 | 7.40 – 17.50 | 0.58 – 5.99 |
| 15 | 0.006 | 4.21 – 42.16 | 1.27 – 13.67 | 4.85 – 8.17 | 8.28 – 14.30 | 0.73 – 6.52 |
| 0 | 0.008 | 25.78 – 128.91 | 1.60 – 32.80 | 4.29 – 9.23 | 7.27 – 18.25 | 0.22 – 6.27 |
| 5 | 0.008 | 25.78 – 128.91 | 8.20 – 21.75 | 14.4 – 217.50 | 45.50 – 68.00 | 5.55 – 35.35 |
| 10 | 0.008 | 25.78 – 128.91 | 7.60 – 21.67 | 7.07 – 19.80 | 23.60 – 70.00 | 1.09 – 5.72 |
| 15 | 0.008 | 25.78 – 128.91 | 7.40 – 21.50 | 7.81 – 19.40 | 26.00 – 86.70 | 1.43 – 11.73 |