

**RUANG LINGKUP KALIBRASI**

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**Temperature**

| No.             | Instrument to be calibrated   | Measurement Range | CMC - Jakarta                     | CMC - Surabaya | CMC-Semarang | Methods/Specifications       |         |
|-----------------|---|-------------------|-----------------------------------|----------------|--------------|------------------------------|---------|
| 1               | Liquid In Glass Thermometer   | -30 °C ~ 0 °C     | 0.09 °C                           | 0.30 °C        | -            | ASTM E 77 - 2014             |         |
|                 |   | 0 °C ~ 100 °C     | 0.11 °C                           | 0.21 °C        | 0.20 °C      |                              |         |
|                 |   | 100 °C ~ 200 °C   | 0.11 °C                           | 0.21 °C        | 0.20 °C      |                              |         |
| 2               | Sensor Termokopel dengan Indikator                                  | -30 °C ~ 0 °C     | 0.24 °C                           | 0.30 °C        | -            | JIS Z 8710 - 1993            |         |
|                 |   | 0 °C ~ 100 °C     | 0.25 °C                           | 0.31 °C        | 0.58 °C      |                              |         |
|                 |   | 100 °C ~ 200 °C   | 0.25 °C                           | 0.31 °C        | 0.59 °C      |                              |         |
|                 | Sensor Tahanan dengan Indikator                                     | 200 °C ~ 600 °C   | 2.1 °C                            | 3.4 °C         | 3.8 °C       |                              |         |
|                 |   | 600 °C ~ 1000 °C  | 3.6 °C                            | 4.4 °C         | 4.6 °C       |                              |         |
|                 |   | Temperature Gauge | -30 °C ~ 0 °C                     | 0.14 °C        | 0.29 °C      |                              | 0.46 °C |
|                 | 0 °C ~ 200 °C   |                   | 0.14 °C                           | 0.20 °C        | 0.46 °C      |                              |         |
|                 | -30 °C ~ 0 °C   |                   | 0.30 °C                           | 0.64 °C        | 1.2 °C       |                              |         |
|                 |   |                   | 0 °C ~ 200 °C                     | 0.59 °C        | 0.60 °C      |                              | 1.2 °C  |
| 200 °C ~ 600 °C |   |                   | 3.7 °C                            | 4.9 °C         | 4.8 °C       |                              |         |
|                 |   |                   |                                   |                |              |                              |         |
| 3               | Temperature Transmitter   | -30 °C ~ 0 °C     | 0.094 °C                          | 0.29 °C        | -            | JIS Z 8710 - 1993            |         |
|                 |   | 0 °C ~ 200 °C     | 0.9 °C                            | 0.20 °C        | 0.28 °C      |                              |         |
|                 |   | 200 °C ~ 600 °C   | 2.2 °C                            | -              | -            |                              |         |
| 4               | Temperature Indicator (without sensor)<br>for Thermocouple Sensor : |                   |                                   |                |              | EURAMET cg-11 ver.2.0 - 2011 |         |
|                 |   | K-type            | -270 °C ~ 1372 °C                 | 0.08 °C        | 0.50 °C      |                              | 0.77 °C |
|                 |   | J-type            | -210 °C ~ 1200 °C                 | 0.07 °C        | 0.40 °C      |                              | 0.91 °C |
|                 |   | T-type            | -270 °C ~ 400 °C                  | 0.08 °C        | 0.51 °C      |                              | 0.27 °C |
|                 |   | E-type            | -270 °C ~ 1000 °C                 | 0.06 °C        | 0.34 °C      |                              | -       |
|                 |   | R-type            | -50 °C ~ 1768 °C                  | 0.25 °C        | 3.97 °C      |                              | 1.3 °C  |
|                 |   | S-type            | -50 °C ~ 1768 °C                  | 0.27 °C        | 3.97 °C      |                              | 1.3 °C  |
|                 |   | B-type            | 0 °C ~ 1820 °C                    | 0.44 °C        | -            |                              | -       |
|                 |   | N-type            | -200 °C ~ 1300 °C                 | -              | 0.77 °C      |                              | -       |
|                 |   |                   | for Resistance Thermometer Sensor |                |              |                              |         |
|                 |   | -200 °C ~ 600 °C  | -                                 | 0.21 °C        | -            |                              |         |
|                 |   | -200 °C ~ 800 °C  | 0.08 °C                           | -              | 0.14 °C      |                              |         |
| 5               | Sensor Termometer Tahanan   | -30 °C ~ 0 °C     | 0.12 °C                           | 0.34 °C        | -            | ASTM E 644 - 2011            |         |
|                 |   | 0 °C ~ 200 °C     | 0.11 °C                           | 0.26 °C        | -            |                              |         |
| 6               | Thermocouple  | -30 °C ~ 0 °C     | 0.30 °C                           | 0.46 °C        | -            | ASTM E 220-13                |         |
|                 |   | 0 °C ~ 200 °C     | 0.30 °C                           | 0.44 °C        | 0.42 °C      |                              |         |
|                 |   | 200 °C ~ 600 °C   | 2.3 °C                            | 2.9 °C         | 4.2 °C       |                              |         |
|                 |   | 600 °C ~ 1000 °C  | 3.8 °C                            | 4.4 °C         | 4.9 °C       |                              |         |
| 7               | Thermohygrometer  | 30 % ~ 95 %       | 2.7 %RH                           | 3.0 %RH        | -            | JIS B 7920 - 2000            |         |
|                 |   | -20 °C ~ 0 °C     | -                                 | 0.5 °C         | -            |                              |         |
|                 |   | 0 °C ~ 15 °C      | 0.52 °C                           | 0.45 °C        | -            |                              |         |
|                 |   | 15 °C ~ 40 °C     | 0.94 °C                           | 0.95 °C        | -            |                              |         |
|                 |   | 40 °C ~ 70 °C     | 1.2 °C                            | -              | -            |                              |         |
| 8               | Thermometer Radiasi (infrared)                                      | 0 °C ~ 50 °C      | 3.3 °C                            | 1.2 °C         | -            | JIS C 1612 - 2000            |         |
|                 |   | 50 °C ~ 100 °C    | 3.5 °C                            | 3.0 °C         | -            |                              |         |
|                 |   | 100 °C ~ 200 °C   | 3.8 °C                            | 3.1 °C         | -            |                              |         |
|                 |   | 200 °C ~ 300 °C   | 4.4 °C                            | 3.6 °C         | -            |                              |         |
|                 |   | 300 °C ~ 400 °C   | 5.2 °C                            | 4.2 °C         | -            |                              |         |
|                 |   | 400 °C ~ 500 °C   | 5.2 °C                            | 4.9 °C         | -            |                              |         |
| 9               | Temperature Enclosure:  |                   |                                   |                |              | AS 2853 - 1986               |         |
|                 | Liquid Bath / Circulating Bath                                      | -30 °C ~ 0 °C     | 0.28 °C                           | 0.37 °C        | 0.26 °C      |                              |         |

**Temperature (continued)**

| No. | Instrument to be calibrated              | Measurement Range | CMC - Jakarta | CMC-Surabaya | CMC-Semarang | Methods/Specifications   |
|-----|--|-------------------|---------------|--------------|--------------|--|
|     | (Oil or Water)                           | 0 °C ~ 100 °C     | 0.28 °C       | 0.57 °C      | 0.21 °C      | AS 2853 - 1986   |
|     |  | 100 °C ~ 200 °C   | 0.16 °C       | 0.31 °C      | 0.21 °C      |  |
|     | Freezer                                  | -30 °C ~ 0 °C     | 0.49 °C       | 0.76 °C      | 1.1 °C       |  |
|     | Refrigerator                             | 0 °C ~ 25 °C      | 0.49 °C       | 0.56 °C      | 0.66 °C      |  |
|     | Inkubator, Oven, Furnace                 | 20 °C ~ 35 °C     | 0.85 °C       | 1.1 °C       | 0.66 °C      |  |
|     |  | 35 °C ~ 200 °C    | 0.85 °C       | 1.3 °C       | 2.9 °C       |  |
|     |  | 200 °C ~ 500 °C   | 2.7 °C        | 7.8 °C       | 4.1 °C       |  |
| 10  | Climatic Chamber :<br>Suhu<br>Kelembaban | -30 °C ~ 200 °C   | 0.8 °C        | 0.64 °C      | 0.74 °C      | DKD-R 5-7 : 2004   |
|     |  | 35 % ~ 95 %       | 1.3 %RH       | 2.7 %RH      | 2.6 %RH      |  |
| 11  | Dry Block / Dry Well Calibrator          | -30 °C ~ 0 °C     | 0.59 °C       | -            | -            | EURAMET cg-13 - ver.4 - 2017   |
|     |  | 0 °C ~ 100 °C     | 0.23 °C       | 0.20 °C      | 0.52 °C      |  |
|     |  | 100 °C ~ 200 °C   | 0.59 °C       | 0.20 °C      | 0.90 °C      |  |
|     |  | 200 °C ~ 600 °C   | 2.4 °C        | 3.2 °C       | 3.6 °C       |  |
|     |  | 600 °C ~ 1000 °C  | 2.9 °C        | -            | -            |  |
| 12  | Autoclave :<br>Suhu                      | 105 °C ~ 150 °C   | 0.7 °C        | -            | 1.0 °C       | BS 2646-5 : 1993   |
|     |  | 105 °C ~ 121 °C   | -             | 0.85 °C      | -            |  |
|     | Tekanan                                  | 0 bar ~ 4 bar     | -             | 0.049 bar    | -            | DKD-R 6-1 : 2014   |
|     |  | 0 bar ~ 10 bar    | 0.12 bar      | -            | 0.14 bar     |  |
| 13  | COD Reactor                              | 50 °C ~ 200 °C    | 0.85 °C       | 0.77 °C      | -            | AS 2853 - 1986   |
| 14  | Hot Plate                                | 30 °C ~ 200 °C    | 3.0 °C        | 1.2 °C       | -            | International Journal of<br>Pharmaceutical Compounding<br>Vol.4 2000 |
|     |  | 200 °C ~ 400 °C   | 3.7 °C        | -            | -            |  |
| 15  | Melting Point Apparatus                  | 30 °C ~ 200 °C    | 0.7 °C        | -            | -            | in house procedure MP-01   |
|     |  | 200 °C ~ 400 °C   | 2.1 °C        | -            | -            |  |
|     |  | 40 °C ~ 300 °C    | -             | 0.67 °C      | -            |  |
| 16  | Ear Thermometer                          | 35 °C ~ 42 °C     | 0.11 °C       | -            | -            | National of Insitute Metrology<br>(Thailand )                        |

**Massa**

| No.           | Instrument to be calibrated    | Measurement Range | CMC - Jakarta                     | CMC-Surabaya | CMC-Semarang | Methods/Specifications |
|---------------|--------------------------------|-------------------|-----------------------------------|--------------|--------------|------------------------|
| 17            | Weights<br>(conventional mass) | 0.001 g ~ 0.05 g  | 0.011 mg                          | 0.017 mg     | -            | CSIRO 2010             |
|               |                                | 0.1 g             | 0.012 mg                          | 0.018 mg     | -            |                        |
|               |                                | 0.2 g             | 0.014 mg                          | 0.018 mg     | -            |                        |
|               |                                | 0.5 g             | 0.025 mg                          | 0.021 mg     | -            |                        |
|               |                                | 1 g               | 0.030 mg                          | 0.021 mg     | 1.0 mg       |                        |
|               |                                | 2 g               | 0.037 mg                          | 0.025 mg     | 1.0 mg       |                        |
|               |                                | 5 g               | 0.046 mg                          | 0.030 mg     | 1.0 mg       |                        |
|               |                                | 10 g              | 0.059 mg                          | 0.036 mg     | 1.0 mg       |                        |
|               |                                | 20 g              | 0.075 mg                          | 0.046 mg     | 1.1 mg       |                        |
|               |                                | 50 g              | 0.083 mg                          | 0.056 mg     | 1.3 mg       |                        |
|               |                                | 100 g             | 0.15 mg                           | 0.08 mg      | 1.3 mg       |                        |
|               |                                | 200 g             | 0.29 mg                           | 0.16 mg      | 1.3 mg       |                        |
|               |                                | 500 g             | 1.2 mg                            | 1.3 mg       | 2.3 mg       |                        |
|               |                                | 1 kg              | 1.6 mg                            | 3.3 mg       | 3.6 mg       |                        |
|               |                                | 2 kg              | 12 mg                             | 14 mg        | 17 mg        |                        |
|               |                                | 5 kg              | 23 mg                             | 18 mg        | 44 mg        |                        |
|               |                                | 18                | Balance<br>(electronic, mechanic) | 0 g ~ 10 g   | -            |                        |
| 0 g ~ 20 g    | 0.07 mg                        |                   |                                   | 0.03 mg      | 0.90 mg      |                        |
| 20 g ~ 50 g   | 0.09 mg                        |                   |                                   | 0.06 mg      | 0.91 mg      |                        |
| 50 g ~ 100 g  | 0.16 mg                        |                   |                                   | 0.13 mg      | 0.92 mg      |                        |
| 100 g ~ 200 g | 0.31 mg                        |                   |                                   | 0.26 mg      | 0.98 mg      |                        |
| 200 g ~ 300 g | 0.49 mg                        |                   |                                   | 0.9 mg       | 1.1 mg       |                        |
|               |                                |                   |                                   |              |              |                        |

**Massa (continued)**

| No. | Instrument to be calibrated | Measurement Range  | CMC - Jakarta | CMC-Surabaya | CMC-Semarang | Methods/Specifications |
|-----|-----------------------------|--------------------|---------------|--------------|--------------|------------------------|
|     |                             | 300 g ~ 500 g      | 1.4 mg        | 1.1 mg       | 2.2 mg       | CSIRO 2010             |
|     |                             | 500 g ~ 1000 g     | 2 mg          | 3.6 mg       | 3.6 mg       |                        |
|     |                             | 1000 g ~ 2000 g    | 12 mg         | 12 mg        | 19 mg        |                        |
|     |                             | 2000 g ~ 3000 g    | 18 mg         | 16 mg        | 21 mg        |                        |
|     |                             | 3000 g ~ 6 g       | 0.03 g        | 0.029 g      | 0.046 g      |                        |
|     |                             | 6 kg ~ 12 kg       | 0.04 g        | 0.11 g       | 0.16 g       |                        |
|     |                             | 12 kg ~ 30 kg      | 0.3 g         | 0.19 g       | 0.8 g        |                        |
|     |                             | 30 kg ~ 60 kg      | 0.3 g         | 5.4 g        | 21 g         |                        |
|     |                             | 60 kg ~ 100 kg     | 6 g           | 11 g         | 53 g         |                        |
|     |                             | 100 kg ~ 300 kg    | 60 g          | 22 g         | 110 g        |                        |
|     |                             | 300 kg ~ 500 kg    | 0.12 kg       | 53 kg        | 0.11 kg      |                        |
|     |                             | 500 kg ~ 1000 kg   | 1.2 kg        | 55 kg        | 0.21 kg      |                        |
|     |                             | 1000 kg ~ 2000 kg  | 1.2 kg        | 1.2 kg       | 0.7 kg       |                        |
|     |                             | 2000 kg ~ 3000 kg  | 1.4 kg        | 1.2 kg       | 1.8 kg       |                        |
|     |                             | 3000 kg ~ 5000 kg  | 2 kg          | 3.5 kg       | 3.2 kg       |                        |
|     |                             | 5000 kg ~ 10000 kg | 3.5 kg        | 11 kg        | -            |                        |

**Volume**

| No.      | Instrument to be calibrated                  | Measurement Range | CMC - Jakarta | CMC-Surabaya | CMC-Semarang | Methods/Specifications  |
|----------|--|-------------------|---------------|--------------|--------------|-------------------------|
| 19       | POVA<br>Piston Pipette                       | 10 uL             | 0.06 uL       | 0.13 uL      | -            | ISO 8655-2              |
|          |  | 20 uL             |               | 0.13 uL      | -            |                         |
|          |  | 50 uL             | 0.15 uL       | 0.15 uL      | -            |                         |
|          |  | 100 uL            | 0.2 uL        | 0.16 uL      | -            |                         |
|          |  | 200 uL            | 0.4 uL        | 0.57 uL      | -            |                         |
|          |  | 500 uL            | 1 uL          | 1.1 uL       | -            |                         |
|          |  | 1 mL              | 2 uL          | 2.3 uL       | -            |                         |
|          | Piston Buret, Dispenset                      | 5 mL              | 5.3 uL        | 4 uL         | -            | ISO 8655-3 , ISO 8655-5 |
|          |  | 10 mL             | 11 uL         | 6.3 uL       | -            |                         |
|          |  | 0.05 mL           | -             | 1.3 uL       | -            |                         |
|          |  | 1 mL              | -             | 2.4 uL       | -            |                         |
|          |  | 5 mL              | -             | 4 uL         | -            |                         |
|          |  | 10 mL             | 6.7 uL        | 6.3 uL       | -            |                         |
|          |  | 25 mL             | 10 uL         | 10 uL        | -            |                         |
|          |  | 50 mL             | 19 uL         | 19 uL        | -            |                         |
| 20       | Volumetric Glassware;<br>Volumetric Measures | 100 mL            | 37 uL         | 39 uL        | -            | ASTM E 542-01, 2012     |
|          |  | 0.5 mL            | 1.7 uL        | -            | -            |                         |
|          |  | 1 mL              | 2.1 uL        | 3 uL         | -            |                         |
|          |  | 2 mL              | -             | 4 uL         | -            |                         |
|          |  | 3 mL              | -             | 5 uL         | -            |                         |
|          |  | 5 mL              | 3.5 uL        | 5 uL         | -            |                         |
|          |  | 10 mL             | -             | 7 uL         | -            |                         |
|          |  | 20 mL             | -             | 11 uL        | -            |                         |
|          |  | 25 mL             | 11 uL         | 11 uL        | -            |                         |
|          |  | 50 mL             | -             | 19 uL        | -            |                         |
|          |  | 100 mL            | 31 uL         | 0.03 mL      | -            |                         |
|          |  | 250 mL            | -             | 0.06 mL      | -            |                         |
|          |  | 500 mL            | 87 uL         | 0.11 mL      | -            |                         |
|          |  | 1000 mL           | 0.16 mL       | 0.19 mL      | -            |                         |
|          |  | 2000 mL           | -             | 0.32 mL      | -            |                         |
| 4000 mL  | -  | 1.0 mL            | -             |              |              |                         |
| 5000 mL  | 0.81 mL                                      | 1.0 mL            | -             |              |              |                         |
| 10000 mL | -  | 2.0 mL            | -             |              |              |                         |
| 20000 mL | 4.4 mL                                       | 3.3 mL            | -             |              |              |                         |

**Pressure**

| No.                 | Instrument to be calibrated     | Measurement Range        | CMC - Jakarta | CMC-Surabaya | CMC-Semarang | Methods/Specifications |
|---------------------|---------------------------------|--------------------------|---------------|--------------|--------------|------------------------|
| 21                  | Dead Weight Tester              | 0 Psi ~ 800 Psi          | 0.03 %        | -            | -            | Euramet cg-3 v-1.0     |
|                     |                                 | 800 Psi ~ 16000 Psi      | 0.02 %        | -            | -            |                        |
| 22                  | Vacuum Gauge                    | -1 bar ~ 0 bar           | 4.1 mbar      | -            | -            | DKD-R 6-1              |
|                     |                                 | 0 cmHg ~ -70 cmHg        | -             | 0.6 cmHg     | -            |                        |
| 23                  | Pressure Test Gauge (pneumatic) | -0.9 bar ~ 0 bar         | 1.40 mbar     | 0.002 bar    | 0.0067 bar   | DKD-R 6-1              |
|                     |                                 | 0 bar ~ 7 bar            | 0.003 bar     | 0.0027 bar   | 0.0081 bar   |                        |
|                     |                                 | 7 bar ~ 40 bar           | 0.016 bar     | 0.012 bar    | 0.068 bar    |                        |
| 24                  | Pressure Test Gauge (hydraulic) | 0 bar ~ 200 bar          | -             | -            | 0.28 bar     | DKD-R 6-1              |
|                     |                                 | 0 bar ~ 1000 bar         | -             | -            | 0.93 bar     |                        |
|                     |                                 | 1 bar ~ 60 bar           | 0.017 bar     | -            | -            |                        |
|                     |                                 | 1 bar ~ 100 bar          | 0.02 bar      | -            | -            |                        |
|                     |                                 | 1 bar ~ 250 bar          | 0.09 bar      | -            | -            |                        |
|                     |                                 | 1 bar ~ 600 bar          | 0.11 bar      | -            | -            |                        |
|                     |                                 | 1 bar ~ 1000 bar         | 0.15 bar      | -            | -            |                        |
|                     |                                 | 25 Psi ~ 500 Psi         | -             | 0.79 Psi     | -            |                        |
|                     |                                 | 501 Psi ~ 1000 Psi       | -             | 0.95 Psi     | -            |                        |
|                     |                                 | 1001 Psi ~ 1500 Psi      | -             | 1.20 Psi     | -            |                        |
|                     |                                 | 1501 Psi ~ 2000 Psi      | -             | 1.40 Psi     | -            |                        |
|                     |                                 | 2001 Psi ~ 3000 Psi      | -             | 1.70 Psi     | -            |                        |
|                     |                                 | 3001 Psi ~ 4000 Psi      | -             | 2.50 Psi     | -            |                        |
| 4001 Psi ~ 5000 Psi | -                               | 3.10 Psi                 | -             |              |              |                        |
| 25                  | Pressure Gauge (pneumatic)      | 0 mBar ~ 1 mBar          | -             | 0.0076 mBar  | -            | DKD-R 6-1              |
|                     |                                 | 1 mBar ~ 10 mBar         | -             | 0.0092 mBar  | -            |                        |
|                     |                                 | 0 mBar ~ 5 mBar          | 0.02 mBar     | -            | -            |                        |
|                     |                                 | 5 mBar ~ 50 mBar         | 0.10 mBar     | -            | -            |                        |
|                     |                                 | 0.1 bar ~ 40 bar         | 0.15 bar      | 0.49 bar     | -            |                        |
| 26                  | Pressure Gauge (hydraulic)      | 6 bar ~ 60 bar           | 0.63 bar      | 0.50 bar     | -            | DKD-R 6-1              |
|                     |                                 | 60 bar ~ 100 bar         | 0.81 bar      | 0.59 bar     | -            |                        |
|                     |                                 | 100 bar ~ 250 bar        | 2.1 bar       | 1.50 bar     | -            |                        |
|                     |                                 | 250 bar ~ 600 bar        | 5.4 bar       | 5.30 bar     | -            |                        |
| 27                  | Pressure Transmitter            | 600 bar ~ 1000 bar       | 7.2 bar       | 7.00 bar     | -            | DKD-R 6-1              |
|                     |                                 | -1 bar ~ -0.1 bar        | 0.12 %        | -            | -            |                        |
|                     |                                 | 0.7 bar ~ 7 bar          | 0.12 %        | -            | -            |                        |
|                     |                                 | 4 bar ~ 40 bar           | 0.12 %        | -            | -            |                        |
|                     |                                 | 1 bar ~ 60 bar           | 0.12 %        | -            | -            |                        |
|                     |                                 | 60 bar ~ 100 bar         | 0.11 %        | -            | -            |                        |
|                     |                                 | 100 bar ~ 250 bar        | 0.11 %        | -            | -            |                        |
| 250 bar ~ 600 bar   | 0.11 %                          | -                        | -             |              |              |                        |
| 600 bar ~ 1000 bar  | 0.11 %                          | -                        | -             |              |              |                        |
| 28                  | Barometer                       | 940 mbar a ~ 1060 mbar a | 1.6 mbar a    | -            | -            | DKD-R 6-1              |
| 29                  | Sphygmomanometer                | 0 mmHg ~ 300 mmHg        | 1.7 mmHg      | -            | -            | DKD-R 6-1              |
| 30                  | Safety Valve / Pressure Switch  | 0 mbar ~ 5 mbar          | 0.06 mbar     | -            | -            | DKD-R 6-1              |
|                     |                                 | 0 mbar ~ 50 mbar         | 0.59 mbar     | -            | -            |                        |
|                     |                                 | 0 bar ~ 1 bar            | 0.01 bar      | -            | -            |                        |
|                     |                                 | 0 bar ~ 10 bar           | 0.12 bar      | -            | -            |                        |
|                     |                                 | 0 bar ~ 20 bar           | 0.23 bar      | -            | -            |                        |
|                     |                                 | 0 bar ~ 40 bar           | 0.46 bar      | -            | -            |                        |
|                     |                                 | 0 bar ~ 60 bar           | 0.90 bar      | -            | -            |                        |
|                     |                                 | 0 bar ~ 100 bar          | 1.3 bar       | -            | -            |                        |
|                     |                                 | 0 bar ~ 250 bar          | 3.7 bar       | -            | -            |                        |
|                     |                                 | 0 bar ~ 600 bar          | 8.5 bar       | -            | -            |                        |
|                     |                                 | 0 bar ~ 1000 bar         | 13 bar        | -            | -            |                        |

**Force**

| No.              | Instrument to be calibrated | Measurement Range    | CMC - Jakarta | CMC-Surabaya | CMC-Semarang | Methods/Specifications |
|------------------|-----------------------------|----------------------|---------------|--------------|--------------|------------------------|
| 31               | Universal Testing Machine   | 0 kN ~ 1 kN          | 0.47 %        | 0.6 %        | -            | ISO 7500-1 : 2018      |
|                  |                             | 0 kN ~ 5 kN          | 0.43 %        | 0.6 %        | -            |                        |
|                  |                             | 0 kN ~ 20 kN         | 0.44 %        | 0.8 %        | -            |                        |
|                  |                             | 0 kN ~ 100 kN        | 0.43 %        | 0.6 %        | -            |                        |
|                  |                             | 0 kN ~ 300 kN        | 0.47 %        | -            | -            | ISO 7500-1 : 2018      |
| 32               | Push Pull Gauge             | 0 gf ~ 200 gf        | 0.081 gf      | 0.09 gf      | 0.09 gf      | ASTM E4 - 2013         |
|                  |                             | 0 gf ~ 500 gf        | 0.16 gf       | 0.45 gf      | 0.09 gf      |                        |
|                  |                             | 0 gf ~ 1000 gf       | 0.40 gf       | 1.1 gf       | 0.76 gf      |                        |
|                  |                             | 0 kgf ~ 2 kgf        | 0.82 gf       | 0.002 kgf    | 1.8 gf       |                        |
|                  |                             | 0 kgf ~ 5 kgf        | 2.1 gf        | 0.005 kgf    | 2.0 gf       |                        |
|                  |                             | 0 kgf ~ 10 kgf       | 8.5 gf        | 0.011 kgf    | 0.011 kgf    |                        |
|                  |                             | 0 kgf ~ 20 kgf       | 0.010 kgf     | 0.019 kgf    | 0.012 kgf    |                        |
|                  |                             | 0 kgf ~ 50 kgf       | 0.060 kgf     | 0.05 kgf     | 0.013 kgf    |                        |
|                  |                             | 0 kgf ~ 100 kgf      | 0.083 kgf     | 0.11 kgf     | 0.10 kgf     |                        |
|                  |                             | 1 kgf = 9,80665 N    |               |              |              |                        |
| 33               | Load Cell / Proving Ring    | 1 kN                 | 0.28 %        | -            | -            | ISO 376 : 2011         |
|                  |                             | 5 kN                 | 0.25 %        | -            | -            |                        |
|                  |                             | 20 kN                | 0.27 %        | -            | -            |                        |
|                  |                             | 100 kN               | 0.24 %        | -            | -            |                        |
|                  |                             | 300 kN               | 0.23 %        | -            | -            |                        |
| 34               | Durometer Calibrator        | Type A<br>0 N ~ 10 N | 0.038 N       | -            | -            | ISO 376 : 2011         |
|                  |                             | Type D<br>0 N ~ 50 N | 0.061 N       | -            | -            |                        |
| 35               | Torque Wrench               | 0 Nm ~ 10 Nm         | -             | 0.25 Nm      | -            | ISO 6789-2 : 2017      |
|                  |                             | 1 Nm ~ 12 Nm         | 0.14 Nm       | -            | 0.10 Nm      |                        |
|                  |                             | 12 Nm ~ 25 Nm        | 0.38 Nm       | -            | 0.24 Nm      |                        |
|                  |                             | 25 Nm ~ 50 Nm        | 0.81 Nm       | -            | 0.77 Nm      |                        |
|                  |                             | 10 Nm ~ 50 Nm        | -             | 0.27 Nm      | -            |                        |
|                  |                             | 50 Nm ~ 100 Nm       | 1.2 Nm        | 0.52 Nm      | 0.83 Nm      |                        |
|                  |                             | 100 Nm ~ 500 Nm      | 4.0 Nm        | 3.7 Nm       | 3.2 Nm       |                        |
| 500 Nm ~ 1000 Nm | 5.1 Nm                      | 7.1 Nm               | 6.2 Nm        |              |              |                        |
| 36               | Torque Meter                | 0 cNm ~ 60 cNm       | 0.029 cNm     | -            | -            | BS 7882 : 2008         |
|                  |                             | 60 cNm ~ 600 cNm     | 0.30 cNm      | -            | -            |                        |
|                  |                             | 6 Nm ~ 10 Nm         | 0.0032 Nm     | -            | -            |                        |
|                  |                             | 10 Nm ~ 20 Nm        | 0.0071 Nm     | -            | -            |                        |
|                  |                             | 20 Nm ~ 50 Nm        | 0.10 Nm       | -            | -            |                        |
|                  |                             | 0 Nm ~ 1 Nm          | -             | 0.0003 Nm    | -            |                        |
|                  |                             | 0 Nm ~ 10 Nm         | -             | 0.01 Nm      | -            |                        |
|                  |                             | 10 Nm ~ 50 Nm        | -             | 0.04 Nm      | -            |                        |
|                  |                             | 50 Nm ~ 100 Nm       | 0.21 Nm       | 0.07 Nm      | -            |                        |
|                  |                             | 100 Nm ~ 200 Nm      | 0.41 Nm       | -            | -            |                        |
|                  |                             | 100 Nm ~ 400 Nm      | -             | 0.35 Nm      | -            |                        |
|                  |                             | 400 Nm ~ 1000 Nm     | -             | 0.70 Nm      | -            |                        |
|                  |                             | 200 Nm ~ 500 Nm      | 1.0 Nm        | -            | -            |                        |
| 500 Nm ~ 1000 Nm | 2.0 Nm                      | -                    | -             |              |              |                        |

**Hardness**

| No.                  | Instrument to be calibrated | Measurement Range    | CMC - Jakarta       | CMC-Surabaya | CMC-Semarang | Methods/Specifications |
|----------------------|-----------------------------|----------------------|---------------------|--------------|--------------|------------------------|
| 37                   | Hardness Tester             | 35.9 HR B ( low )    | 1.10 HR B           | -            | -            | ASTM E18-18a           |
|                      |                             | 65.8 HR B ( medium ) | 1.0 HR B            | -            | -            |                        |
|                      |                             | 97.9 HR B ( high )   | 0.98 HR B           | -            | -            |                        |
|                      |                             | 28.9 HR C ( low )    | 0.98 HR C           | -            | -            |                        |
|                      |                             | 45.9 HR C ( medium ) | 0.76 HR C           | -            | -            |                        |
|                      |                             | 61.7 HR C ( high )   | 0.52 HR C           | -            | -            |                        |
|                      |                             | 211 HV <sub>10</sub> | 14 HV <sub>10</sub> | -            | -            | ASTM E92-17            |
| 489 HV <sub>10</sub> | 15 HV <sub>10</sub>         | -                    | -                   |              |              |                        |

**Hardness (continued)**

| No. | Instrument to be calibrated | Measurement Range |                  | CMC - Jakarta | CMC-Surabaya     | CMC-Semarang | Methods/Specifications |      |                       |             |
|-----|-----------------------------|-------------------|------------------|---------------|------------------|--------------|------------------------|------|-----------------------|-------------|
|     |                             | 756               | HV <sub>10</sub> | 33            | HV <sub>10</sub> | -            | ASTM E10-18            |      |                       |             |
|     |                             | 122               | HB W             | 2.4           | HB W             | -            |                        |      |                       |             |
|     |                             | 212               | HB W             | 3.0           | HB W             | -            |                        |      |                       |             |
|     |                             |                   |                  | 559           | HB W             | 7.0          | HB W                   | -    | ASTM E18-18a          |             |
|     |                             |                   |                  | 38.1          | HR B             | -            | 0.22                   | HR B |                       | -           |
|     |                             |                   |                  | 51.7          | HR B             | -            | 0.18                   | HR B |                       | -           |
|     |                             |                   |                  | 92.3          | HR B             | -            | 0.64                   | HR B |                       | -           |
|     |                             |                   |                  | 28.2          | HR C             | -            | 0.17                   | HR C |                       | -           |
|     |                             |                   |                  | 47.8          | HR C             | -            | 0.17                   | HR C |                       | -           |
|     |                             |                   |                  | 61.9          | HR C             | -            | 0.22                   | HR C | -                     | ASTM E92-17 |
|     |                             |                   |                  | 221           | HV               | -            | 3.9                    | HV   | -                     |             |
|     |                             |                   |                  | 404           | HV               | -            | 7.0                    | HV   | -                     |             |
|     |                             |                   |                  | 726           | HV               | -            | 13                     | HV   | -                     | ASTM E10-18 |
|     |                             |                   |                  | 112           | HB W             | -            | 2.4                    | HB W | -                     |             |
|     |                             |                   |                  | 242           | HB W             | -            | 3.4                    | HB W | -                     |             |
|     |                             | 545               | HB W             | -             | 3.8              | HB W         | -                      |      |                       |             |
| 38  | Durometer                   | 10                | HS ~ 90          | HS            | 0.60             | HS           | -                      | -    | ASTM D 2240-05 (2010) |             |

**Density**

| No. | Instrument to be calibrated | Measurement Range |              | CMC - Jakarta | CMC-Surabaya | CMC-Semarang | Methods/Specifications |              |
|-----|-----------------------------|-------------------|--------------|---------------|--------------|--------------|------------------------|--------------|
| 39  | Hydrometer                  | 0.700             | g/ml ~ 1.000 | g/ml          | 0.0022       | g/ml         | -                      | AS 2026-2003 |
|     |                             | 1.000             | g/ml ~ 1.500 | g/ml          | 0.0024       | g/ml         | -                      |              |
|     |                             | 1.500             | g/ml ~ 1.850 | g/ml          | 0.0027       | g/ml         | -                      |              |

**Length**

| No. | Instrument to be calibrated              | Measurement Range |              | CMC - Jakarta | CMC-Surabaya | CMC-Semarang | Methods/Specifications |                   |                   |                   |                   |
|-----|--|-------------------|--------------|---------------|--------------|--------------|------------------------|-------------------|-------------------|-------------------|-------------------|
| 40  | Gauge Block                              | 0.5               | mm ~ 10      | mm            | 0.11         | μm           | -                      | JIS B 7506 : 2004 |                   |                   |                   |
|     |  | 10                | mm ~ 25      | mm            | 0.12         | μm           | -                      |                   |                   |                   |                   |
|     |  | 25                | mm ~ 50      | mm            | 0.15         | μm           | -                      |                   |                   |                   |                   |
|     |  | 50                | mm ~ 75      | mm            | 0.19         | μm           | -                      |                   |                   |                   |                   |
|     |  | 75                | mm ~ 100     | mm            | 0.24         | μm           | -                      |                   |                   |                   |                   |
|     |  | 100               | mm ~ 200     | mm            | 0.69         | μm           | -                      |                   |                   |                   |                   |
|     |  | 200               | mm ~ 300     | mm            | 0.96         | μm           | -                      |                   |                   |                   |                   |
|     |  | 300               | mm ~ 400     | mm            | 1.2          | μm           | -                      |                   |                   |                   |                   |
| 41  | Outside Micrometer                       | 0                 | mm ~ 125     | mm            | 1.2          | μm           | 1.2                    | μm                | -                 | JIS B 7502 - 2016 |                   |
|     |  | 125               | mm ~ 1500    | mm            | 8.5          | μm           | 4.6                    | μm                | -                 |                   |                   |
| 42  | Inside Micrometer                        | Caliper Type      | 5            | mm ~ 300      | mm           | 1.9          | μm                     | 1.6               | μm                | -                 | JIS B 7502 - 2016 |
|     |  |                   | Tubular Type | 25            | mm ~ 100     | mm           | 1.4                    | μm                | 1.1               | μm                |                   |
|     |  | 100               | mm ~ 1500    | mm            | 8.4          | μm           | 7.1                    | μm                | -                 |                   |                   |
| 43  | Depth Micrometer                         | 0                 | mm ~ 150     | mm            | 1.7          | μm           | 1.6                    | μm                | -                 | JIS B 7544 - 1994 |                   |
|     |  | 150               | mm ~ 300     | mm            | 2.2          | μm           | -                      | -                 |                   |                   |                   |
| 44  | Three Point Internal Micrometer/ Holtest | 2.5               | mm ~ 100     | mm            | 4.6          | μm           | -                      | -                 | JIS B 7502 - 2016 |                   |                   |
| 45  | Calliper                                 | 0                 | mm ~ 600     | mm            | 27           | μm           | 19                     | μm                | -                 | JIS B 7507 - 2016 |                   |
|     |  | 600               | mm ~ 1500    | mm            | 38           | μm           | 20                     | μm                | -                 |                   |                   |
| 46  | Height Gauge                             | 0                 | mm ~ 1500    | mm            | 47           | μm           | 19                     | μm                | -                 | JIS B 7517 - 2018 |                   |
| 47  | Dial Indicator                           | 0                 | mm ~ 1       | mm            | 1.1          | μm           | 2.1                    | μm                | -                 | JIS B 7533 - 1990 |                   |
|     |  | 0                 | mm ~ 3       | mm            | 1.2          | μm           | 2.1                    | μm                | -                 |                   |                   |
|     |  | 0                 | mm ~ 5       | mm            | 1.4          | μm           | 2.1                    | μm                | -                 | JIS B 7503 - 2011 |                   |
|     |  | 0                 | mm ~ 10      | mm            | -            | 2.4          | μm                     | -                 |                   |                   |                   |
|     |  | 10                | mm ~ 25      | mm            | -            | 7.3          | μm                     | -                 |                   |                   |                   |
|     |  | 0                 | mm ~ 25      | mm            | 0.6          | μm           | -                      | -                 |                   |                   |                   |
|     |  | 0                 | mm ~ 50      | mm            | 0.6          | μm           | -                      | -                 |                   |                   |                   |
|     |  | 0                 | mm ~ 100     | mm            | 5.8          | μm           | -                      | -                 |                   |                   |                   |

Length (Continued)

| No. | Instrument to be calibrated   | Measurement Range   | CMC - Jakarta | CMC-Surabaya | CMC-Semarang | Methods/Specifications   |
|-----|---|---------------------|---------------|--------------|--------------|--|
| 48  | Dial Gauge Tester   | 0 mm ~ 5 mm         | 0.86 μm       | 2.1 μm       | -            | JIS B 7502 - 2016  |
|     |   | 5 mm ~ 25 mm        | 1.0 μm        | 2.2 μm       | -            |  |
| 49  | Cylinder Gauge (Bore Gauge)<br>Dial Indicator<br>Anvil<br>Anvil   | 0 mm ~ 1 mm         | 1.4 μm        | 1.3 μm       | -            | JIS B 7515 - 1982  |
|     |   | 0 mm ~ 800 mm       | -             | 2.7 μm       | -            |  |
|     |   | 6 mm ~ 400 mm       | 1.6 μm        | -            | -            | JIS B 7515 - 1982  |
| 50  | Thread Plug Gauge: average diameter<br>Major & minor diameter<br>Pitch Angel  | M 1 ~ M 150         | 5.6 μm        | 5.5 μm       | -            | JIS B 0261 - 2004  |
|     |   | M 1 ~ M 150         | 1.4 μm        | 1.2 μm       | -            |  |
|     |   | M 1 ~ M 150         | 3.5 sec       | 3.5 sec      | -            |  |
| 51  | Plug Gauge  | 0 mm ~ 200 mm       | 0.69 μm       | 3.9 μm       | -            | JIS B 7420 - 1997  |
| 52  | Ring Gauge  | 0 mm ~ 485 mm       | 2.5 μm        | -            | -            | JIS B 7420 - 1997  |
| 53  | Feeler Gauge  | 0 mm ~ 10 mm        | 2.0 μm        | 3.3 μm       | -            | JIS B 7524 - 2008  |
| 54  | Pin Gauge   | 0 mm ~ 10 mm        | 1.2 μm        | -            | -            | JIS B 7420 - 1997  |
|     |   | 0 mm ~ 25 mm        | -             | 2.6 μm       | -            |  |
| 55  | Gap Gauge / Snap Gauge  | 0 mm ~ 300 mm       | 4.4 μm        | -            | -            | JIS B 7420 - 1997  |
|     |   | 0 mm ~ 250 mm       | -             | 5.7 μm       | -            |  |
| 56  | Bevel Protractor  | 0 ° ~ 90 °          | 0.58 menit    | -            | -            | BS 1685 : 2008   |
| 57  | Theodolite:<br>Angular Scale verification (sudut horizontal)<br>Angular Scale verification (sudut vertical)<br>Liquid level sensitivity                 |                     |               |              |              | ISO 17123-2,<br>KAN-TN-LK-02   |
|     |   | 0 ° ~ 360 °         | 3.3 sec       | 5 sec        | -            |  |
|     |   | 0 ° ~ 360 °         | 5.3 sec       | -            | -            |  |
|     |   | 0 mm/m ~ 0.5 mm/m   | 0.02 mm/m     | 0.023 mm/m   | -            |  |
| 58  | Measuring Microscope: Panjang<br>Sudut  | 200 mm x 200 mm     | 4.8 μm        | -            | -            | JIS B 7153 - 1995,   |
|     |   | 0 ° ~ 360 °         | 3.1 detik     | -            | -            |  |
|     |   | 300 mm x 300 mm     | -             | 2.5 μm       | -            |  |
|     |   | 0 ° ~ 360 °         | -             | 0.052 detik  | -            |  |
| 59  | Measuring Projector (Profile Projector)<br>Scale deviation  | 0 ° ~ 360 °         | 4.7 menit     | 5.7 menit    | -            | JIS B 7184 - 1999  |
|     |   | 200 mm x 200 mm     | 4.8 μm        | 2.7 μm       | -            |  |
| 60  | Autolevel:<br>Deviasi sudut kolimasi pada jarak 60 m<br>Deviasi sudut kolimasi pada jarak 1000 m<br>Optic level sensitivity<br>Liquid level sensitivity |                     |               |              |              | ISO 17123-2,<br>KAN-TN-LK-02   |
|     |   |                     | 0.11 mm       | -            | -            |  |
|     |   |                     | 0.33 mm       | -            | -            |  |
|     |   |                     | -             | 5 sec        | -            |  |
| 61  | Steel Ruler   | 0 mm ~ 1000 mm      | 0.34 mm       | 0.34 mm      | -            | JIS B 7516 - 2005  |
| 62  | Waterpass   | 0.02 mm/m ~ 10 mm/m | 0.012 mm/m    | 0.012 mm/m   | -            | DIN 877-1986   |
| 63  | Test Sieve  | 0 mm ~ 10 mm        | 4.3 μm        | 3.9 μm       | -            | ASTM E11- 17   |
| 64  | Coating Thickness   | 0 mm ~ 8 mm         | 2.7 μm        | 3.1 μm       | -            | ASTM B 499-09  |
| 65  | Scale Loupe   | 0 mm ~ 20 mm        | 4.5 μm        | 6.9 μm       | -            | JIS B 7153 - 1995  |
| 66  | Thickness Film  | 0 mm ~ 10 mm        | 1.0 μm        | 2.6 μm       | -            | In House Procedure MKSP ML-27  |
| 67  | Graticule/ Calibration Grid   | 0 mm ~ 200 mm       | 4.4 μm        | 4.9 μm       | -            | JIS B 7153 - 1995  |
| 68  | Thickness Gauge   | 0 mm ~ 10 mm        | 0.81 μm       | 0.65 μm      | -            | JIS B 7503 - 2017  |
|     |   | 10 mm ~ 25 mm       | 0.82 μm       | -            | -            |  |
|     |   | 25 mm ~ 50 mm       | 5.8 μm        | -            | -            |  |
|     |   | 50 mm ~ 100 mm      | 58 μm         | -            | -            |  |
|     |   | 10 mm ~ 100 mm      | -             | 5.8 μm       | -            |  |
| 69  | Standar Scale   | 0 mm ~ 300 mm       | 4.4 μm        | -            | -            | JIS B 7541 - 2001  |
|     |   | 0 mm ~ 200 mm       | -             | 4.9 μm       | -            |  |
| 70  | Head Micrometer   | 0 mm ~ 25 mm        | 1.2 μm        | 1.0 μm       | -            | JIS B 7502 - 2016  |
| 71  | Pitch Gage  | 0 mm ~ 10 mm        | 4.3 μm        | -            | -            | JIS B 0261 - 2004  |
|     |   | 0.2 mm ~ 10 mm      | -             | 3.8 μm       | -            |  |
| 72  | Depth Gauge   | 0 mm ~ 150 mm       |               | 19 μm        | -            | JIS B 7518 - 2018  |
|     |   | 0 mm ~ 300 mm       | 8.2 μm        | -            | -            |  |
| 73  | Taper Gauge   | 0 mm ~ 200 mm       | 4.4 μm        | 4.9 μm       | -            | User Manual 2Dpak II-Mitutoyo  |
| 74  | Ultrasonic Thickness Meter  | 0.5 mm ~ 100 mm     | 5.8 μm        | 5.8 μm       | -            | ASTM E 797-2010  |
| 75  | Radius Gauge  | 0.1 mm ~ 150 mm     | 4.3 μm        | 5.8 μm       | -            | Uncertainty and Dimensional Calibration, Journal of Research of NIST |

**Length (Continued)**

| No. | Instrument to be calibrated   | Measurement Range    | CMC - Jakarta | CMC-Surabaya | CMC-Semarang | Methods/Specifications                                |
|-----|---|----------------------|---------------|--------------|--------------|---|
| 76  | Angle Block   | 0 ° ~ 90 °           | 4.0 sec       | 3.7 sec      | -            | NBSIR 80-1967   |
| 77  | 3-Wire  | 0.17 mm ~ 3.2 mm     | 4.3 μm        | 3.8 μm       | -            | in house procedure MKSP ML-43                         |
| 78  | Setting Bar   | 0 mm ~ 100 mm        | 0.38 μm       | -            | -            | JIS B 7420  |
|     |   | 0 mm ~ 200 mm        | -             | 4.9 μm       | -            |   |
|     |   | 100 mm ~ 600 mm      | 1.9 μm        | -            | -            | JIS B 7420  |
| 79  | Step Gauge  | 0 mm ~ 600 mm        | 3.8 μm        | 3.8 μm       | -            | in house procedure MKSP ML-34                         |
| 80  | Straight Edge (Straightness)  | 0 mm ~ 500 mm        | 1.7 μm        | -            | -            | JIS B 7514  |
| 81  | Square (Squareness)   | 0 mm ~ 500 mm        | 4.4 μm        | -            | -            | JIS B 7526  |
| 82  | V-Block   | 0 mm ~ 150 mm        | 3.7 μm        | 2.7 μm       | -            | JIS B 7540  |
| 83  | Surface Plate   | 1000 mm x 1000 mm    | 5.6 μm        | -            | -            | JIS B 7513  |
| 84  | Roughness Tester  | 0.05 μmRa ~ 1.6 μmRa | 0.051 μmRa    | -            | -            | User Manual 'Surface Roughness Tester-SJ-40-Mitutoyo' |
| 85  | Skala Okuler Microscope   | 0.002 mm ~ 10 mm     | 0.83 μm       | -            | -            | JIS B 7153  |
| 86  | Welding Gauge, Panjang (Skala Linier)<br>Panjang (Skala Taper)<br>Sudut | 0 mm ~ 300 mm        | 4.4 μm        | -            | -            | in house procedure MKSP ML-48                         |
|     |   | 0 mm ~ 200 mm        | 4.4 μm        | -            | -            |   |
|     |   | 0 ° ~ 90 °           | 3.6 detik     | -            | -            |   |
| 87  | Ultrasonic Standard Block Panjang<br>Diameter<br>Sudut                  | 0 mm ~ 300 mm        | 4.5 μm        | -            | -            | in house procedure MKSP ML-49                         |
|     |   | 0 mm ~ 300 mm        | 4.5 μm        | -            | -            |   |
|     |   | 0 ° ~ 90 °           | 3.6 detik     | -            | -            |   |
| 88  | Counter Meter   | 0 m ~ 9999 m         | 29 mm         | -            | -            | in house procedure MKSP ML-                           |
| 89  | Length Gauge (LVDT)   | 0 mm ~ 100 mm        | 0.35 μm       | -            | -            | Instruksi Manual ULM Mahr 600-E                       |
| 90  | Thread Ring Gauge   | 0 mm ~ 100 mm        | 5 μm          | -            | -            | Euramet cg-10 - 2012                                  |
| 91  | Pengukuran Panjang menggunakan UMM                                      | 0 mm ~ 300 mm        | 4.5 μm        | -            | -            | in house procedure MKSP ML-55                         |
| 92  | Pengukuran Diameter menggunakan UMM                                     | 0 mm ~ 300 mm        | 4.5 μm        | -            | -            | in house procedure MKSP ML-56                         |
| 93  | Pengukuran Radius menggunakan UMM                                       | 0 mm ~ 150 mm        | 4.3 μm        | -            | -            | in house procedure MKSP ML-57                         |

**Electrical**

| No. | Instrument to be calibrated | Measurement Range | CMC - Jakarta | CMC-Surabaya | CMC-Semarang | Methods/Specifications         |
|-----|-----------------------------|-------------------|---------------|--------------|--------------|--------------------------------|
| 94  | DC Current Source           | 0.1 mA ~ 10 mA    | 5.0 μA        | -            | -            | in house procedure MKSP ECL-01 |
|     |                             | 0.1 A ~ 1 A       | 1 mA          | -            | -            |                                |
|     |                             | 1 A ~ 3 A         | 2.3 mA        | -            | -            |                                |
| 95  | Sumber Arus Tinggi DC       | 10 A ~ 200 A      | 1.9 A         | -            | -            | In house procedure MKSP ECL 16 |
|     |                             | 200 A ~ 400 A     | 3.1 A         | -            | -            |                                |
|     |                             | 400 A ~ 600 A     | 5.4 A         | -            | -            |                                |
|     |                             | 600 A ~ 800 A     | 6.4 A         | -            | -            |                                |
|     |                             | 800 A ~ 1000 A    | 11 A          | -            | -            |                                |
| 96  | Sumber Arus Tinggi AC       | f = 50 Hz ~ 60 Hz |               |              |              | In house procedure MKSP ECL 16 |
|     |                             | 10 A ~ 200 A      | 1.9 A         | -            | -            |                                |
|     |                             | 200 A ~ 400 A     | 3.4 A         | -            | -            |                                |
|     |                             | 400 A ~ 600 A     | 5.1 A         | -            | -            |                                |
|     |                             | 600 A ~ 800 A     | 6.1 A         | -            | -            |                                |
| 97  | AC Current Source           | f = 45 Hz ~ 1kHz  |               |              |              | in house procedure MKSP ECL-01 |
|     |                             | 0.1 A ~ 1 A       | 0.6 mA        | -            | -            |                                |
|     |                             | 1 A ~ 3 A         | 2.3 mA        | -            | -            |                                |
| 98  | DC Ammeter                  | 2 μA ~ 200 μA     | 18 nA         | -            | -            | in house procedure MKSP ECL-03 |
|     |                             | 0.2 mA ~ 2 mA     | 0.5 μA        | -            | -            |                                |
|     |                             | 2 mA ~ 20 mA      | 4.8 μA        | -            | -            |                                |
|     |                             | 20 mA ~ 200 mA    | 67 μA         | -            | -            |                                |
|     |                             | 0.2 A ~ 2 A       | 5.8 mA        | -            | -            |                                |
|     |                             | 2 A ~ 10 A        | 5.8 mA        | -            | -            |                                |
| 99  | AC Ammeter                  | f = 45 Hz ~ 1 kHz |               |              |              | in house procedure MKSP ECL-02 |
|     |                             | 0.2 mA ~ 2 mA     | 0.53 μA       | -            | -            |                                |
|     |                             | 2 mA ~ 20 mA      | 5.3 μA        | -            | -            |                                |



Electrical (continued)

| No.            | Instrument to be calibrated | Measurement Range              | CMC - Jakarta   | CMC-Surabaya | CMC-Semarang | Methods/Specifications            |                                   |
|----------------|-----------------------------|--------------------------------|-----------------|--------------|--------------|-----------------------------------|-----------------------------------|
|                |                             | 20 mA ~ 200 mA                 | 53 $\mu$ A      | -            | -            | in house procedure MKSP<br>ECL-02 |                                   |
|                |                             | 0.2 A ~ 2 A                    | 0.29 mA         | -            | -            |                                   |                                   |
|                |                             | 2 A ~ 10 A                     | 11 mA           | -            | -            |                                   |                                   |
| 100            | DC Voltage Source           | 1 mV ~ 100 mV                  | 14 $\mu$ V      | -            | -            | in house procedure MKSP<br>ECL-01 |                                   |
|                |                             | 100 mV ~ 1 V                   | 71 $\mu$ V      | -            | -            |                                   |                                   |
|                |                             | 1 V ~ 10 V                     | 0.7 mV          | -            | -            | in house procedure MKSP<br>ECL-01 |                                   |
|                |                             | 10 V ~ 100 V                   | 7 mV            | -            | -            |                                   |                                   |
| 100 V ~ 1000 V | 60 mV                       | -                              | -               |              |              |                                   |                                   |
| 101            | DC HV Source                | 0 kV ~ 1 kV                    | 1.0 kV          | -            | -            | In house procedure MKSP<br>ECL 12 |                                   |
|                |                             | 1 kV ~ 5 kV                    | 5.0 kV          | -            | -            |                                   |                                   |
|                |                             | 5 kV ~ 9 kV                    | 8.0 kV          | -            | -            |                                   |                                   |
| 102            | AC Voltage Source           | f = 10 Hz ~ 20kHz              |                 |              |              |                                   | in house procedure MKSP<br>ECL-01 |
|                |                             | 1 mV ~ 100 mV                  | 0.03 $\mu$ V    | -            | -            |                                   |                                   |
|                |                             | 100 mV ~ 1 V                   | 0.3 mV          | -            | -            | in house procedure MKSP<br>ECL-01 |                                   |
|                |                             | 1 V ~ 10 V                     | 3.2 mV          | -            | -            |                                   |                                   |
|                |                             | 10 V ~ 100 V                   | 32 mV           | -            | -            |                                   |                                   |
| 100 V ~ 750 V  | 0.25 mV                     | -                              | -               |              |              |                                   |                                   |
| 103            | DC Voltmeter                | 0 mV ~ 200 mV                  | 18 $\mu$ V      | -            | -            | in house procedure MKSP<br>ECL-03 |                                   |
|                |                             | 200 mV ~ 2000 mV               | 0.03 mV         | -            | -            |                                   |                                   |
|                |                             | 2 V ~ 20 V                     | 0.38 mV         | -            | -            |                                   |                                   |
|                |                             | 20 V ~ 200 V                   | 2.5 mV          | -            | -            |                                   |                                   |
|                |                             | 200 V ~ 500 V                  | 8.9 mV          | -            | -            |                                   |                                   |
|                |                             | 500 V ~ 1000 V                 | 15 mV           | -            | -            |                                   |                                   |
| 104            | AC Voltmeter                | 45 Hz ~ 10 kHz                 |                 |              |              |                                   | in house procedure MKSP<br>ECL-04 |
|                |                             | 0 mV ~ 200 mV                  | 23 $\mu$ V      | -            | -            |                                   |                                   |
|                |                             | 0.2 V ~ 2 V                    | 0.16 mV         | -            | -            |                                   |                                   |
|                |                             | 2 V ~ 20 V                     | 0.9 mV          | -            | -            |                                   |                                   |
|                |                             | 20 V ~ 200 V                   | 16 mV           | -            | -            |                                   |                                   |
|                |                             | 200 V ~ 700 V                  | 0.14 V          | -            | -            |                                   |                                   |
|                |                             | 45 Hz ~ 1 kHz                  |                 |              |              |                                   |                                   |
| 700 V ~ 1000 V | 0.15 V                      | -                              | -               |              |              |                                   |                                   |
| 105            | Resistor                    | 1 $\Omega$ ~ 10 $\Omega$       | 10 m $\Omega$   | -            | -            | in house procedure MKSP<br>ECL-01 |                                   |
|                |                             | 10 $\Omega$ ~ 100 $\Omega$     | 16 m $\Omega$   | -            | -            |                                   |                                   |
|                |                             | 100 $\Omega$ ~ 1000 $\Omega$   | 0.18 $\Omega$   | -            | -            |                                   |                                   |
|                |                             | 1 k $\Omega$ ~ 10 k $\Omega$   | 1.2 $\Omega$    | -            | -            |                                   |                                   |
|                |                             | 10 k $\Omega$ ~ 100 k $\Omega$ | 0.14 k $\Omega$ | -            | -            |                                   |                                   |
|                |                             | 100 k $\Omega$ ~ 1 M $\Omega$  | 0.15 k $\Omega$ | -            | -            |                                   |                                   |
|                |                             | 1 M $\Omega$ ~ 10 M $\Omega$   | 6.0 k $\Omega$  | -            | -            |                                   |                                   |
|                |                             | 10 M $\Omega$ ~ 100 M $\Omega$ | 53 k $\Omega$   | -            | -            |                                   |                                   |
| 106            | Ohm Meter                   | 0.1 $\Omega$                   | 10 m $\Omega$   | -            | -            | in house procedure MKSP<br>ECL-05 |                                   |
|                |                             | 1 $\Omega$                     | 10 m $\Omega$   | -            | -            |                                   |                                   |
|                |                             | 10 $\Omega$                    | 6 m $\Omega$    | -            | -            |                                   |                                   |
|                |                             | 100 $\Omega$                   | 11 m $\Omega$   | -            | -            | in house procedure MKSP<br>ECL-05 |                                   |
|                |                             | 1 k $\Omega$                   | 0.02 $\Omega$   | -            | -            |                                   |                                   |
|                |                             | 10 k $\Omega$                  | 0.2 $\Omega$    | -            | -            |                                   |                                   |
|                |                             | 100 k $\Omega$                 | 2 $\Omega$      | -            | -            |                                   |                                   |
|                |                             | 1 M $\Omega$                   | 0.13 k $\Omega$ | -            | -            |                                   |                                   |
|                |                             | 10 M $\Omega$                  | 1.3 k $\Omega$  | -            | -            |                                   |                                   |
|                |                             | 100 M $\Omega$                 | 0.04 M $\Omega$ | -            | -            |                                   |                                   |
|                |                             | 1000 M $\Omega$                | 3.3 M $\Omega$  | -            | -            |                                   |                                   |
| 107            | Capacitance Meter           | f = 1 kHz                      |                 |              |              |                                   | in house procedure MKSP<br>ECL-09 |
|                |                             | 1 nF                           | 23 pF           | -            | -            |                                   |                                   |
|                |                             | 10 nF                          | 0.02 nF         | -            | -            |                                   |                                   |
|                |                             | 20 nF                          | 0.03 nF         | -            | -            |                                   |                                   |
|                |                             | 50 nF                          | 0.04 nF         | -            | -            |                                   |                                   |

Electrical (continued)

| No. | Instrument to be calibrated         | Measurement Range  | CMC - Jakarta | CMC-Surabaya | CMC-Semarang | Methods/Specifications            |                                   |
|-----|-------------------------------------|--|---------------|--------------|--------------|-----------------------------------|-----------------------------------|
|     |                                     | 100 nF   | 0.07 nF       | -            | -            | in house procedure MKSP<br>ECL-09 |                                   |
|     |                                     | 1 μF   | 0.75 nF       | -            | -            |                                   |                                   |
|     |                                     | 10 μF  | 9 nF          | -            | -            |                                   |                                   |
|     |                                     | 100 μF   | 0.11 μF       | -            | -            |                                   |                                   |
| 108 | Inductance Meter                    | f = 1 kHz  |               |              |              |                                   | in house procedure MKSP<br>ECL-08 |
|     |                                     | 1 mH   | 0.058 mH      | -            | -            |                                   |                                   |
|     |                                     | 10 mH  | 0.058 mH      | -            | -            |                                   |                                   |
|     |                                     | 19 mH  | 0.061 mH      | -            | -            |                                   |                                   |
|     |                                     | 29 mH  | 0.063 mH      | -            | -            |                                   |                                   |
|     |                                     | 50 mH  | 0.088 mH      | -            | -            |                                   |                                   |
|     |                                     | 100 mH   | 0.10 mH       | -            | -            |                                   |                                   |
|     |                                     | 1 H  | 0.058 H       | -            | -            |                                   |                                   |
| 109 | AC Watt Meter                       | V = 20 V ~ 1000 V; I ≥ 1A<br>f = 45 Hz ~ 400 Hz; cos φ = 1 |               |              |              |                                   | in house procedure MKSP<br>ECL-10 |
|     |                                     | 0 kW ~ 1 kW  | 1.1 W         | -            | -            |                                   |                                   |
|     |                                     | 1 kW ~ 10 kW   | 11 W          | -            | -            |                                   |                                   |
|     |                                     | 10 kW ~ 100 kW   | 0.8 kW        | -            | -            |                                   |                                   |
| 110 | Insulation Tester                   | 100 kW ~ 1000 kW   | 5 kW          | -            | -            | in house procedure MKSP<br>ECL-13 |                                   |
|     |                                     | 1 kΩ   | 0.58 Ω        | -            | -            |                                   |                                   |
|     |                                     | 10 kΩ  | 0.61 Ω        | -            | -            |                                   |                                   |
|     |                                     | 100 kΩ   | 2.6 Ω         | -            | -            |                                   |                                   |
|     |                                     | 1 MΩ   | 4.5 kΩ        | -            | -            |                                   |                                   |
|     |                                     | 10 MΩ  | 14 kΩ         | -            | -            |                                   |                                   |
|     |                                     | 100 MΩ   | 18 kΩ         | -            | -            |                                   |                                   |
|     |                                     | 1 GΩ   | 1.4 MΩ        | -            | -            |                                   |                                   |
| 111 | DC Clamp Meter                      | f = 50 Hz ~ 60 Hz  |               |              |              |                                   | in house procedure MKSP<br>ECL-15 |
|     |                                     | 10 A ~ 50 A  | 0.31 A        | -            | -            |                                   |                                   |
|     |                                     | 50 A ~ 100 A   | 0.58 A        | -            | -            |                                   |                                   |
|     |                                     | 100 A ~ 200 A  | 0.59 A        | -            | -            |                                   |                                   |
| 112 | AC Clamp Meter                      | f = 50 Hz ~ 60 Hz  |               |              |              |                                   | in house procedure MKSP<br>ECL-14 |
|     |                                     | 200 A ~ 500 A  | 2.3 A         | -            | -            |                                   |                                   |
|     |                                     | 10 A ~ 50 A  | 0.41 A        | -            | -            |                                   |                                   |
|     |                                     | 50 A ~ 100 A   | 0.81 A        | -            | -            |                                   |                                   |
| 113 | Oscilloscope - DC Voltage Amplitude | 100 A ~ 200 A  | 1.7 A         | -            | -            | in house procedure MKSP<br>ECL-17 |                                   |
|     |                                     | 200 A ~ 500 A  | 3.1 A         | -            | -            |                                   |                                   |
|     |                                     | 10 mV/Div  | 0.06 mV/Div   | -            | -            |                                   |                                   |
|     |                                     | 50 mV/Div  | 0.29 mV/Div   | -            | -            |                                   |                                   |
|     |                                     | 100 mV/Div   | 0.58 mV/Div   | -            | -            |                                   |                                   |
|     |                                     | 0.5 V/Div  | 2.9 mV/Div    | -            | -            |                                   |                                   |
|     |                                     | 1 V/Div  | 5.8 mV/Div    | -            | -            |                                   |                                   |
|     |                                     | 5 V/Div  | 29 mV/Div     | -            | -            |                                   |                                   |
| 114 | Oscilloscope - AC Voltage Amplitude | 10 Hz ~ 10 kHz   |               |              |              |                                   | in house procedure MKSP<br>ECL-17 |
|     |                                     | 10 V/Div   | 58 mV/Div     | -            | -            |                                   |                                   |
|     |                                     | 30 V/Div   | 0.12 V/Div    | -            | -            |                                   |                                   |
|     |                                     | 5 mVpp   | 0.03 mVpp     | -            | -            |                                   |                                   |
|     |                                     | 10 mVpp  | 0.06 mVpp     | -            | -            |                                   |                                   |
|     |                                     | 50 mVpp  | 0.29 mVpp     | -            | -            |                                   |                                   |
|     |                                     | 100 mVpp   | 0.58 mVpp     | -            | -            |                                   |                                   |

**Electrical (continued)**

| No. | Instrument to be calibrated | Measurement Range | CMC - Jakarta | CMC-Surabaya | CMC-Semarang | Methods/Specifications            |
|-----|-----------------------------|-------------------|---------------|--------------|--------------|-----------------------------------|
|     |                             | 10 Vpp            | 58 mVpp       | -            | -            |                                   |
|     |                             | 50 Vpp            | 0.29 Vpp      | -            | -            |                                   |
| 115 | Oscilloscope - Time Base    | 1 $\mu$ s         | 5.8 ns        | -            | -            | in house procedure MKSP<br>ECL-17 |
|     |                             | 3 $\mu$ s         | 5.8 ns        | -            | -            |                                   |
|     |                             | 5 $\mu$ s         | 5.8 ns        | -            | -            |                                   |
|     |                             | 10 $\mu$ s        | 5.8 ns        | -            | -            |                                   |
|     |                             | 30 $\mu$ s        | 5.8 ns        | -            | -            |                                   |
|     |                             | 50 $\mu$ s        | 5.8 ns        | -            | -            |                                   |
|     |                             | 100 $\mu$ s       | 5.9 ns        | -            | -            |                                   |
|     |                             | 300 $\mu$ s       | 12 ns         | -            | -            |                                   |
|     |                             | 500 $\mu$ s       | 30 ns         | -            | -            |                                   |
|     |                             | 1 ms              | 11 $\mu$ s    | -            | -            |                                   |
|     |                             | 3 ms              | 33 $\mu$ s    | -            | -            |                                   |
|     |                             | 5 ms              | 55 $\mu$ s    | -            | -            |                                   |
|     |                             | 10 ms             | 0.11 ms       | -            | -            |                                   |
|     |                             | 30 ms             | 0.33 ms       | -            | -            |                                   |
|     |                             | 50 ms             | 0.55 ms       | -            | -            |                                   |
| 116 | Oscilloscope - Frekwensi    | 50 kHz            | 2.9 Hz        | -            | -            | in house procedure MKSP<br>ECL-17 |
|     |                             | 10 MHz            | 0.58 kHz      | -            | -            |                                   |
|     |                             | 50 MHz            | 2.9 kHz       | -            | -            |                                   |
|     |                             | 100 MHz           | 5.8 kHz       | -            | -            |                                   |
|     |                             | 150 MHz           | 5.8 kHz       | -            | -            |                                   |
|     |                             | 200 MHz           | 5.8 kHz       | -            | -            |                                   |
|     |                             | 250 MHz           | 5.8 kHz       | -            | -            |                                   |
|     |                             | 300 MHz           | 5.8 kHz       | -            | -            |                                   |
|     |                             | 350 MHz           | 5.8 kHz       | -            | -            |                                   |

**WAKTU DAN FREKUENSI**

| No. | Instrument to be calibrated | Measurement Range     | CMC - Jakarta | CMC-Surabaya | CMC-Semarang | Methods/Specifications            |
|-----|-----------------------------|-----------------------|---------------|--------------|--------------|-----------------------------------|
| 117 | Stopwatch                   | 10 s ~ 86400 s        | 0.58 s        | 0.65 s       | -            | in house procedure MKSP<br>STP-01 |
| 118 | Sumber Frekwensi            | 50 Hz ~ 100 Hz        | 20 mHz        | -            | -            | in house procedure MKSP<br>ECL-01 |
|     |                             | 100 Hz ~ 500 Hz       | 1.2 Hz        | -            | -            |                                   |
|     |                             | 500 Hz ~ 1 kHz        | 1.2 Hz        | -            | -            |                                   |
|     |                             | 1 kHz ~ 10 kHz        | 12 Hz         | -            | -            |                                   |
|     |                             | 10 kHz ~ 20 kHz       | 12 Hz         | -            | -            |                                   |
|     |                             | 20 kHz ~ 50 kHz       | 12 Hz         | -            | -            |                                   |
|     |                             | 50 kHz ~ 100 kHz      | 0.12 kHz      | -            | -            |                                   |
| 119 | Frequency Meter             | 50 kHz                | 0.58 kHz      | -            | -            | in house procedure MKSP<br>ECL-07 |
|     |                             | 100 kHz               | 0.59 kHz      | -            | -            |                                   |
| 120 | RPM-Meter (optical sensor)  | 100 rpm ~ 500 rpm     | 0.19 rpm      | -            | -            | in house procedure MKSPTCH-<br>01 |
|     |                             | 500 rpm ~ 1000 rpm    | 0.32 rpm      | -            | -            |                                   |
|     |                             | 1000 rpm ~ 5000 rpm   | 1.5 rpm       | -            | -            |                                   |
|     |                             | 5000 rpm ~ 10000 rpm  | 3.0 rpm       | -            | -            |                                   |
|     |                             | 10000 rpm ~ 20000 rpm | 6.1 rpm       | -            | -            |                                   |
|     |                             | 20000 rpm ~ 50000 rpm | 15 rpm        | -            | -            |                                   |
|     |                             | 50000 rpm ~ 60000 rpm | 29 rpm        | -            | -            |                                   |

**PHOTOMETRY**

| No. | Instrument to be calibrated | Measurement Range | CMC - Jakarta | CMC-Surabaya | CMC-Semarang | Methods/Specifications |
|-----|-----------------------------|-------------------|---------------|--------------|--------------|------------------------|
| 121 | Luxmeter                    | 0 lux ~ 50 lux    | 2.7 %         | -            | -            | DIN 5032               |
|     |                             | 50 lux ~ 100 lux  | 2.7 %         | -            | -            |                        |
|     |                             | 100 lux ~ 200 lux | 2.6 %         | -            | -            |                        |
|     |                             | 200 lux ~ 400 lux | 2.8 %         | -            | -            |                        |
|     |                             | 400 lux ~ 600 lux | 3.0 %         | -            | -            |                        |
|     |                             | 600 lux ~ 800 lux | 2.9 %         | -            | -            |                        |

**PHOTOMETRY (continued)**

| No. | Instrument to be calibrated | Measurement Range  | CMC - Jakarta            | CMC-Surabaya                   | CMC-Semarang           | Methods/Specifications |          |
|-----|-----------------------------|--------------------|--------------------------|--------------------------------|------------------------|------------------------|----------|
|     |                             | 800 lux ~ 1000 lux | 2.8 %                    | -                              | -                      |                        |          |
| 122 | Glossmeter                  | 20°<br>60°         | 69.0 Gloss<br>82.0 Gloss | ~ 110.0 Gloss<br>~ 106.0 Gloss | 6.3 Gloss<br>3.9 Gloss | -<br>-<br>-<br>-       | ISO 7668 |

**INSTRUMEN ANALISA**

| No. | Instrument to be calibrated | Measurement Range | CMC - Jakarta | CMC-Surabaya | CMC-Semarang | Methods/Specifications |
|-----|-----------------------------|-------------------|---------------|--------------|--------------|------------------------|
| 123 | Spectrophotometer:          |                   |               |              |              |                        |
|     | Panjang Gelombang (UV-VIS)  | 279 nm            | 0.91 nm       | 0.91 nm      | -            |                        |
|     |                             | 288 nm            | 0.91 nm       | 0.91 nm      | -            |                        |
|     |                             | 334 nm            | 0.91 nm       | 0.91 nm      | -            |                        |
|     |                             | 361 nm            | 0.91 nm       | 0.91 nm      | -            |                        |
|     |                             | 419 nm            | 0.91 nm       | 0.91 nm      | -            |                        |
|     |                             | 446 nm            | 0.91 nm       | 0.91 nm      | -            |                        |
|     |                             | 454 nm            | 0.91 nm       | 0.91 nm      | -            |                        |
|     |                             | 460 nm            | 0.91 nm       | 0.91 nm      | -            |                        |
|     |                             | 537 nm            | 0.91 nm       | 0.91 nm      | -            |                        |
|     |                             | 638 nm            | 0.91 nm       | 0.91 nm      | -            |                        |
|     | Panjang Gelombang (UV-VIS)  | 402.4 nm          | -             | 2.6 nm       | -            |                        |
|     |                             | 529.9 nm          | -             | 2.6 nm       | -            |                        |
|     |                             | 791.4 nm          | -             | 2.6 nm       | -            |                        |
|     | Transmittance               | 0.0 %T            | 1.3 %T        | -            | -            |                        |
|     |                             | 9.8 %T ~ 10.0 %T  | 1.3 %T        | 0.97 %T      | -            |                        |
|     |                             | 47.7 %T ~ 49.9 %T | 1.3 %T        | 0.97 %T      | -            |                        |
|     |                             | 49.1 %T ~ 52.2 %T | 1.3 %T        | 0.97 %T      | -            |                        |
|     |                             | 100 %T            | 1.3 %T        | -            | -            |                        |
|     | SRE                         | 220 nm            | 0.51 %T       | -            | -            |                        |
|     |                             | 340 nm            | 0.51 %T       | 0.52 %T      | -            |                        |
|     |                             | 400 nm            | 0.51 %T       | 0.51 %T      | -            |                        |
| 124 | pH Meter                    | 4 pH              | 0.023 pH      | 0.025 pH     | 0.021 pH     |                        |
|     |                             | 7 pH              | 0.023 pH      | 0.028 pH     | 0.021 pH     | ASTM D 1293 - 2018     |
|     |                             | 10 pH             | 0.023 pH      | 0.035 pH     | 0.031 pH     |                        |
| 125 | Viscometer                  | 5 cP ~ 100000 cP  | 2.1 %         | -            | -            | ASTM D 2196-05         |
| 126 | Conductivity meter          | 84 µS/cm          | 1 µS/cm       | -            | -            |                        |
|     |                             | 147 µS/cm         | -             | 2 µS/cm      | 2 µS/cm      |                        |
|     |                             | 1.4 mS/cm         | 5 µS/cm       | 20 µS/cm     | 22 µS/cm     | ASTM D 1125-2009       |
|     |                             | 12.8 mS/cm        | 51 µS/cm      | 0.22 mS/cm   | 0.2 mS/cm    |                        |
|     |                             | 111.8 mS/cm       | 0.4 mS/cm     | 1.8 mS/cm    | 1.7 mS/cm    |                        |
| 127 | Refractometer               | 0 brix ~ 60 brix  | 0.1 brix      | -            | -            |                        |
|     |                             | 5 brix ~ 30 brix  | -             | 0.09 brix    | -            | OIML R 142 : 2008      |
|     |                             | 40 brix ~ 60 brix | -             | 0.13 brix    | -            |                        |

**ALAT KESEHATAN**

| No. | Instrument to be calibrated                                       | Measurement Range      | CMC          | Methods/Specifications     |
|-----|---|------------------------|--------------|----------------------------|
| 1   | Alat Bedah Frekwensi Tinggi (ESU)                                 |                        |              |                            |
|     | Power Cutting   | 0 W ~ 400 W            | 0.58 W       | in-house procedure (MD-01) |
|     | Power Coagulating   | 0 W ~ 400 W            | 0.58 W       |                            |
| 2   | Alat Hisap Medik<br>(Suction Pump/Suction Unit)<br>Suction Thorax | 0 mmHg ~ 700 mmHg      | 4.09 mmHg    | In-house procedure (MD-02) |
| 3   | Anaesthesia Unit  | 0 lpm ~ 25 lpm         | 0.58 lpm     | In-house procedure (MD-03) |
|     |   | 0 % Vapor ~ 12 % Vapor | 0.58 % Vapor |                            |
| 4   | Bed Side Monitor (Patient Monitor)                                |                        |              |                            |
|     | Blood Pressure  | 0 mmHg ~ 295 mmHg      | 0.82 mmHg    | In-house procedure (MD-04) |
|     | Saturasi O2   | 75 % ~ 100 %           | 0.82 %       |                            |
|     | Pulse Rate  | 30 bpm ~ 250 bpm       | 0.82 bpm     |                            |

**ALAT KESEHATAN (continued)**

| No. | Instrument to be calibrated                                   | Measurement Range                              | CMC                     | Methods/Specifications     |
|-----|---|--|-------------------------|----------------------------|
|     | Heart Rate  | 30 bpm ~ 300 bpm                               | 0.82 bpm                |                            |
|     | Respirasi   | 15 brpm ~ 120 brpm                             | 0.82 brpm               |                            |
| 5   | Blood Pressure Monitor (Tensimeter elektrik)                  | 0 mmHg ~ 295 mmHg                              | 0.82 mmHg               | In-house procedure (MD-05) |
| 6   | Blood Solution Warmer (Blood Warmers, Fluid Solution Warmers) | 0 °C ~ 50 °C                                   | 0.5 °C                  | In-house procedure (MD-06) |
| 7   | Cardiotocograph   | 30 bpm ~ 240 bpm                               | 0.65 bpm                | In-house procedure (MD-11) |
| 8   | Defibrillator (DC Shock)                                      |  |                         |                            |
|     | Energy  | 0.1 joule ~ 360 joule                          | 0.59 Joule              | In-house procedure (MD-08) |
|     | Heart Rate  | 30 bpm ~ 240 bpm                               | 0.82 bpm                |                            |
| 9   | Defibrillator Monitor   |  |                         |                            |
|     | Energy  | 0.1 joule ~ 360 joule                          | 0.59 Joule              | In-house procedure (MD-09) |
|     | Heart Rate  | 30 bpm ~ 300 bpm                               | 0.82 bpm                |                            |
|     | Saturasi O2   | 75 % ~ 100 %                                   | 0.82 %                  |                            |
|     | Pulse Rate  | 30 bpm ~ 250 bpm                               | 0.82 bpm                |                            |
|     | Respirasi   | 15 brpm ~ 120 brpm                             | 0.82 brpm               |                            |
| 10  | Dental Unit   |  |                         |                            |
|     | Vacuum  | 0 mmHg ~ -700 mmHg                             | 4.09 mmHg               | In-house Procedure (MD-10) |
|     | Pressure  | 0 mmHg ~ 5000 mmHg                             | 1.04 mmHg               |                            |
| 11  | Echocardiograph   |  |                         |                            |
|     | Fetal Heart rate  | 30 bpm ~ 240 bpm                               | 0.65 bpm                | In-house procedure (MD-11) |
| 12  | Electrocardiograf (EKG Recorder)                              |  |                         |                            |
|     | Heart Rate  | 30 bpm ~ 300 bpm                               | 0.82 bpm                | In-house procedure (MD-12) |
|     | Sensitivitas  | 0 mm/mV ~ 20 mm/mV                             | 0.93 mm/mV              |                            |
|     | Kecepatan Kertas  | 0 mm/s ~ 50 mm/s                               | 0.93 mm/s               |                            |
| 13  | Electrocardiograph Monitor (ECG Monitor)                      |  |                         |                            |
|     | Heart Rate  | 30 bpm ~ 300 bpm                               | 0.82 bpm                | In-house procedure (MD-13) |
| 14  | ENT Treatment   |  |                         |                            |
|     | Vacuum  | 0 mmHg ~ -700 mmHg                             | 4.09 mmHg               | In-house procedure (MD-14) |
|     | Pressure  | 0 mmHg ~ 5000 mmHg                             | 1.04 mmHg               |                            |
| 15  | Examination Lamp (Lampu Tindakan)                             |  |                         |                            |
|     | Head Lamp / Ligh Source / Operating Lamp Ceiling Type         | 0 lux ~ 200 Klux                               | 0.5 lux                 | In-house procedure (MD-15) |
| 16  | Fetal Detektor (Doppler)                                      |  |                         |                            |
|     | Fetal Heart rate  | 30 bpm ~ 240 bpm                               | 0.65 bpm                | In-house procedure (MD-17) |
| 17  | Incubator Perawatan (Infant Incubator, Baby Incubator)        |  |                         |                            |
|     | Kebisingan  | 30 dbA ~ 80 dbA                                | - -                     | In-house procedure (MD-17) |
|     | Flow rate   | 0 m/s ~ 0.5 m/s                                | - -                     |                            |
|     | Kelembaban  | 0 % ~ 90 %                                     | - -                     |                            |
|     |   |  |                         |                            |
| 18  | Infant Warmer   | 25 °C ~ 40 °C                                  | 0.15 °C                 | In-house procedure (MD-18) |
| 19  | Infusion Pump   |  |                         |                            |
|     | Flow rate   | 0.5 ml/H ~ 1000 ml/H                           | 0.29 ml/H               | In-house procedure (MD-19) |
|     | Pressure  | 0 psi ~ 45 psi                                 | 0.06 psi                |                            |
| 20  | Nebulizer   |  |                         |                            |
|     | Flow  | 0 lpm ~ 25 lpm                                 | 0.58 lpm                | In-house procedure (MD-20) |
|     | Time  | 0 menit ~ 9 jam                                | 0.58 menit              |                            |
| 21  | Phototherapy Unit   | 0 μW/cm <sup>2</sup> ~ 1999 μW/cm <sup>2</sup> | 0.01 μW/cm <sup>2</sup> | In-house procedure (MD-21) |
| 22  | Pulse Oxymeter (Saturasi OXigen)                              | 75 % ~ 100 %                                   | 0.82 %                  | In-house procedure (MD-22) |
| 23  | Spirometer  | 0 L ~ 3 L                                      | 0.43 mL                 | In-house procedure (MD-23) |
| 24  | Sphygmomanometer (Tensimeter Air Raksa)                       | 0 mmHg ~ 300 mmHg                              | 0.87 mmHg               | In-house procedure (MD-24) |
| 25  | Ultrasonography (USG)   |  |                         |                            |
|     | Jarak Kedalaman   | 0 mm ~ 150 mm                                  | 0.06 mm                 | In-house procedure (MD-25) |
|     | Pengukuran Dead Zone  |  |                         |                            |
|     | Pengukuran Gray Scale Target (ø)                              |  |                         |                            |

**ALAT KESEHATAN (continued)**

| No. | Instrument to be calibrated          | Measurement Range        | CMC          | Methods/Specifications     |
|-----|--------------------------------------|--------------------------|--------------|----------------------------|
|     | Pengukuran Axial-Lateral Target      |                          |              |                            |
| 26  | Ventilator                           |                          |              |                            |
|     | Tidal volume                         | 0 (L) ~ 200 (L)          | 0.58 (L)     | In-house procedure (MD-26) |
|     | Minute vol                           | 0 (L) ~ 200 (L)          | 0.58 (L)     |                            |
|     | Breath rate                          | 2 (bpm) ~ 150 (bpm)      | 0.58 (bpm)   |                            |
|     | I : E ratio                          |                          | 0.58         |                            |
|     | PIP                                  | 0 (cmH2O) ~ 120 (cmH2O)  | 0.58 (cmH2O) |                            |
|     | PEEP                                 | -5 (cmH2O) ~ 40 (cmH2O)  | 0.58 (cmH2O) |                            |
|     | MAP                                  | 0 (cmH2O) ~ 80 (cmH2O)   | 0.58 (cmH2O) |                            |
|     | IPP                                  | 0 (cmH2O) ~ 120 (cmH2O)  | 0.58 (cmH2O) |                            |
|     | Peak Inspirasi Flow                  | 0 lpm ~ 150 lpm          | 0.58 lpm     |                            |
|     | FIO2                                 | 0 (%) ~ 100 (%)          | 0.58 (%)     |                            |
| 27  | X-Ray dental Panoramic               |                          |              |                            |
|     | Kuat Cahaya Lampu Kolimator          | 0 lux ~ 200 lux          | 0.5 lux      | In-house Procedure (MD-27) |
|     | Ketepatan Berkas Kolimasi            | 0 mm ~ 300 mm            | - -          |                            |
|     | Akurasi kV                           | 35 KVp ~ 155 KVp         | 0.07 Kvp     |                            |
|     | Akurasi waktu Expose                 | 0.1 ms ~ 2000 s          | 0.07 s       |                            |
|     | Reproduksibilitas Expose             | 30 Gy ~ 1000 Gy          | 0.07 Gy      |                            |
|     | Linieritas mA/mAs                    | ~                        | 0.07 mAs     |                            |
|     | Keluaran Radiasi Berkas Utama ( mR ) | 0.1 mR/min ~ 1000 mR/min | 0.07 Gy      |                            |
|     | HVL                                  | 1.2 mAl ~ 14 mAl         | 0.09 mmAl    |                            |
| 28  | X-Ray Dental Unit                    |                          |              |                            |
|     | Ketepatan Berkas Kolimasi            | 0 mm ~ 300 mm            | - -          | In-house Procedure (MD-28) |
|     | Akurasi kV                           | 35 KVp ~ 155 KVp         | 0.07 Kvp     |                            |
|     | Akurasi waktu Expose                 | 0.1 ms ~ 2000 s          | 0.07 s       |                            |
|     | Reproduksibilitas Expose             | 30 Gy ~ 1000 Gy          | 0.07 Gy      |                            |
|     | Linieritas mA/mAs                    | ~                        | 0.07 mAs     |                            |
|     | Keluaran Radiasi Berkas Utama ( mR ) | 0.1 mR/min ~ 1000 mR/min | 0.07 Gy      |                            |
|     | HVL                                  | 1.2 mAl ~ 14 mAl         | 0.09 mmAl    |                            |
| 29  | X-Ray General Purpose                |                          |              |                            |
|     | Kuat Cahaya Lampu Kolimator          | 0 lux ~ 200 lux          | 0.5 lux      | In-house Procedure (MD-29) |
|     | Ketepatan Berkas Kolimasi            | 0 mm ~ 300 mm            | - -          |                            |
|     | Akurasi kV                           | 35 KVp ~ 155 KVp         | 0.07 Kvp     |                            |
|     | Akurasi waktu Expose                 | 0.1 ms ~ 2000 s          | 0.07 s       |                            |
|     | Reproduksibilitas Expose             | 30 Gy ~ 1000 Gy          | 0.07 Gy      |                            |
|     | Linieritas mA/mAs                    | ~                        | 0.07 mAs     |                            |
|     | Keluaran Radiasi Berkas Utama ( mR ) | 0.1 mR/min ~ 1000 mR/min | 0.07 Gy      |                            |
|     | HVL                                  | 1.2 mAl ~ 14 mAl         | 0.09 mmAl    |                            |
| 30  | X-Ray Mamography                     |                          |              |                            |
|     | Ketepatan Berkas Kolimasi            | 0 mm ~ 300 mm            | - -          | In-house Procedure (MD-30) |
|     | Akurasi kV                           | 35 KVp ~ 155 KVp         | 0.07 Kvp     |                            |
|     | Akurasi waktu Expose                 | 0.1 ms ~ 2000 s          | 0.07 s       |                            |
|     | Reproduksibilitas Expose             | 30 Gy ~ 1000 Gy          | 0.07 Gy      |                            |
|     | Linieritas mA/mAs                    | ~                        | 0.07 mAs     |                            |
|     | Keluaran Radiasi Berkas Utama ( mR ) | 0.1 mR/min ~ 1000 mR/min | 0.07 Gy      |                            |
|     | HVL                                  | 1.2 mAl ~ 14 mAl         | 0.09 mmAl    |                            |
| 31  | X-Ray Mobile C-Arm                   |                          |              |                            |
|     | Ketepatan Berkas Kolimasi            | 0 mm ~ 300 mm            | - -          | In-house Procedure (MD-31) |
|     | Akurasi kV                           | 35 KVp ~ 155 KVp         | 0.07 Kvp     |                            |
|     | Akurasi waktu Expose                 | 0.1 ms ~ 2000 s          | 0.07 s       |                            |
|     | Reproduksibilitas Expose             | 30 Gy ~ 1000 Gy          | 0.07 Gy      |                            |
|     | Linieritas mA/mAs                    | ~                        | 0.07 mAs     |                            |
|     | Keluaran Radiasi Berkas Utama ( mR ) | 0.1 mR/min ~ 1000 mR/min | 0.07 Gy      |                            |
|     | HVL                                  | 1.2 mAl ~ 14 mAl         | 0.09 mmAl    |                            |

**ALAT KESEHATAN (continued)**

| No. | Instrument to be calibrated          | Measurement Range            | CMC          | Methods/Specifications     |
|-----|--------------------------------------|------------------------------|--------------|----------------------------|
| 32  | X-Ray Mobile Unit                    | ~                            |              |                            |
|     | Kuat Cahaya Lampu Kolimator          | 0 lux ~ 200 lux              | 0.5 lux      | In-house Procedure (MD-32) |
|     | Ketepatan Berkas Kolimasi            | 0 mm ~ 300 mm                | - -          |                            |
|     | Akurasi kV                           | 35 KVp ~ 155 KVp             | 0.07 Kvp     |                            |
|     | Akurasi waktu Expose                 | 0.1 ms ~ 2000 s              | 0.07 s       |                            |
|     | Reproduksibilitas Expose             | 30 Gy ~ 1000 Gy              | 0.07 Gy      |                            |
|     | Linieritas mA/mAs                    | ~                            | 0.07 mAs     |                            |
|     | Keluaran Radiasi Berkas Utama ( mR ) | 0.1 mR/min ~ 1000 mR/min     | 0.07 Gy      |                            |
|     | HVL                                  | 1.2 mAl ~ 14 mAl             | 0.09 mmAl    |                            |
| 33  | Ventilator Anaeatesia                |                              |              |                            |
|     | Vaporizer                            | 0 % Vapor ~ 12 % Vapor       | 0.58 % Vapor | In-house procedure (MD-33) |
|     | Tidal volume                         | 0 (L) ~ 200 (L)              | 0.58 (L)     |                            |
|     | Minute vol                           | 0 (L) ~ 200 (L)              | 0.58 (L)     |                            |
|     | Breath rate                          | 2 (bpm) ~ 150 (bpm)          | 0.58 (bpm)   |                            |
|     | I : E ratio                          |                              | 0.58         |                            |
|     | PIP                                  | 0 (cmH2O) ~ 120 (cmH2O)      | 0.58 (cmH2O) |                            |
|     | PEEP                                 | -5 (cmH2O) ~ 40 (cmH2O)      | 0.58 (cmH2O) |                            |
|     | MAP                                  | 0 (cmH2O) ~ 80 (cmH2O)       | 0.58 (cmH2O) |                            |
|     | IPP                                  | 0 (cmH2O) ~ 120 (cmH2O)      | 0.58 (cmH2O) |                            |
|     | Peak Inspirasi Flow                  | 0 lpm ~ 150 lpm              | 0.58 lpm     |                            |
|     | FIO2                                 | 0 (%) ~ 100 (%)              | 0.58 (%)     |                            |
| 34  | Syringe Pump                         |                              |              |                            |
|     | Flow Rate                            | 0.5 ml/H ~ 1000 ml/H         | 0.29 ml/H    | In-house procedure (MD-35) |
|     | Pressure                             | 0 psi ~ 45 psi               | 0.06 psi     |                            |
| 35  | Oxygen Therapy/ Flow Meter           | 0 lpm ~ 25 lpm               | 0.58 lpm     | In-house procedure (MD-36) |
| 36  | Treadmill                            | 30 bpm ~ 240 bpm             | 0.82 bpm     | In-house procedure (MD-37) |
|     |                                      | 1 ml/H ~ 10 ml/H             | 0.05 ml/H    |                            |
| 37  | Paparan Radiasi X-Ray                | 0.1 $\mu$ Sv/hr ~ 500 mSv/hr | - -          | In-house Procedure (MD-40) |