

## DAFTAR PUSTAKA

- Herbert, M. A., Shetty, D., Vijay, G. S., Shetty, R., & Shivamurthy, B. (2015). Experimental Investigation in Drilling of Carbon Fiber Reinforced Polymer Composite using HSS and Solid Carbide Drills. *International Journal of Current Engineering and Technology*, 5(1), 313–320.
- Qureshi, M. A. M., Khan, S. A., Bhutta, M. M. A., Saleem, M. Q., & Harris, M. (2017). Carbon fiber-reinforced polymer composite drilling via aluminum chromium nitride-coated tools: Hole quality and tool wear assessment. *Journal of Reinforced Plastics and Composites*, 36(19), 1403–1420.
- Heisel, U., & Pfeifroth, T. (2012). Influence of point angle on drill hole quality and machining forces when drilling CFRP. *Procedia CIRP*, 1(1), 471–476.
- Wang, Y. G., Sun, C. Y., Yan, X. P., & Jiang, K. R. (2011). *Study on the Surface Delamination in Milling Carbon Fiber Reinforced Plastic with PCD Tool*. *Advanced Materials Research*, 381, 1–5.
- Krishnaraj, V., Prabukarthi, A., Ramanathan, A., Elanghovan, N., Kumar, M. S., Zitoune, R., & Davim, J. P. (2012). Optimization of machining parameters at high speed drilling of carbon fiber reinforced plastic (CFRP) laminates. *Composites Part B: Engineering*, 43(4), 1791–1799.
- Hintze Wolfgang, W., Hartmann, D., & Schütte, C. (2011). Occurrence and propagation of delamination during the machining of carbon fibre reinforced plastics (CFRPs) - An experimental study. *Composites Science and Technology*, 71(15), 1719–1726.
- Davim, J. P., Gaitonde, V. N., Abrão, A. M., Rubio, J. C., Karnik, S. R., & Correia, A. E. (2011). A study aimed at minimizing delamination during drilling of CFRP composites. *Journal of Composite Materials*, 45(22), 2359–2368.
- Shahrajabian, H., Hadi, M. And Farahnakian, M. (2012) 'Experimental Investigation of Machining Parameters On Machinability of Carbon Fiber/Epoxy Composites', 2(3), pp.30-36.
- Rahim, E. A., Mohid, Z., Jamil, M. F. M., Mat, K. C., Koyasu, R., & Sasahara, H. (2012). *Experimental Study of Helical Milling on CFRP*

*(Carbon Fibre Reinforced Polymer) for the Hole Making Process. Advanced Materials Research, 576, 68–71.*

Rahim, E. A., Mohid, Z., Hamzah, M. R., Yusuf, A. F., & Rahman, N. A. (2014). *Performance of Tools Design when Helical Milling on Carbon Fiber Reinforced Plastics (CFRP) Aluminum (Al) Stack. Applied Mechanics and Materials, 465-466, 1075–1079.*

Hintze, W., & Hartmann, D. (2013). *Modeling of Delamination During Milling of Unidirectional CFRP. Procedia CIRP, 8, 444-449.*

Hosokawa, A., Hirose, N., Ueda, T., & Furumoto, T. (2014). *High-quality machining of CFRP with high helix end mill. CIRP Annals, 63(1), 89–92.*

Aurich, J. C., Kirsch, B., Müller, C., & Heberger, L. (2014). *Quality of Drilled and Milled Rivet Holes in Carbon Fiber Reinforced Plastics. Procedia CIRP, 24, 56–61.*

Surdia, Tata dan Shinroku Saito. 2000. *Pengetahuan Bahan Teknik Cetakan Kelima, Jakarta: Pradnya Paramita.*

Sianipar, M.T. (2009) 'Analisa Kolom Bertulang Yang diperkuat Dengan Carbon Fiber Reinforced Polymer (CFRP). Skripsi. Sumatra Utara: Fakultas Teknik, Universitas Sumatra Utara.

Pangestuti, E. K. (2009). *Penggunaan Carbon Fiber Renforced Plate Sebagai Tulangan Ekternal Pada Struktur Balok Beton. The use of Carbon Fiber Reinforced Plate as Externally Bonded Composite Material of Reinforced Concrete Beam Structure',9,pp. 180-188.*

Nasrul Umam. 2015. *Analisis Uji Impact Pada Baja ST60 dengan Variasi Ketebalan Lapisan Karbon Fiber Untuk Aplikasi Kerangka Mobil Listrik. Universitas Negeri Semarang.*

Hadi, B.K. 2016. *Mekanika Struktur Komposit. Departemen Pendidikan Nasional. Bandung.*

Widodo, B., 2007. *Analisis Sifat Mekanik Komposit Epoksi Dengan Penguat Serat Pohon Aren (Ijuk) Model Lamina Berorientasi Sudut Acak (Random). Institut Teknologi Nasional. Malang.*

Hadi, B.K. 2001. *Mekanika Struktur Komposit. Departemen Pendidikan Nasional. Bandung.*

- Jones, M. R. 1975. *Mechanics of Composite Material*. Mc Graw Hill Kogakusha. Ltd.
- Gibson, 1994. *Principle Of Composite Material Mechanics*. New York : Mc Graw Hill, Inc.
- Porwanto, D.A. and Johar, L (2011)'Characterization of Bamboo Fiber and Fiber Glass Composite as an Alternative Raw Material for Industry', ITS Library.
- Christiani, Evi. 2008. Tesis, Karakteristik Ijuk Pada Papan Komposit Ijuk Serat Pendek Sebagai Perisai Radiasi Neutron. Sumatera Utara.
- Maryanti B. et al. 2011. Pengaruh Alkalisasi Komposit Serat Kelapa-Poliester Terhadap Kekuatan Tarik. International Standard Serial Number (ISSN).
- Michael, H.W., 1998, Stress and Analysis of Fiber Rein Forced Composite Material, Mc Graw Hill International Edition.
- Widarto. 2008. Teknik Pemesinan Jilid 2. Jakarta: Direktorat Pembinaan Sekolah Menengah Kejuruan. Departemen Pendidikan Nasional.
- Kalpakjian, S., dan Schmid, S.R. 2001. *Manufacturing Engineering and Technology. 4th Edition*. Prentice Hall: Pearson Education. Inc.
- Purnomo, Bagus. 2017. Analisa Nilai Kekasaran Permukaan Magnesium AZ31 Yang Dibubut Menggunakan Pahat Putar Dan Udara Dingin. Skripsi. Jurusan Teknik Mesin. Universitas Lampung. Bandar Lampung.
- Singh, I., Bhatnagar, N., & Viswanath, P. (2008). *Drilling of uni-directional glass fiber reinforced plastics: Experimental and finite element study. Materials & Design, 29(2), 546–553.*
- Ahmad, J. (2009). *Machining of Polymer Composites*.doi:10.1007/978-0-387-68619-6.
- Mkaddem, A., Demirci, I., & Mansori, M. E. (2008). *A micro – macro combined approach using FEM for modelling of machining of FRP composites: Cutting forces analysis. Composites Science and Technology, 68(15-16), 3123–3127.*
- Bawa, H., 2004. Manufacturing Processes-Ii. Tata Mcgraw-Hill Education.
- Schneider, G., 2002. Cutting Tool Applications. Nelson Pub.

- Nugroho, T. U., Saputro, H. And Estriyanto, Y. (2012)' Pengaruh kecepatan pemakanan dan pemberian pendingin terhadap tingkat keausan', 1(1), pp. 79-89.
- Choirul, Muhammad Azhar. 2014. *Analisis Kekasaran Permukaan Benda Kerja Dengan Variasi Jenis Material dan Pahat Potong*. Universitas Bengkulu. Bengkulu.
- Hadimi. 2008. Pengaruh Perubahan Kecepatan Pemakanan Terhadap Kekasaran Permukaan Pada Proses Pembubutan. *Jurnal Ilmiah Semesta Teknik*, Vol. 11, No. 1, 18-28.
- Paridawati. 2015. *Pengaruh Kecepatan Dan Sudut Potong Terhadap Kekasaran Benda Kerja Pada Mesin Bubut*. Universitas Islam 45 Bekasi. Jawa Barat.
- Andri Mardiansyah. 2014. "Analisis Kekasaran Permukaan Benda Kerja Dengan Variasi Jenis Material Dan Pahat Potong". Skripsi. Universitas Bengkulu.
- Jin, Z.J., Bao, Y.J. and Gao, H. (2008) 'Disfigurement formation and control in drilling carbon fiber reinforced composites', *Int. J. Materials and Product Technology*, Vol. 31, No. 1, pp.46–53.
- Tsao, C.C. and Hocheng, H. (2007b) 'Parametric study on thrust force of core drill', *Journal of Materials Processing Technology*, Vols. 192–193, pp.37–40.
- Tsao, C.C. (2008b) 'Thrust force and delamination of core saw drill during drilling of carbon fiber reinforced plastics (CFRP)', *International Journal of Advanced Manufacturing Technology*, Vol. 37, Nos. 1–2, pp.23–28.
- Tsao, C.C. and Hocheng, H. (2004) 'Taguchi analysis of delamination associated with various drill bits in drilling of composite material', *International Journal of Machine Tools and Manufacture*, Vol. 44, No. 10, pp.1085–1090.
- Davim, P.J. and Reis, P. (2003b) 'Study of delamination in drilling carbon fiber reinforced plastics (CFRP) using design experiments', *Composite Structures*, Vol. 59, No. 4, pp.481–487.
- Rajakumar, I. P. T., Hariharan, P., & Vijayaraghavan, L. (2012). Drilling of carbon fibre reinforced plastic (CFRP) composites - a review. *International Journal of Materials and Product Technology*, 43(1/2/3/4), 43. doi:10.1504/ijmpt.2012.047647

Davim, P.J. and Reis, P. (2003a) 'Drilling carbon fiber reinforced plastics manufactured by autoclave- experimental and statistical study', *Materials and Design*, Vol. 24, No. 5, pp.315–324.

## Lampiran 1

### PENYIMPANGAN

#### Taguchi Analysis: Penyimpangan versus Diameter (mm; Kecepatan Sp; Feed Rate (m

Response Table for Signal to Noise Ratios  
Smaller is better

| Level | Kecepatan        |                  |                       |
|-------|------------------|------------------|-----------------------|
|       | Diameter<br>(mm) | Spindel<br>(RPM) | Feed Rate<br>(mm/min) |
| 1     | 23,83            | 20,21            | 22,48                 |
| 2     | 20,67            | 22,87            | 20,93                 |
| 3     | 21,06            | 22,48            | 22,15                 |
| Delta | 3,16             | 2,66             | 1,55                  |
| Rank  | 1                | 2                | 3                     |

| Predictor               | Coef        | SE Coef    | T     | P     | VIF   |
|-------------------------|-------------|------------|-------|-------|-------|
| Constant                | 0,04306     | 0,08421    | 0,51  | 0,614 |       |
| Diameter (mm)           | 0,006639    | 0,006347   | 1,05  | 0,306 | 1,000 |
| Kecepatan Spindel (RPM) | -0,00001006 | 0,00001662 | -0,61 | 0,551 | 1,000 |
| Feed Rate (mm/min)      | 0,000239    | 0,001269   | 0,19  | 0,852 | 1,000 |

### DELAMINASI

#### Sisi Masuk

#### Taguchi Analysis: Delaminasi S versus Diameter (mm; Kecepatan Sp; Feed Rate (m

Response Table for Signal to Noise Ratios  
Smaller is better

| Level | Kecepatan        |                  |                       |
|-------|------------------|------------------|-----------------------|
|       | Diameter<br>(mm) | Spindel<br>(RPM) | Feed Rate<br>(mm/min) |
| 1     | -0,8050          | -0,6595          | -0,6650               |
| 2     | -0,4060          | -0,5680          | -0,5605               |
| 3     | -0,4519          | -0,4354          | -0,4373               |
| Delta | 0,3990           | 0,2241           | 0,2277                |
| Rank  | 1                | 3                | 2                     |

| Predictor               | Coef        | SE Coef    | T     | P     | VIF   |
|-------------------------|-------------|------------|-------|-------|-------|
| Constant                | 1,24906     | 0,04233    | 29,51 | 0,000 |       |
| Diameter (mm)           | -0,011139   | 0,003191   | -3,49 | 0,002 | 1,000 |
| Kecepatan Spindel (RPM) | -0,00001871 | 0,00000835 | -2,24 | 0,035 | 1,000 |
| Feed Rate (mm/min)      | -0,0014333  | 0,0006381  | -2,25 | 0,035 | 1,000 |

## Sisi Keluar

### Taguchi Analysis: Delaminasi S versus Diameter (mm; Kecepatan Sp; Feed Rate (m

Response Table for Signal to Noise Ratios  
Smaller is better

| Level | Kecepatan     |               |                    |
|-------|---------------|---------------|--------------------|
|       | Diameter (mm) | Spindel (RPM) | Feed Rate (mm/min) |
| 1     | -1,5567       | -2,4004       | -1,8566            |
| 2     | -1,4137       | -1,5913       | -1,7064            |
| 3     | -1,5896       | -0,5684       | -0,9970            |
| Delta | 0,1758        | 1,8320        | 0,8597             |
| Rank  | 3             | 1             | 2                  |

| Predictor               | Coef        | SE Coef    | T     | P     | VIF   |
|-------------------------|-------------|------------|-------|-------|-------|
| Constant                | 1,7024      | 0,1786     | 9,53  | 0,000 |       |
| Diameter (mm)           | 0,00083     | 0,01347    | 0,06  | 0,951 | 1,000 |
| Kecepatan Spindel (RPM) | -0,00016752 | 0,00003526 | -4,75 | 0,000 | 1,000 |
| Feed Rate (mm/min)      | -0,006256   | 0,002693   | -2,32 | 0,029 | 1,000 |

## KEKASARAN

### Taguchi Analysis: Kekasaran (u versus Diameter (mm; Kecepatan Sp; Feed Rate (m

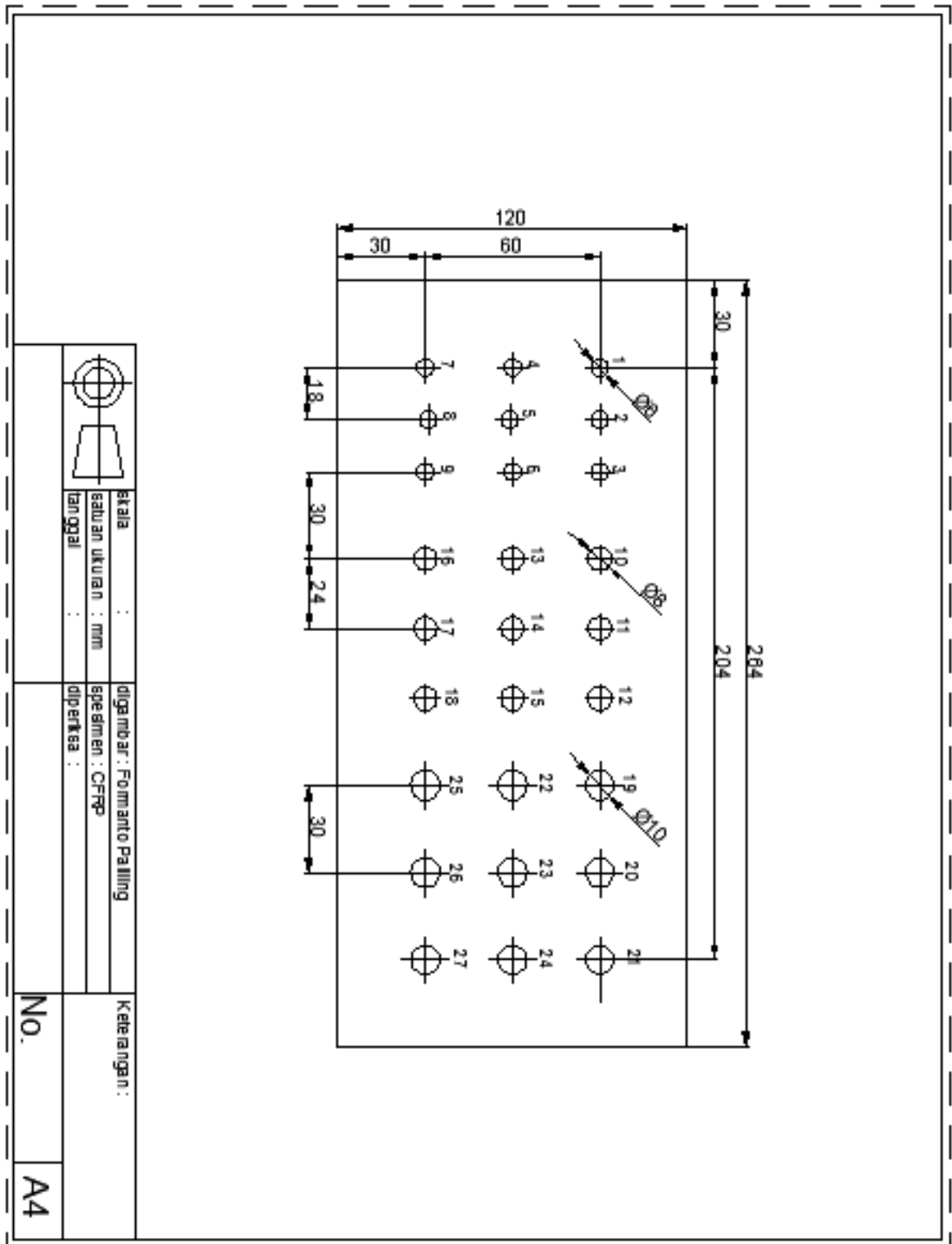
Response Table for Signal to Noise Ratios  
Smaller is better

| Level | Kecepatan     |               |                    |
|-------|---------------|---------------|--------------------|
|       | Diameter (mm) | Spindel (RPM) | Feed Rate (mm/min) |
| 1     | -16,50        | -14,53        | -14,31             |
| 2     | -13,89        | -13,96        | -14,83             |
| 3     | -13,69        | -15,59        | -14,94             |
| Delta | 2,82          | 1,63          | 0,63               |
| Rank  | 1             | 2             | 3                  |

| Predictor               | Coef      | SE Coef   | T     | P     | VIF   |
|-------------------------|-----------|-----------|-------|-------|-------|
| Constant                | 7,626     | 2,504     | 3,05  | 0,006 |       |
| Diameter (mm)           | -0,4629   | 0,1888    | -2,45 | 0,022 | 1,000 |
| Kecepatan Spindel (RPM) | 0,0005440 | 0,0004943 | 1,10  | 0,283 | 1,000 |
| Feed Rate (mm/min)      | 0,02175   | 0,03775   | 0,58  | 0,570 | 1,000 |

## Lampiran 2

### Gambar Autocad





### Lampiran 3

| No                                  |                                     | Data Kekasaran                      |      |       |       |       |       |        |        |        |      |      |      |      |      |      |       |       |       |       |      |
|-------------------------------------|-------------------------------------|-------------------------------------|------|-------|-------|-------|-------|--------|--------|--------|------|------|------|------|------|------|-------|-------|-------|-------|------|
|                                     |                                     | No.                                 | Resu | Rp[μ] | Rv[μ] | Rz[μ] | Rc[μ] | Rt[μ]  | Ra[μm] | Rq[μm] | Rsk  | Rku  | Rsm  | RΔq  | Rδc  | Rmr  | Rzjis | λc[μ] | λs[μ] | λf[μ] | File |
| 1                                   | <input checked="" type="checkbox"/> | 1                                   | 31.8 | 32.3  | 64.2  | 25.6  | 166.  | 5.463  | 7.902  | -0.96  | 6.63 | 104. | 161. | 13.3 | 100. | 30.4 | 800.  | 2.50  | -     | 19    |      |
|                                     | <input checked="" type="checkbox"/> | 2                                   | 34.4 | 39.5  | 73.9  | 22.3  | 159.  | 5.139  | 7.818  | 0.27   | 9.13 | 55.2 | 154. | 13.8 | 100. | 31.5 | 800.  | 2.50  | -     | 19    |      |
|                                     | <input checked="" type="checkbox"/> | 3                                   | 65.7 | 28.4  | 94.2  | 41.5  | 148.  | 5.824  | 9.328  | 2.65   | 14.6 | 125. | 212. | 11.2 | 100. | -    | 800.  | 2.50  | -     | 19    |      |
|                                     | <input checked="" type="checkbox"/> | 4                                   | 23.4 | 15.7  | 39.1  | 26.3  | 134.  | 4.131  | 5.542  | 0.78   | 4.48 | 121. | 136. | 10.1 | 100. | 28.6 | 800.  | 2.50  | -     | 19    |      |
|                                     | <input checked="" type="checkbox"/> | 5                                   | 38.3 | 29.7  | 68.0  | 36.7  | 144.  | 5.958  | 8.380  | 0.80   | 6.22 | 92.3 | 177. | 11.3 | 100. | 45.9 | 800.  | 2.50  | -     | 19    |      |
|                                     |                                     | Count                               | 5    | 5     | 5     | 5     | 5     | 5      | 5      | 5      | 5    | 5    | 5    | 5    | 5    | 5    | 5     | 5     | 5     | 5     | 5    |
|                                     |                                     | Average                             | 38.7 | 29.1  | 67.9  | 30.5  | 150.  | 5.303  | 7.794  | 0.71   | 8.23 | 99.7 | 168. | 12.0 | 100. | 34.1 | -     | -     | -     | -     | -    |
|                                     |                                     | Min.                                | 23.4 | 15.7  | 39.1  | 22.3  | 134.  | 4.131  | 5.542  | -0.96  | 4.48 | 55.2 | 136. | 10.1 | 100. | 28.6 | -     | -     | -     | -     | -    |
|                                     |                                     | Max.                                | 65.7 | 39.5  | 94.2  | 41.5  | 166.  | 5.958  | 9.328  | 2.65   | 14.6 | 125. | 212. | 13.8 | 100. | 45.9 | -     | -     | -     | -     | -    |
|                                     |                                     | Range                               | 42.3 | 23.8  | 55.0  | 19.2  | 31.5  | 1.827  | 3.786  | 3.62   | 10.1 | 70.0 | 76.3 | 3.73 | 0.00 | 17.2 | -     | -     | -     | -     | -    |
|                                     |                                     | σ                                   | 16.0 | 8.65  | 19.8  | 8.19  | 12.3  | 0.729  | 1.395  | 1.30   | 3.96 | 28.2 | 28.7 | 1.56 | 0.00 | 7.94 | -     | -     | -     | -     | -    |
|                                     |                                     | 3σ                                  | 48.1 | 25.9  | 59.4  | 24.5  | 37.1  | 2.187  | 4.184  | 3.91   | 11.8 | 84.6 | 86.3 | 4.68 | 0.00 | 23.8 | -     | -     | -     | -     | -    |
|                                     | 2                                   | <input checked="" type="checkbox"/> | 1    | 28.2  | 49.6  | 77.9  | 25.2  | 185.   | 4.545  | 6.92   | -0.6 | 13.4 | 97.5 | 165. | 11.9 | 100. | 33.9  | 800.  | 2.50  | -     | 19   |
| <input checked="" type="checkbox"/> |                                     | 2                                   | 19.2 | 22.5  | 41.8  | 25.6  | 179.  | 4.476  | 6.03   | -0.2   | 4.26 | 147. | 126. | 12.4 | 100. | 25.6 | 800.  | 2.50  | -     | 19    |      |
| <input checked="" type="checkbox"/> |                                     | 3                                   | 43.1 | 64.9  | 108.  | 26.9  | 178.  | 8.234  | 12.0   | 1.02   | 6.35 | 124. | 197. | 18.7 | 100. | 29.2 | 800.  | 2.50  | -     | 19    |      |
| <input checked="" type="checkbox"/> |                                     | 4                                   | 25.2 | 37.3  | 62.5  | 27.6  | 184.  | 6.146  | 8.46   | -0.6   | 4.75 | 122. | 171. | 17.2 | 100. | 27.6 | 800.  | 2.50  | -     | 19    |      |
| <input checked="" type="checkbox"/> |                                     | 5                                   | 33.4 | 61.9  | 95.4  | 40.7  | 161.  | 6.046  | 8.81   | -1.0   | 10.3 | 108. | 208. | 13.9 | 100. | 45.8 | 800.  | 2.50  | -     | 19    |      |
|                                     |                                     | Count                               | 5    | 5     | 5     | 5     | 5     | 5      | 5      | 5      | 5    | 5    | 5    | 5    | 5    | 5    | 5     | 5     | 5     | 5     | 5    |
|                                     |                                     | Average                             | 29.8 | 47.2  | 77.1  | 29.2  | 177.  | 5.889  | 8.46   | -0.3   | 7.83 | 120. | 174. | 14.8 | 100. | 32.4 | -     | -     | -     | -     | -    |
|                                     |                                     | Min.                                | 19.2 | 22.5  | 41.8  | 25.2  | 161.  | 4.476  | 6.03   | -1.0   | 4.26 | 97.5 | 126. | 11.9 | 100. | 25.6 | -     | -     | -     | -     | -    |
|                                     |                                     | Max.                                | 43.1 | 64.9  | 108.  | 40.7  | 185.  | 8.234  | 12.0   | 1.02   | 6.35 | 124. | 197. | 18.7 | 100. | 45.8 | -     | -     | -     | -     | -    |
|                                     |                                     | Range                               | 23.8 | 42.4  | 66.3  | 15.4  | 24.5  | 3.758  | 6.06   | 2.09   | 9.21 | 49.7 | 82.2 | 6.73 | 0.00 | 20.2 | -     | -     | -     | -     | -    |
|                                     |                                     | σ                                   | 9.02 | 17.6  | 26.2  | 6.50  | 9.87  | 1.532  | 2.32   | 0.80   | 3.95 | 18.6 | 31.9 | 3.00 | 0.00 | 8.09 | -     | -     | -     | -     | -    |
|                                     |                                     | 3σ                                  | 27.0 | 52.9  | 78.7  | 19.5  | 29.6  | 4.597  | 6.97   | 2.42   | 11.8 | 56.0 | 95.7 | 9.00 | 0.00 | 24.2 | -     | -     | -     | -     | -    |
| 3                                   |                                     | <input checked="" type="checkbox"/> | 1    | 52.4  | 34.4  | 86.8  | 56.4  | 450.   | 11.410 | 15.6   | 0.96 | 4.22 | 193. | 185. | 39.8 | 100. | 800.  | 2.50  | -     | 19    |      |
|                                     | <input checked="" type="checkbox"/> | 2                                   | 36.4 | 21.8  | 58.2  | 36.9  | 470.  | 8.671  | 11.2   | 0.83   | 3.50 | 198. | 162. | 31.8 | 100. | 800. | 2.50  | -     | 19    |       |      |
|                                     | <input checked="" type="checkbox"/> | 3                                   | 28.9 | 55.5  | 84.4  | 42.2  | 487.  | 8.246  | 11.3   | -0.95  | 4.97 | 175. | 198. | 24.5 | 100. | 800. | 2.50  | -     | 19    |       |      |
|                                     | <input checked="" type="checkbox"/> | 4                                   | 24.7 | 34.1  | 58.9  | 47.3  | 479.  | 7.603  | 9.74   | -0.4   | 2.93 | 237. | 149. | 27.1 | 100. | 800. | 2.50  | -     | 19    |       |      |
|                                     | <input checked="" type="checkbox"/> | 5                                   | 58.6 | 47.1  | 105.1 | 56.1  | 456.  | 6.103  | 9.34   | -0.14  | 11.4 | 219. | 180. | 22.5 | 100. | 800. | 2.50  | -     | 19    |       |      |
|                                     |                                     | Count                               | 5    | 5     | 5     | 5     | 5     | 5      | 5      | 5      | 5    | 5    | 5    | 5    | 5    | 5    | 5     | 5     | 5     | 5     | 5    |
|                                     |                                     | Average                             | 40.2 | 38.6  | 78.8  | 47.8  | 464.  | 8.407  | 11.4   | 0.04   | 5.41 | 204. | 175. | 29.1 | 100. | -    | -     | -     | -     | -     |      |
|                                     |                                     | Min.                                | 24.7 | 21.8  | 58.2  | 36.9  | 450.  | 6.103  | 9.34   | -0.95  | 2.93 | 175. | 149. | 22.5 | 100. | -    | -     | -     | -     | -     |      |
|                                     |                                     | Max.                                | 58.6 | 55.5  | 105.1 | 56.4  | 479.  | 11.410 | 15.6   | 0.96   | 11.4 | 237. | 198. | 39.8 | 100. | -    | -     | -     | -     | -     |      |
|                                     |                                     | Range                               | 33.9 | 33.6  | 47.5  | 19.5  | 28.8  | 5.307  | 6.31   | 1.92   | 8.48 | 62.0 | 49.0 | 17.3 | 0.00 | -    | -     | -     | -     | -     |      |
|                                     |                                     | σ                                   | 14.7 | 13.0  | 20.2  | 8.58  | 11.5  | 1.941  | 2.50   | 0.83   | 3.44 | 24.0 | 19.3 | 6.91 | 0.00 | -    | -     | -     | -     | -     |      |
|                                     |                                     | 3σ                                  | 44.2 | 39.0  | 60.8  | 25.6  | 34.5  | 5.823  | 7.52   | 2.51   | 10.3 | 72.0 | 58.0 | 20.7 | 0.00 | -    | -     | -     | -     | -     |      |
|                                     | 4                                   | <input checked="" type="checkbox"/> | 1    | 40.8  | 40.2  | 81.1  | 35.6  | 204.   | 7.043  | 9.31   | 0.01 | 4.72 | 132. | 160. | 11.0 | 100. | 35.6  | 800.  | 2.50  | -     | 19   |
| <input checked="" type="checkbox"/> |                                     | 2                                   | 28.1 | 23.2  | 51.3  | 26.0  | 203.  | 5.023  | 6.59   | -0.4   | 4.06 | 135. | 130. | 10.3 | 100. | 26.0 | 800.  | 2.50  | -     | 19    |      |
| <input checked="" type="checkbox"/> |                                     | 3                                   | 25.5 | 18.2  | 43.7  | 19.5  | 199.  | 3.190  | 4.44   | 0.47   | 6.83 | 130. | 124. | 7.34 | 100. | 21.6 | 800.  | 2.50  | -     | 19    |      |
| <input checked="" type="checkbox"/> |                                     | 4                                   | 37.4 | 27.6  | 65.1  | 26.6  | 198.  | 6.685  | 8.89   | -0.54  | 4.25 | 97.6 | 172. | 11.9 | 100. | 31.1 | 800.  | 2.50  | -     | 19    |      |
| <input checked="" type="checkbox"/> |                                     | 5                                   | 42.2 | 54.1  | 96.3  | 40.2  | 213.  | 6.672  | 9.68   | -1.1   | 7.61 | 91.2 | 211. | 13.1 | 100. | -    | 800.  | 2.50  | -     | 19    |      |
|                                     |                                     | Count                               | 5    | 5     | 5     | 5     | 5     | 5      | 5      | 5      | 5    | 5    | 5    | 5    | 5    | 5    | 4     | 5     | 5     | 5     | 5    |
|                                     |                                     | Average                             | 34.8 | 32.7  | 67.5  | 29.6  | 203.  | 5.723  | 7.78   | -0.3   | 5.49 | 117. | 159. | 10.7 | 100. | 28.6 | -     | -     | -     | -     |      |
|                                     |                                     | Min.                                | 25.5 | 18.2  | 43.7  | 19.5  | 198.  | 3.190  | 4.44   | -1.1   | 4.06 | 91.2 | 124. | 7.34 | 100. | 21.6 | -     | -     | -     | -     |      |
|                                     |                                     | Max.                                | 42.2 | 54.1  | 96.3  | 40.2  | 213.  | 7.043  | 9.68   | 0.47   | 7.61 | 135. | 211. | 13.1 | 100. | 35.6 | -     | -     | -     | -     |      |
|                                     |                                     | Range                               | 16.7 | 35.8  | 52.6  | 20.6  | 14.3  | 3.853  | 5.23   | 1.66   | 3.54 | 44.0 | 87.4 | 5.82 | 0.00 | 14.0 | -     | -     | -     | -     |      |
|                                     |                                     | σ                                   | 7.57 | 14.5  | 21.5  | 8.24  | 5.74  | 1.618  | 2.22   | 0.62   | 1.61 | 21.1 | 35.3 | 2.18 | 0.00 | 6.11 | -     | -     | -     | -     |      |
|                                     |                                     | 3σ                                  | 22.7 | 43.5  | 64.5  | 24.7  | 17.2  | 4.855  | 6.66   | 1.86   | 4.84 | 63.3 | 106. | 6.55 | 0.00 | 18.3 | -     | -     | -     | -     |      |
| 5                                   |                                     | <input checked="" type="checkbox"/> | 1    | 52.7  | 31.9  | 84.7  | 49.3  | 151.   | 13.249 | 17.6   | 0.97 | 3.57 | 233. | 187. | 23.4 | 100. | -     | 800.  | 2.50  | -     | 19   |
|                                     | <input checked="" type="checkbox"/> | 2                                   | 71.1 | 39.3  | 110.  | 47.6  | 158.  | 17.503 | 21.4   | 0.88   | 2.87 | 160. | 219. | 33.9 | 100. | -    | 800.  | 2.50  | -     | 19    |      |
|                                     | <input checked="" type="checkbox"/> | 3                                   | 86.6 | 37.1  | 123.  | 39.3  | 189.  | 8.750  | 12.5   | 1.53   | 9.05 | 169. | 180. | 17.5 | 100. | -    | 800.  | 2.50  | -     | 19    |      |
|                                     | <input checked="" type="checkbox"/> | 4                                   | 36.8 | 31.9  | 68.7  | 30.0  | 167.  | 10.194 | 13.1   | 0.76   | 3.26 | 152. | 147. | 21.8 | 100. | 30.0 | 800.  | 2.50  | -     | 19    |      |
|                                     | <input checked="" type="checkbox"/> | 5                                   | 44.9 | 21.9  | 66.9  | 36.2  | 159.  | 5.962  | 8.22   | 0.89   | 6.15 | 182. | 157. | 12.7 | 100. | -    | 800.  | 2.50  | -     | 19    |      |
|                                     |                                     | Count                               | 5    | 5     | 5     | 5     | 5     | 5      | 5      | 5      | 5    | 5    | 5    | 5    | 5    | 5    | 1     | 5     | 5     | 5     | 5    |
|                                     |                                     | Average                             | 58.4 | 32.4  | 90.9  | 40.5  | 165.  | 11.132 | 14.5   | 1.00   | 4.98 | 179. | 178. | 21.9 | 100. | 30.0 | -     | -     | -     | -     |      |
|                                     |                                     | Min.                                | 36.8 | 21.9  | 66.9  | 30.0  | 151.  | 5.962  | 8.22   | 0.76   | 2.87 | 152. | 147. | 12.7 | 100. | 30.0 | -     | -     | -     | -     |      |
|                                     |                                     | Max.                                | 86.6 | 39.3  | 123.  | 49.3  | 189.  | 17.503 | 21.4   | 1.53   | 9.05 | 233. | 219. | 33.9 | 100. | 30.0 | -     | -     | -     | -     |      |
|                                     |                                     | Range                               | 49.8 | 17.3  | 56.8  | 19.2  | 38.0  | 11.541 | 13.2   | 0.77   | 6.18 | 81.7 | 71.8 | 21.1 | 0.00 | 0.00 | -     | -     | -     | -     |      |
|                                     |                                     | σ                                   | 20.2 | 6.71  | 25.3  | 8.03  | 14.5  | 4.426  | 5.07   | 0.30   | 2.61 | 32.2 | 28.0 | 7.89 | 0.00 | 0.00 | -     | -     | -     | -     |      |
|                                     |                                     | 3σ                                  | 60.7 | 20.1  | 76.0  | 24.0  | 43.7  | 13.278 | 15.2   | 0.91   | 7.84 | 96.8 | 84.2 | 23.6 | 0.00 | 0.00 | -     | -     | -     | -     |      |



|    |         |      |       |       |       |        |         |       |       |       |      |      |      |      |      |       |       |       |       |      |   |
|----|---------|------|-------|-------|-------|--------|---------|-------|-------|-------|------|------|------|------|------|-------|-------|-------|-------|------|---|
| 11 | No.     | Resu | Rp[μ] | Rv[μ] | Rz[μ] | Rc[μ]  | Rt[μ]   | Ra[μ] | Rq[μ] | Rsk   | Rku  | Rsm  | RΔq  | Rδc  | Rmr  | Rzjis | λc[μ] | λs[μ] | λf[μ] | File |   |
|    | ✓ 1     |      | 33.1  | 19.7  | 52.9  | 27.7   | 195.    | 5.495 | 8.00  | 1.83  | 6.14 | 138. | 169. | 14.3 | 100. | 27.7  | 800.  | 2.50  | -     | 191  |   |
|    | ✓ 2     |      | 45.4  | 18.6  | 64.0  | 29.3   | 188.    | 5.343 | 8.02  | 1.97  | 8.26 | 99.1 | 150. | 12.4 | 100. | 36.5  | 800.  | 2.50  | -     | 191  |   |
|    | ✓ 3     |      | 24.6  | 16.1  | 40.7  | 20.3   | 187.    | 4.400 | 6.01  | 1.37  | 5.17 | 97.8 | 129. | 10.9 | 100. | 23.9  | 800.  | 2.50  | -     | 191  |   |
|    | ✓ 4     |      | 71.0  | 13.3  | 84.3  | 37.1   | 176.    | 4.481 | 7.07  | 3.36  | 24.4 | 117. | 175. | 10.8 | 100. | 37.1  | 800.  | 2.50  | -     | 191  |   |
|    | ✓ 5     |      | 53.6  | 26.6  | 80.2  | 24.0   | 178.    | 7.235 | 11.2  | 2.15  | 8.94 | 221. | 136. | 13.1 | 100. | -     | 800.  | 2.50  | -     | 191  |   |
|    | Count   |      | 5     | 5     | 5     | 5      | 5       | 5     | 5     | 5     | 5    | 5    | 5    | 5    | 5    | 5     | 4     | 5     | 5     | 5    | 5 |
|    | Average |      | 45.5  | 18.8  | 64.4  | 27.7   | 185.    | 5.391 | 8.07  | 2.14  | 10.5 | 134. | 152. | 12.3 | 100. | 31.3  | -     | -     | -     | -    | - |
|    | Min.    |      | 24.6  | 13.3  | 40.7  | 20.3   | 176.    | 4.400 | 6.01  | 1.37  | 5.17 | 97.8 | 129. | 10.8 | 100. | 23.9  | -     | -     | -     | -    | - |
|    | Max.    |      | 71.0  | 26.6  | 84.3  | 37.1   | 195.    | 7.235 | 11.2  | 3.36  | 24.4 | 221. | 175. | 14.3 | 100. | 37.1  | -     | -     | -     | -    | - |
|    | Range   |      | 46.4  | 13.3  | 43.6  | 16.8   | 19.3    | 2.835 | 5.21  | 1.99  | 19.2 | 123. | 45.9 | 3.52 | 0.00 | 13.2  | -     | -     | -     | -    | - |
| σ  |         | 18.0 | 4.98  | 18.3  | 6.32  | 7.97   | 1.143   | 1.94  | 0.74  | 7.87  | 51.1 | 20.0 | 1.50 | 0.00 | 6.54 | -     | -     | -     | -     | -    |   |
| 3σ |         | 54.2 | 14.9  | 54.9  | 18.9  | 23.9   | 3.428   | 5.84  | 2.23  | 23.6  | 153. | 60.2 | 4.50 | 0.00 | 19.6 | -     | -     | -     | -     | -    |   |
| 12 | No.     | Resu | Rp[μ] | Rv[μ] | Rz[μ] | Rc[μ]  | Rt[μ]   | Ra[μ] | Rq[μ] | Rsk   | Rku  | Rsm  | RΔq  | Rδc  | Rmr  | Rzjis | λc[μ] | λs[μ] | λf[μ] | File |   |
|    | ✓ 1     |      | 19.6  | 14.3  | 33.9  | 20.4   | 147.    | 3.482 | 4.59  | 0.51  | 3.84 | 173. | 111. | 8.29 | 100. | -     | 800.  | 2.50  | -     | 191  |   |
|    | ✓ 2     |      | 23.9  | 12.7  | 36.6  | 25.2   | 157.    | 3.704 | 4.74  | 0.33  | 4.07 | 226. | 104. | 9.48 | 100. | -     | 800.  | 2.50  | -     | 191  |   |
|    | ✓ 3     |      | 32.5  | 22.7  | 55.3  | 37.0   | 134.    | 5.730 | 7.87  | 0.13  | 4.58 | 150. | 148. | 10.9 | 100. | -     | 800.  | 2.50  | -     | 191  |   |
|    | ✓ 4     |      | 23.1  | 24.9  | 48.1  | 22.9   | 178.    | 4.839 | 6.66  | -0.29 | 4.44 | 91.7 | 164. | 12.4 | 100. | 28.8  | 800.  | 2.50  | -     | 191  |   |
|    | ✓ 5     |      | 24.5  | 19.0  | 43.5  | 23.3   | 159.    | 4.753 | 6.42  | 0.43  | 4.13 | 140. | 163. | 9.05 | 100. | 23.3  | 800.  | 2.50  | -     | 191  |   |
|    | Count   |      | 5     | 5     | 5     | 5      | 5       | 5     | 5     | 5     | 5    | 5    | 5    | 5    | 5    | 2     | 5     | 5     | 5     | 5    |   |
|    | Average |      | 24.7  | 18.7  | 43.5  | 25.8   | 155.    | 4.502 | 6.06  | 0.22  | 4.21 | 156. | 138. | 10.0 | 100. | 26.1  | -     | -     | -     | -    |   |
|    | Min.    |      | 19.6  | 12.7  | 33.9  | 20.4   | 134.    | 3.482 | 4.59  | -0.29 | 3.84 | 91.7 | 104. | 8.29 | 100. | 23.3  | -     | -     | -     | -    |   |
|    | Max.    |      | 32.5  | 24.9  | 55.3  | 37.0   | 178.    | 5.730 | 7.87  | 0.51  | 4.58 | 226. | 164. | 12.4 | 100. | 28.8  | -     | -     | -     | -    |   |
|    | Range   |      | 12.9  | 12.2  | 21.3  | 16.6   | 44.0    | 2.248 | 3.28  | 0.80  | 0.73 | 134. | 60.1 | 4.15 | 0.00 | 5.57  | -     | -     | -     | -    |   |
| σ  |         | 4.76 | 5.27  | 8.65  | 6.53  | 16.2   | 0.917   | 1.38  | 0.32  | 0.29  | 49.0 | 28.5 | 1.66 | 0.00 | 3.93 | -     | -     | -     | -     |      |   |
| 3σ |         | 14.2 | 15.8  | 25.9  | 19.6  | 48.8   | 2.750   | 4.15  | 0.97  | 0.89  | 147. | 85.7 | 4.98 | 0.00 | 11.8 | -     | -     | -     | -     |      |   |
| 13 | No.     | Resu | Rp[μ] | Rv[μ] | Rz[μ] | Rc[μ]  | Rt[μ]   | Ra[μ] | Rq[μ] | Rsk   | Rku  | Rsm  | RΔq  | Rδc  | Rmr  | Rzjis | λc[μ] | λs[μ] | λf[μ] | File |   |
|    | ✓ 1     |      | 34.0  | 40.9  | 74.9  | 22.9   | 196.483 | 6.06  | 8.96  | -0.91 | 6.67 | 78.9 | 174. | 14.4 | 100. | 26.7  | 800.  | 2.50  | -     | 191  |   |
|    | ✓ 2     |      | 30.2  | 38.0  | 68.2  | 32.4   | 231.373 | 6.14  | 9.21  | -0.53 | 5.96 | 183. | 154. | 12.3 | 100. | -     | 800.  | 2.50  | -     | 191  |   |
|    | ✓ 3     |      | 22.2  | 30.0  | 52.2  | 15.2   | 217.672 | 5.08  | 7.54  | -1.45 | 6.44 | 104. | 109. | 10.3 | 100. | 15.2  | 800.  | 2.50  | -     | 191  |   |
|    | ✓ 4     |      | 23.2  | 20.3  | 43.6  | 19.0   | 165.642 | 4.18  | 5.75  | -0.40 | 5.18 | 85.4 | 116. | 9.48 | 100. | 21.2  | 800.  | 2.50  | -     | 191  |   |
|    | ✓ 5     |      | 28.7  | 22.2  | 51.0  | 17.7   | 188.704 | 4.63  | 6.17  | -0.01 | 4.64 | 115. | 135. | 9.73 | 100. | 17.7  | 800.  | 2.50  | -     | 191  |   |
|    | Count   |      | 5     | 5     | 5     | 5      | 5       | 5     | 5     | 5     | 5    | 5    | 5    | 5    | 5    | 4     | 5     | 5     | 5     | 5    |   |
|    | Average |      | 27.7  | 30.3  | 58.0  | 21.5   | 199.975 | 5.22  | 7.53  | -0.67 | 5.78 | 113. | 137. | 11.2 | 100. | 20.2  | -     | -     | -     | -    |   |
|    | Min.    |      | 22.2  | 20.3  | 43.6  | 15.2   | 165.642 | 4.18  | 5.75  | -1.45 | 4.64 | 78.9 | 109. | 9.48 | 100. | 15.2  | -     | -     | -     | -    |   |
|    | Max.    |      | 34.0  | 40.9  | 74.9  | 32.4   | 231.373 | 6.14  | 9.21  | -0.01 | 6.67 | 183. | 174. | 14.4 | 100. | 26.7  | -     | -     | -     | -    |   |
|    | Range   |      | 11.8  | 20.5  | 31.3  | 17.1   | 65.731  | 1.96  | 3.45  | 1.48  | 2.03 | 104. | 65.2 | 4.97 | 0.00 | 11.4  | -     | -     | -     | -    |   |
| σ  |         | 4.93 | 9.16  | 13.0  | 6.72  | 25.578 | 0.86    | 1.57  | 0.56  | 0.85  | 41.7 | 26.8 | 2.10 | 0.00 | 4.98 | -     | -     | -     | -     |      |   |
| 3σ |         | 14.8 | 27.4  | 39.1  | 20.1  | 76.735 | 2.59    | 4.71  | 1.68  | 2.56  | 125. | 80.6 | 6.31 | 0.00 | 14.9 | -     | -     | -     | -     |      |   |
| 14 | No.     | Resu | Rp[μ] | Rv[μ] | Rz[μ] | Rc[μ]  | Rt[μ]   | Ra[μ] | Rq[μ] | Rsk   | Rku  | Rsm  | RΔq  | Rδc  | Rmr  | Rzjis | λc[μ] | λs[μ] | λf[μ] | File |   |
|    | ✓ 1     |      | 19.7  | 47.0  | 66.7  | 29.2   | 152.    | 4.038 | 5.69  | -1.09 | 13.7 | 128. | 149. | 8.96 | 100. | 29.2  | 800.  | 2.50  | -     | 191  |   |
|    | ✓ 2     |      | 20.1  | 15.7  | 35.8  | 20.7   | 167.    | 3.253 | 4.41  | 0.87  | 5.23 | 104. | 116. | 8.50 | 100. | 24.6  | 800.  | 2.50  | -     | 191  |   |
|    | ✓ 3     |      | 34.8  | 30.2  | 65.1  | 31.6   | 178.    | 5.105 | 7.51  | 1.24  | 7.11 | 112. | 191. | 9.82 | 100. | 34.8  | 800.  | 2.50  | -     | 191  |   |
|    | ✓ 4     |      | 33.2  | 20.0  | 53.2  | 34.7   | 177.    | 4.803 | 6.57  | 0.61  | 5.10 | 94.4 | 158. | 10.2 | 100. | 39.8  | 800.  | 2.50  | -     | 191  |   |
|    | ✓ 5     |      | 50.4  | 24.9  | 75.4  | 34.0   | 169.    | 4.731 | 7.46  | 1.94  | 11.2 | 107. | 189. | 9.09 | 100. | 40.9  | 800.  | 2.50  | -     | 191  |   |
|    | Count   |      | 5     | 5     | 5     | 5      | 5       | 5     | 5     | 5     | 5    | 5    | 5    | 5    | 5    | 5     | 5     | 5     | 5     | 5    |   |
|    | Average |      | 31.6  | 27.6  | 59.2  | 30.0   | 169.    | 4.386 | 6.33  | 0.71  | 8.49 | 109. | 161. | 9.32 | 100. | 33.9  | -     | -     | -     | -    |   |
|    | Min.    |      | 19.7  | 15.7  | 35.8  | 20.7   | 152.    | 3.253 | 4.41  | -1.09 | 5.10 | 94.4 | 116. | 8.50 | 100. | 24.6  | -     | -     | -     | -    |   |
|    | Max.    |      | 50.4  | 47.0  | 75.4  | 34.7   | 178.    | 5.105 | 7.51  | 1.94  | 13.7 | 128. | 191. | 10.2 | 100. | 40.9  | -     | -     | -     | -    |   |
|    | Range   |      | 30.7  | 31.2  | 39.5  | 14.0   | 25.2    | 1.852 | 3.10  | 3.03  | 8.69 | 33.7 | 75.6 | 1.72 | 0.00 | 16.2  | -     | -     | -     | -    |   |
| σ  |         | 12.6 | 12.1  | 15.2  | 5.64  | 10.2   | 0.744   | 1.30  | 1.12  | 3.86  | 12.4 | 31.3 | 0.69 | 0.00 | 6.94 | -     | -     | -     | -     |      |   |
| 3σ |         | 37.9 | 36.3  | 45.8  | 16.9  | 30.6   | 2.232   | 3.91  | 3.38  | 11.5  | 37.2 | 94.1 | 2.08 | 0.00 | 20.8 | -     | -     | -     | -     |      |   |
| 15 | No.     | Resu | Rp[μ] | Rv[μ] | Rz[μ] | Rc[μ]  | Rt[μ]   | Ra[μ] | Rq[μ] | Rsk   | Rku  | Rsm  | RΔq  | Rδc  | Rmr  | Rzjis | λc[μ] | λs[μ] | λf[μ] | File |   |
|    | ✓ 1     |      | 36.8  | 28.7  | 65.6  | 40.2   | 183.    | 7.658 | 10.5  | 1.10  | 4.51 | 193. | 146. | 15.7 | 100. | -     | 800.  | 2.50  | -     | 191  |   |
|    | ✓ 2     |      | 43.7  | 19.7  | 63.4  | 33.9   | 225.    | 4.094 | 6.16  | 1.74  | 11.6 | 221. | 136. | 9.48 | 100. | -     | 800.  | 2.50  | -     | 191  |   |
|    | ✓ 3     |      | 26.5  | 12.2  | 38.8  | 21.2   | 138.    | 2.667 | 3.78  | 1.14  | 8.17 | 164. | 100. | 5.35 | 100. | -     | 800.  | 2.50  | -     | 191  |   |
|    | ✓ 4     |      | 64.7  | 14.3  | 79.0  | 28.6   | 177.    | 4.287 | 7.70  | 4.16  | 28.8 | 113. | 144. | 7.77 | 100. | 32.4  | 800.  | 2.50  | -     | 191  |   |
|    | ✓ 5     |      | 29.3  | 10.2  | 39.5  | 15.4   | 187.    | 2.690 | 3.59  | 1.38  | 10.6 | 115. | 113. | 8.15 | 100. | 16.8  | 800.  | 2.50  | -     | 191  |   |
|    | Count   |      | 5     | 5     | 5     | 5      | 5       | 5     | 5     | 5     | 5    | 5    | 5    | 5    | 5    | 5     | 5     | 5     | 5     | 5    |   |
|    | Average |      | 40.2  | 17.0  | 57.3  | 27.9   | 182.    | 4.279 | 6.35  | 1.91  | 12.7 | 161. | 128. | 9.30 | 100. | 24.6  | -     | -     | -     | -    |   |
|    | Min.    |      | 26.5  | 10.2  | 38.8  | 15.4   | 138.    | 2.667 | 3.59  | 1.10  | 4.51 | 113. | 100. | 5.35 | 100. | 16.8  | -     | -     | -     | -    |   |
|    | Max.    |      | 64.7  | 28.7  | 79.0  | 40.2   | 225.    | 7.658 | 10.5  | 4.16  | 28.8 | 221. | 146. | 15.7 | 100. | 32.4  | -     | -     | -     | -    |   |
|    | Range   |      | 38.1  | 18.5  | 40.2  | 24.7   | 86.9    | 4.991 | 6.94  | 3.05  | 24.3 | 107. | 46.4 | 10.4 | 0.00 | 15.5  | -     | -     | -     | -    |   |
| σ  |         | 15.2 | 7.43  | 17.6  | 9.85  | 30.9   | 2.036   | 2.90  | 1.28  | 9.39  | 47.5 | 20.4 | 3.90 | 0.00 | 11.0 | -     | -     | -     | -     |      |   |
| 3σ |         | 45.7 | 22.3  | 52.8  | 29.5  | 92.9   | 6.107   | 8.70  | 3.85  | 28.1  | 142. | 61.3 | 11.7 | 0.00 | 33.0 | -     | -     | -     | -     |      |   |

|    |         |      |       |       |       |       |       |        |       |       |      |      |      |      |      |       |       |       |       |      |
|----|---------|------|-------|-------|-------|-------|-------|--------|-------|-------|------|------|------|------|------|-------|-------|-------|-------|------|
| 16 | No.     | Resu | Rp[μ] | Rv[μ] | Rz[μ] | Rc[μ] | Rt[μ] | Ra[μm] | Rq[μ] | Rsk   | Rku  | Rsm  | RΔq  | Rδc  | Rmr  | Rzjis | λc[μ] | λs[μ] | λf[μ] | File |
|    | ✓ 1     |      | 71.6  | 13.7  | 85.3  | 30.1  | 519.  | 3.836  | 6.13  | 3.89  | 39.3 | 243. | 182. | 18.0 | 100. | -     | 800.  | 2.50  | -     | 191  |
|    | ✓ 2     |      | 69.2  | 14.5  | 83.8  | 83.7  | 514.  | 4.204  | 7.02  | 3.64  | 26.6 | 562. | 158. | 19.4 | 100. | -     | 800.  | 2.50  | -     | 191  |
|    | ✓ 3     |      | 44.8  | 17.7  | 62.5  | 38.6  | 515.  | 5.954  | 9.94  | 2.52  | 10.2 | 115. | 146. | 23.0 | 100. | -     | 800.  | 2.50  | -     | 191  |
|    | ✓ 4     |      | 56.1  | 18.6  | 74.7  | 43.1  | 439.  | 4.122  | 6.21  | 1.84  | 17.1 | 162. | 152. | 15.7 | 100. | -     | 800.  | 2.50  | -     | 191  |
|    | ✓ 5     |      | 82.5  | 24.2  | 106.  | 31.8  | 439.  | 5.101  | 8.16  | 3.52  | 28.5 | 108. | 226. | 16.9 | 100. | 34.2  | 800.  | 2.50  | -     | 191  |
|    | Count   |      | 5     | 5     | 5     | 5     | 5     | 5      | 5     | 5     | 5    | 5    | 5    | 5    | 5    | 1     | 5     | 5     | 5     | 5    |
|    | Average |      | 64.8  | 17.7  | 82.6  | 45.5  | 485.  | 4.643  | 7.49  | 3.08  | 24.3 | 238. | 173. | 18.6 | 100. | 34.2  | -     | -     | -     | -    |
|    | Min.    |      | 44.8  | 13.7  | 62.5  | 30.1  | 439.  | 3.836  | 6.13  | 1.84  | 10.2 | 108. | 146. | 15.7 | 100. | 34.2  | -     | -     | -     | -    |
|    | Max.    |      | 82.5  | 24.2  | 106.  | 83.7  | 519.  | 5.954  | 9.94  | 3.89  | 39.3 | 562. | 226. | 23.0 | 100. | 34.2  | -     | -     | -     | -    |
|    | Range   |      | 37.6  | 10.5  | 44.2  | 53.6  | 80.3  | 2.118  | 3.80  | 2.05  | 29.0 | 453. | 80.0 | 7.30 | 0.00 | 0.00  | -     | -     | -     | -    |
| σ  |         | 14.5 | 4.16  | 16.2  | 22.0  | 42.2  | 0.872 | 1.59   | 0.86  | 11.1  | 188. | 32.7 | 2.81 | 0.00 | 0.00 | -     | -     | -     | -     |      |
| 3σ |         | 43.7 | 12.4  | 48.7  | 66.0  | 126.  | 2.617 | 4.77   | 2.60  | 33.3  | 566. | 98.2 | 8.44 | 0.00 | 0.00 | -     | -     | -     | -     |      |
| 17 | No.     | Resu | Rp[μ] | Rv[μ] | Rz[μ] | Rc[μ] | Rt[μ] | Ra[μm] | Rq[μ] | Rsk   | Rku  | Rsm  | RΔq  | Rδc  | Rmr  | Rzjis | λc[μ] | λs[μ] | λf[μ] | File |
|    | ✓ 1     |      | 39.7  | 39.2  | 78.9  | 29.7  | 191.  | 7.41   | 10.3  | -0.87 | 4.70 | 85.3 | 197. | 17.2 | 100. | 39.4  | 800.  | 2.50  | -     | 191  |
|    | ✓ 2     |      | 46.9  | 51.9  | 98.9  | 33.1  | 188.  | 7.40   | 10.4  | -0.85 | 5.74 | 81.7 | 186. | 17.4 | 100. | 33.1  | 800.  | 2.50  | -     | 191  |
|    | ✓ 3     |      | 69.4  | 22.7  | 92.1  | 32.6  | 194.  | 5.82   | 8.37  | 0.92  | 12.5 | 105. | 163. | 17.4 | 100. | -     | 800.  | 2.50  | -     | 191  |
|    | ✓ 4     |      | 18.6  | 21.4  | 40.1  | 14.6  | 187.  | 4.73   | 6.33  | -0.12 | 3.85 | 83.0 | 107. | 14.8 | 100. | 14.6  | 800.  | 2.50  | -     | 191  |
|    | ✓ 5     |      | 28.5  | 14.8  | 43.3  | 19.1  | 161.  | 3.77   | 5.16  | 1.61  | 7.45 | 110. | 112. | 10.6 | 100. | 19.1  | 800.  | 2.50  | -     | 191  |
|    | Count   |      | 5     | 5     | 5     | 5     | 5     | 5      | 5     | 5     | 5    | 5    | 5    | 5    | 5    | 4     | 5     | 5     | 5     | 5    |
|    | Average |      | 40.6  | 30.0  | 70.7  | 25.8  | 184.  | 5.83   | 8.14  | 0.13  | 6.86 | 93.0 | 153. | 15.5 | 100. | 26.5  | -     | -     | -     | -    |
|    | Min.    |      | 18.6  | 14.8  | 40.1  | 14.6  | 161.  | 3.77   | 5.16  | -0.87 | 3.85 | 81.7 | 107. | 10.6 | 100. | 14.6  | -     | -     | -     | -    |
|    | Max.    |      | 69.4  | 51.9  | 98.9  | 33.1  | 194.  | 7.41   | 10.4  | 1.61  | 12.5 | 110. | 197. | 17.4 | 100. | 39.4  | -     | -     | -     | -    |
|    | Range   |      | 50.8  | 37.1  | 58.8  | 18.5  | 32.3  | 3.64   | 5.31  | 2.48  | 8.69 | 28.2 | 89.7 | 6.80 | 0.00 | 24.7  | -     | -     | -     | -    |
| σ  |         | 19.3 | 15.2  | 27.4  | 8.45  | 12.9  | 1.61  | 2.37   | 1.10  | 3.44  | 13.4 | 41.4 | 2.93 | 0.00 | 11.6 | -     | -     | -     | -     |      |
| 3σ |         | 58.1 | 45.6  | 82.2  | 25.3  | 38.9  | 4.84  | 7.12   | 3.30  | 10.3  | 40.4 | 124. | 8.81 | 0.00 | 34.8 | -     | -     | -     | -     |      |
| 18 | No.     | Resu | Rp[μ] | Rv[μ] | Rz[μ] | Rc[μ] | Rt[μ] | Ra[μm] | Rq[μ] | Rsk   | Rku  | Rsm  | RΔq  | Rδc  | Rmr  | Rzjis | λc[μ] | λs[μ] | λf[μ] | File |
|    | ✓ 1     |      | 48.0  | 15.0  | 63.1  | 22.3  | 182.  | 5.434  | 9.31  | 2.66  | 10.2 | 113. | 129. | 10.1 | 100. | 24.8  | 800.  | 2.50  | -     | 19   |
|    | ✓ 2     |      | 73.7  | 29.8  | 103.  | 33.8  | 191.  | 5.003  | 8.25  | 2.89  | 21.4 | 93.5 | 225. | 12.8 | 100. | 42.4  | 800.  | 2.50  | -     | 19   |
|    | ✓ 3     |      | 26.4  | 23.9  | 50.3  | 26.8  | 161.  | 4.521  | 6.39  | 1.21  | 5.67 | 167. | 153. | 13.1 | 100. | -     | 800.  | 2.50  | -     | 19   |
|    | ✓ 4     |      | 28.5  | 51.6  | 80.1  | 30.9  | 192.  | 5.455  | 7.70  | -0.27 | 8.62 | 163. | 195. | 15.7 | 100. | -     | 800.  | 2.50  | -     | 19   |
|    | ✓ 5     |      | 48.7  | 25.0  | 73.7  | 38.5  | 174.  | 10.302 | 15.0  | 1.51  | 4.44 | 186. | 131. | 13.7 | 100. | -     | 800.  | 2.50  | -     | 19   |
|    | Count   |      | 5     | 5     | 5     | 5     | 5     | 5      | 5     | 5     | 5    | 5    | 5    | 5    | 5    | 2     | 5     | 5     | 5     | 5    |
|    | Average |      | 45.0  | 29.0  | 74.1  | 30.5  | 180.  | 6.143  | 9.33  | 1.60  | 10.0 | 144. | 167. | 13.1 | 100. | 33.6  | -     | -     | -     | -    |
|    | Min.    |      | 26.4  | 15.0  | 50.3  | 22.3  | 161.  | 4.521  | 6.39  | -0.27 | 4.44 | 93.5 | 129. | 10.1 | 100. | 24.8  | -     | -     | -     | -    |
|    | Max.    |      | 73.7  | 51.6  | 103.  | 38.5  | 192.  | 10.302 | 15.0  | 2.89  | 21.4 | 186. | 225. | 15.7 | 100. | 42.4  | -     | -     | -     | -    |
|    | Range   |      | 47.2  | 36.5  | 53.1  | 16.1  | 30.7  | 5.781  | 8.61  | 3.16  | 16.9 | 92.9 | 95.3 | 5.58 | 0.00 | 17.6  | -     | -     | -     | -    |
| σ  |         | 19.1 | 13.6  | 19.9  | 6.22  | 12.7  | 2.356 | 3.34   | 1.27  | 6.73  | 39.4 | 41.9 | 2.00 | 0.00 | 12.4 | -     | -     | -     | -     |      |
| 3σ |         | 57.3 | 41.0  | 59.7  | 18.6  | 38.3  | 7.068 | 10.0   | 3.81  | 20.2  | 118. | 125. | 6.01 | 0.00 | 37.4 | -     | -     | -     | -     |      |
| 19 | No.     | Resu | Rp[μ] | Rv[μ] | Rz[μ] | Rc[μ] | Rt[μ] | Ra[μm] | Rq[μ] | Rsk   | Rku  | Rsm  | RΔq  | Rδc  | Rmr  | Rzjis | λc[μ] | λs[μ] | λf[μ] | File |
|    | ✓ 1     |      | 23.5  | 20.4  | 44.0  | 22.7  | 105.  | 3.843  | 5.16  | 0.01  | 5.10 | 174. | 129. | 7.80 | 100. | -     | 800.  | 2.50  | -     | 191  |
|    | ✓ 2     |      | 25.7  | 54.8  | 80.6  | 26.8  | 165.  | 3.948  | 6.00  | -1.45 | 21.8 | 84.3 | 166. | 8.01 | 100. | 35.1  | 800.  | 2.50  | -     | 191  |
|    | ✓ 3     |      | 28.8  | 11.0  | 39.8  | 17.1  | 180.  | 3.472  | 4.79  | 1.53  | 7.37 | 60.7 | 124. | 8.16 | 100. | 21.7  | 800.  | 2.50  | -     | 191  |
|    | ✓ 4     |      | 43.3  | 18.1  | 61.4  | 25.8  | 153.  | 4.273  | 6.15  | 1.53  | 9.18 | 102. | 155. | 8.10 | 100. | 30.7  | 800.  | 2.50  | -     | 191  |
|    | ✓ 5     |      | 26.7  | 16.0  | 42.7  | 27.0  | 156.  | 4.633  | 6.38  | 1.30  | 5.02 | 112. | 157. | 9.93 | 100. | 31.8  | 800.  | 2.50  | -     | 191  |
|    | Count   |      | 5     | 5     | 5     | 5     | 5     | 5      | 5     | 5     | 5    | 5    | 5    | 5    | 5    | 4     | 5     | 5     | 5     | 5    |
|    | Average |      | 29.6  | 24.1  | 53.7  | 23.9  | 152.  | 4.034  | 5.70  | 0.57  | 9.71 | 106. | 146. | 8.40 | 100. | 29.8  | -     | -     | -     | -    |
|    | Min.    |      | 23.5  | 11.0  | 39.8  | 17.1  | 105.  | 3.472  | 4.79  | -1.45 | 5.02 | 60.7 | 124. | 7.80 | 100. | 21.7  | -     | -     | -     | -    |
|    | Max.    |      | 43.3  | 54.8  | 80.6  | 27.0  | 180.  | 4.633  | 6.38  | 1.53  | 21.8 | 174. | 166. | 9.93 | 100. | 35.1  | -     | -     | -     | -    |
|    | Range   |      | 19.7  | 43.7  | 40.7  | 9.82  | 74.6  | 1.161  | 1.58  | 3.02  | 16.8 | 113. | 42.5 | 2.13 | 0.00 | 13.4  | -     | -     | -     | -    |
| σ  |         | 7.88 | 17.5  | 17.2  | 4.15  | 28.0  | 0.440 | 0.68   | 1.31  | 7.01  | 42.5 | 18.6 | 0.86 | 0.00 | 5.75 | -     | -     | -     | -     |      |
| 3σ |         | 23.6 | 52.5  | 51.7  | 12.4  | 84.2  | 1.321 | 2.04   | 3.95  | 21.0  | 127. | 55.9 | 2.60 | 0.00 | 17.2 | -     | -     | -     | -     |      |
| 20 | No.     | Resu | Rp[μ] | Rv[μ] | Rz[μ] | Rc[μ] | Rt[μ] | Ra[μm] | Rq[μ] | Rsk   | Rku  | Rsm  | RΔq  | Rδc  | Rmr  | Rzjis | λc[μ] | λs[μ] | λf[μ] | File |
|    | ✓ 1     |      | 65.8  | 37.6  | 103.  | 47.9  | 212.  | 10.56  | 14.5  | 0.22  | 5.19 | 148. | 239. | 12.7 | 100. | 47.9  | 800.  | 2.50  | -     | 191  |
|    | ✓ 2     |      | 45.0  | 39.5  | 84.6  | 37.0  | 180.  | 6.444  | 10.0  | 0.15  | 7.72 | 164. | 139. | 10.2 | 100. | -     | 800.  | 2.50  | -     | 191  |
|    | ✓ 3     |      | 47.2  | 30.3  | 77.6  | 35.6  | 218.  | 5.871  | 8.30  | 0.27  | 6.97 | 121. | 155. | 8.75 | 100. | 39.3  | 800.  | 2.50  | -     | 191  |
|    | ✓ 4     |      | 30.0  | 16.8  | 46.9  | 27.5  | 225.  | 4.818  | 6.50  | 0.59  | 4.57 | 87.6 | 149. | 8.19 | 100. | 33.9  | 800.  | 2.50  | -     | 191  |
|    | ✓ 5     |      | 14.9  | 28.8  | 43.8  | 24.0  | 231.  | 4.078  | 5.42  | -0.37 | 4.91 | 106. | 149. | 7.28 | 100. | 28.3  | 800.  | 2.50  | -     | 191  |
|    | Count   |      | 5     | 5     | 5     | 5     | 5     | 5      | 5     | 5     | 5    | 5    | 5    | 5    | 5    | 4     | 5     | 5     | 5     | 5    |
|    | Average |      | 40.6  | 30.6  | 71.3  | 34.4  | 213.  | 6.355  | 8.96  | 0.17  | 5.87 | 125. | 166. | 9.44 | 100. | 37.3  | -     | -     | -     | -    |
|    | Min.    |      | 14.9  | 16.8  | 43.8  | 24.0  | 180.  | 4.078  | 5.42  | -0.37 | 4.57 | 87.6 | 139. | 7.28 | 100. | 28.3  | -     | -     | -     | -    |
|    | Max.    |      | 65.8  | 39.5  | 103.  | 47.9  | 231.  | 10.56  | 14.5  | 0.59  | 7.72 | 164. | 239. | 12.7 | 100. | 47.9  | -     | -     | -     | -    |
|    | Range   |      | 50.8  | 22.6  | 59.6  | 23.8  | 51.2  | 6.488  | 9.14  | 0.97  | 3.15 | 76.7 | 100. | 5.49 | 0.00 | 19.5  | -     | -     | -     | -    |
| σ  |         | 19.1 | 8.95  | 25.5  | 9.29  | 19.9  | 2.526 | 3.59   | 0.35  | 1.38  | 31.0 | 41.0 | 2.14 | 0.00 | 8.33 | -     | -     | -     | -     |      |
| 3σ |         | 57.4 | 26.8  | 76.5  | 27.8  | 59.8  | 7.578 | 10.7   | 1.05  | 4.16  | 93.1 | 123. | 6.43 | 0.00 | 25.0 | -     | -     | -     | -     |      |

|    |         |      |      |      |      |      |      |       |      |       |      |      |      |      |      |       |      |      |       |      |
|----|---------|------|------|------|------|------|------|-------|------|-------|------|------|------|------|------|-------|------|------|-------|------|
| 21 | No.     | Resu | Rp[μ | Rv[μ | Rz[μ | Rc[μ | Rt[μ | Ra[μ  | Rq[μ | Rsk   | Rku  | Rsm  | RΔq  | Rδc  | Rmr  | Rzjis | Ac[μ | As[μ | Alf[μ | File |
|    | ✓ 1     |      | 43.4 | 22.8 | 66.2 | 26.8 | 155. | 6.473 | 8.62 | 1.15  | 5.46 | 74.3 | 172. | 13.7 | 100. | 37.7  | 800. | 2.50 | -     | 191  |
|    | ✓ 2     |      | 45.1 | 19.4 | 64.6 | 18.5 | 151. | 4.143 | 6.16 | 1.22  | 11.0 | 73.4 | 157. | 10.5 | 100. | 24.4  | 800. | 2.50 | -     | 191  |
|    | ✓ 3     |      | 36.9 | 14.4 | 51.3 | 27.8 | 129. | 3.662 | 5.32 | 1.65  | 9.89 | 138. | 126. | 9.61 | 100. | 27.8  | 800. | 2.50 | -     | 191  |
|    | ✓ 4     |      | 24.9 | 23.0 | 48.0 | 27.7 | 136. | 4.562 | 6.46 | 0.03  | 5.13 | 168. | 119. | 11.6 | 100. | -     | 800. | 2.50 | -     | 191  |
|    | ✓ 5     |      | 35.1 | 24.1 | 59.3 | 29.4 | 127. | 4.566 | 6.46 | 0.28  | 6.41 | 171. | 132. | 10.1 | 100. | -     | 800. | 2.50 | -     | 191  |
|    | Count   |      | 5    | 5    | 5    | 5    | 5    | 5     | 5    | 5     | 5    | 5    | 5    | 5    | 5    | 3     | 5    | 5    | 5     | 5    |
|    | Average |      | 37.1 | 20.7 | 57.9 | 26.0 | 140. | 4.681 | 6.60 | 0.86  | 7.59 | 125. | 141. | 11.1 | 100. | 29.9  | -    | -    | -     | -    |
|    | Min.    |      | 24.9 | 14.4 | 48.0 | 18.5 | 127. | 3.662 | 5.32 | 0.03  | 5.13 | 73.4 | 119. | 9.61 | 100. | 24.4  | -    | -    | -     | -    |
|    | Max.    |      | 45.1 | 24.1 | 66.2 | 29.4 | 155. | 6.473 | 8.62 | 1.65  | 11.0 | 171. | 172. | 13.7 | 100. | 37.7  | -    | -    | -     | -    |
|    | Range   |      | 20.2 | 9.71 | 18.2 | 10.9 | 28.3 | 2.811 | 3.30 | 1.61  | 5.93 | 98.4 | 52.4 | 4.10 | 0.00 | 13.2  | -    | -    | -     | -    |
|    | σ       |      | 8.00 | 3.96 | 8.01 | 4.31 | 12.7 | 1.068 | 1.21 | 0.68  | 2.70 | 48.7 | 22.2 | 1.61 | 0.00 | 6.89  | -    | -    | -     | -    |
|    | 3σ      |      | 24.0 | 11.8 | 24.0 | 12.9 | 38.3 | 3.205 | 3.65 | 2.04  | 8.12 | 146. | 66.7 | 4.85 | 0.00 | 20.6  | -    | -    | -     | -    |
| 22 | No.     | Resu | Rp[μ | Rv[μ | Rz[μ | Rc[μ | Rt[μ | Ra[μ  | Rq[μ | Rsk   | Rku  | Rsm  | RΔq  | Rδc  | Rmr  | Rzjis | Ac[μ | As[μ | Alf[μ | File |
|    | ✓ 1     |      | 73.5 | 9.89 | 83.3 | 41.8 | 258. | 3.502 | 6.06 | 5.52  | 56.7 | 236. | 159. | 9.23 | 100. | -     | 800. | 2.50 | -     | 191  |
|    | ✓ 2     |      | 19.5 | 13.9 | 33.5 | 22.9 | 286. | 3.492 | 4.62 | 1.14  | 4.58 | 240. | 115. | 9.07 | 100. | -     | 800. | 2.50 | -     | 191  |
|    | ✓ 3     |      | 28.5 | 14.4 | 43.0 | 22.2 | 235. | 3.657 | 4.97 | 1.47  | 6.09 | 126. | 126. | 12.3 | 100. | -     | 800. | 2.50 | -     | 191  |
|    | ✓ 4     |      | 50.7 | 12.2 | 63.0 | 25.1 | 240. | 3.892 | 5.76 | 2.90  | 21.3 | 119. | 155. | 11.8 | 100. | 25.1  | 800. | 2.50 | -     | 191  |
|    | ✓ 5     |      | 29.3 | 31.9 | 61.3 | 24.7 | 235. | 4.645 | 6.58 | 0.39  | 6.39 | 93.1 | 184. | 11.0 | 100. | 27.4  | 800. | 2.50 | -     | 191  |
|    | Count   |      | 5    | 5    | 5    | 5    | 5    | 5     | 5    | 5     | 5    | 5    | 5    | 5    | 5    | 2     | 5    | 5    | 5     | 5    |
|    | Average |      | 40.3 | 16.5 | 56.8 | 27.3 | 251. | 3.838 | 5.60 | 2.28  | 19.0 | 163. | 148. | 10.7 | 100. | 26.3  | -    | -    | -     | -    |
|    | Min.    |      | 19.5 | 9.89 | 33.5 | 22.2 | 235. | 3.492 | 4.62 | 0.39  | 4.58 | 93.1 | 115. | 9.07 | 100. | 25.1  | -    | -    | -     | -    |
|    | Max.    |      | 73.5 | 31.9 | 83.3 | 41.8 | 286. | 4.645 | 6.58 | 5.52  | 56.7 | 240. | 184. | 12.3 | 100. | 27.4  | -    | -    | -     | -    |
|    | Range   |      | 53.9 | 22.0 | 49.8 | 19.6 | 51.6 | 1.153 | 1.96 | 5.13  | 52.1 | 147. | 68.8 | 3.23 | 0.00 | 2.28  | -    | -    | -     | -    |
|    | σ       |      | 21.7 | 8.81 | 19.3 | 8.18 | 21.9 | 0.479 | 0.79 | 2.02  | 22.1 | 69.9 | 27.6 | 1.48 | 0.00 | 1.61  | -    | -    | -     | -    |
|    | 3σ      |      | 65.3 | 26.4 | 58.0 | 24.5 | 65.7 | 1.438 | 2.39 | 6.08  | 66.4 | 209. | 82.8 | 4.46 | 0.00 | 4.84  | -    | -    | -     | -    |
| 23 | No.     | Resu | Rp[μ | Rv[μ | Rz[μ | Rc[μ | Rt[μ | Ra[μ  | Rq[μ | Rsk   | Rku  | Rsm  | RΔq  | Rδc  | Rmr  | Rzjis | Ac[μ | As[μ | Alf[μ | File |
|    | ✓ 1     |      | 21.9 | 44.2 | 66.1 | 25.1 | 128. | 4.693 | 6.78 | -1.33 | 8.28 | 184. | 163. | 10.0 | 100. | -     | 800. | 2.50 | -     | 191  |
|    | ✓ 2     |      | 31.2 | 16.2 | 47.5 | 21.4 | 106. | 3.646 | 5.08 | 0.65  | 6.46 | 74.5 | 141. | 7.35 | 100. | 30.0  | 800. | 2.50 | -     | 191  |
|    | ✓ 3     |      | 21.7 | 18.2 | 39.9 | 16.3 | 131. | 2.951 | 4.12 | 0.68  | 6.05 | 115. | 109. | 6.78 | 100. | 18.1  | 800. | 2.50 | -     | 191  |
|    | ✓ 4     |      | 19.1 | 27.6 | 46.8 | 16.5 | 96.5 | 2.937 | 3.97 | -0.29 | 8.64 | 65.2 | 114. | 5.66 | 100. | 21.5  | 800. | 2.50 | -     | 191  |
|    | ✓ 5     |      | 21.4 | 12.3 | 33.7 | 16.4 | 90.4 | 3.071 | 4.09 | 0.69  | 5.54 | 69.2 | 117. | 6.52 | 100. | 21.8  | 800. | 2.50 | -     | 191  |
|    | Count   |      | 5    | 5    | 5    | 5    | 5    | 5     | 5    | 5     | 5    | 5    | 5    | 5    | 5    | 4     | 5    | 5    | 5     | 5    |
|    | Average |      | 23.1 | 23.7 | 46.8 | 19.2 | 110. | 3.460 | 4.81 | 0.08  | 6.99 | 101. | 129. | 7.27 | 100. | 22.8  | -    | -    | -     | -    |
|    | Min.    |      | 19.1 | 12.3 | 33.7 | 16.3 | 90.4 | 2.937 | 3.97 | -1.33 | 5.54 | 65.2 | 109. | 5.66 | 100. | 18.1  | -    | -    | -     | -    |
|    | Max.    |      | 31.2 | 44.2 | 66.1 | 25.1 | 131. | 4.693 | 6.78 | 0.69  | 8.64 | 184. | 163. | 10.0 | 100. | 30.0  | -    | -    | -     | -    |
|    | Range   |      | 12.1 | 31.8 | 32.3 | 8.82 | 41.0 | 1.756 | 2.80 | 2.03  | 3.09 | 118. | 54.9 | 4.38 | 0.00 | 11.8  | -    | -    | -     | -    |
|    | σ       |      | 4.69 | 12.7 | 12.1 | 3.99 | 18.4 | 0.748 | 1.18 | 0.90  | 1.38 | 50.2 | 22.9 | 1.66 | 0.00 | 5.03  | -    | -    | -     | -    |
|    | 3σ      |      | 14.0 | 38.3 | 36.4 | 11.9 | 55.4 | 2.244 | 3.56 | 2.70  | 4.14 | 150. | 68.8 | 4.99 | 0.00 | 15.1  | -    | -    | -     | -    |
| 24 | No.     | Resu | Rp[μ | Rv[μ | Rz[μ | Rc[μ | Rt[μ | Ra[μ  | Rq[μ | Rsk   | Rku  | Rsm  | RΔq  | Rδc  | Rmr  | Rzjis | Ac[μ | As[μ | Alf[μ | File |
|    | ✓ 1     |      | 16.7 | 19.2 | 36.0 | 17.2 | 169. | 3.571 | 4.98 | -0.06 | 4.99 | 82.0 | 117. | 9.26 | 100. | 21.1  | 800. | 2.50 | -     | 191  |
|    | ✓ 2     |      | 31.2 | 11.6 | 42.8 | 28.8 | 135. | 5.499 | 8.07 | 1.98  | 6.11 | 145. | 128. | 12.1 | 100. | 28.8  | 800. | 2.50 | -     | 191  |
|    | ✓ 3     |      | 27.4 | 15.5 | 42.9 | 24.8 | 167. | 4.398 | 6.69 | 1.93  | 7.21 | 125. | 120. | 8.69 | 100. | 27.0  | 800. | 2.50 | -     | 191  |
|    | ✓ 4     |      | 25.9 | 35.8 | 61.8 | 22.2 | 169. | 4.487 | 6.58 | 0.88  | 6.62 | 110. | 165. | 10.4 | 100. | 24.9  | 800. | 2.50 | -     | 191  |
|    | ✓ 5     |      | 24.8 | 15.3 | 40.2 | 18.5 | 152. | 3.895 | 5.50 | 0.65  | 5.81 | 98.5 | 136. | 9.17 | 100. | 20.5  | 800. | 2.50 | -     | 191  |
|    | Count   |      | 5    | 5    | 5    | 5    | 5    | 5     | 5    | 5     | 5    | 5    | 5    | 5    | 5    | 5     | 5    | 5    | 5     | 5    |
|    | Average |      | 25.2 | 19.5 | 44.7 | 22.3 | 158. | 4.370 | 6.36 | 1.07  | 6.15 | 112. | 133. | 9.93 | 100. | 24.4  | -    | -    | -     | -    |
|    | Min.    |      | 16.7 | 11.6 | 36.0 | 17.2 | 135. | 3.571 | 4.98 | -0.06 | 4.99 | 82.0 | 117. | 8.69 | 100. | 20.5  | -    | -    | -     | -    |
|    | Max.    |      | 31.2 | 35.8 | 61.8 | 28.8 | 169. | 5.499 | 8.07 | 1.98  | 7.21 | 145. | 165. | 12.1 | 100. | 28.8  | -    | -    | -     | -    |
|    | Range   |      | 14.4 | 24.1 | 25.7 | 11.5 | 33.7 | 1.928 | 3.09 | 2.06  | 2.22 | 63.4 | 48.1 | 3.41 | 0.00 | 8.20  | -    | -    | -     | -    |
|    | σ       |      | 5.30 | 9.50 | 9.91 | 4.70 | 14.7 | 0.734 | 1.19 | 0.88  | 0.83 | 24.4 | 19.2 | 1.37 | 0.00 | 3.59  | -    | -    | -     | -    |
|    | 3σ      |      | 15.9 | 28.5 | 29.7 | 14.0 | 44.2 | 2.201 | 3.58 | 2.64  | 2.51 | 73.2 | 57.7 | 4.12 | 0.00 | 10.7  | -    | -    | -     | -    |
| 25 | No.     | Resu | Rp[μ | Rv[μ | Rz[μ | Rc[μ | Rt[μ | Ra[μ  | Rq[μ | Rsk   | Rku  | Rsm  | RΔq  | Rδc  | Rmr  | Rzjis | Ac[μ | As[μ | Alf[μ | File |
|    | ✓ 1     |      | 40.0 | 19.0 | 59.1 | 31.4 | 148. | 5.439 | 7.53 | 1.53  | 6.06 | 139. | 154. | 11.6 | 100. | 31.4  | 800. | 2.50 | -     | 191  |
|    | ✓ 2     |      | 56.8 | 38.4 | 95.3 | 36.1 | 209. | 5.510 | 9.63 | 2.89  | 18.4 | 125. | 182. | 11.7 | 100. | 36.1  | 800. | 2.50 | -     | 191  |
|    | ✓ 3     |      | 51.1 | 19.6 | 70.7 | 31.7 | 160. | 7.939 | 12.6 | 2.17  | 8.03 | 120. | 155. | 19.3 | 100. | 36.1  | 800. | 2.50 | -     | 191  |
|    | ✓ 4     |      | 44.6 | 17.6 | 62.2 | 34.5 | 192. | 8.426 | 11.6 | 1.59  | 5.15 | 132. | 139. | 16.4 | 100. | 34.5  | 800. | 2.50 | -     | 191  |
|    | ✓ 5     |      | 29.0 | 19.6 | 48.6 | 24.0 | 151. | 5.084 | 6.74 | 1.05  | 4.65 | 101. | 124. | 11.3 | 100. | 28.1  | 800. | 2.50 | -     | 191  |
|    | Count   |      | 5    | 5    | 5    | 5    | 5    | 5     | 5    | 5     | 5    | 5    | 5    | 5    | 5    | 5     | 5    | 5    | 5     | 5    |
|    | Average |      | 44.3 | 22.8 | 67.2 | 31.6 | 172. | 6.480 | 9.64 | 1.85  | 8.47 | 123. | 151. | 14.0 | 100. | 33.2  | -    | -    | -     | -    |
|    | Min.    |      | 29.0 | 17.6 | 48.6 | 24.0 | 148. | 5.084 | 6.74 | 1.05  | 4.65 | 101. | 124. | 11.3 | 100. | 28.1  | -    | -    | -     | -    |
|    | Max.    |      | 56.8 | 38.4 | 95.3 | 36.1 | 209. | 8.426 | 12.6 | 2.89  | 18.4 | 139. | 182. | 19.3 | 100. | 36.1  | -    | -    | -     | -    |
|    | Range   |      | 27.8 | 20.7 | 46.6 | 12.0 | 61.7 | 3.342 | 5.90 | 1.83  | 13.8 | 37.7 | 58.4 | 8.04 | 0.00 | 7.97  | -    | -    | -     | -    |
|    | σ       |      | 10.6 | 8.74 | 17.5 | 4.63 | 27.1 | 1.572 | 2.54 | 0.70  | 5.73 | 14.2 | 21.7 | 3.63 | 0.00 | 3.43  | -    | -    | -     | -    |
|    | 3σ      |      | 32.0 | 26.2 | 52.7 | 13.9 | 81.5 | 4.717 | 7.63 | 2.11  | 17.1 | 42.7 | 65.2 | 10.9 | 0.00 | 10.3  | -    | -    | -     | -    |

|           |                                     |      |      |      |      |      |       |        |      |       |      |      |      |      |      |       |      |      |      |      |   |
|-----------|-------------------------------------|------|------|------|------|------|-------|--------|------|-------|------|------|------|------|------|-------|------|------|------|------|---|
| <b>26</b> | No.                                 | Resu | Rp[μ | Rv[μ | Rz[μ | Rc[μ | Rt[μ  | Ra[μ   | Rq[μ | Rsk   | Rku  | Rsm  | RΔq  | Rδc  | Rmr  | Rzjis | λc[μ | λs[μ | λf[μ | File |   |
|           | <input checked="" type="checkbox"/> | 1    | 17.9 | 14.1 | 32.1 | 14.4 | 165.  | 2.953  | 3.92 | -0.04 | 4.78 | 248. | 98.8 | 5.85 | 100. | -     | 800. | 2.50 | -    | 191  |   |
|           | <input checked="" type="checkbox"/> | 2    | 13.0 | 14.4 | 27.5 | 11.6 | 161.  | 3.232  | 4.29 | -0.65 | 3.96 | 97.5 | 101. | 5.73 | 100. | -     | 800. | 2.50 | -    | 191  |   |
|           | <input checked="" type="checkbox"/> | 3    | 20.9 | 23.8 | 44.8 | 19.0 | 138.  | 4.547  | 6.22 | -0.95 | 4.80 | 110. | 112. | 9.85 | 100. | -     | 800. | 2.50 | -    | 191  |   |
|           | <input checked="" type="checkbox"/> | 4    | 72.4 | 21.4 | 93.9 | 22.9 | 217.  | 4.293  | 6.74 | 2.64  | 30.2 | 207. | 170. | 8.03 | 100. | -     | 800. | 2.50 | -    | 191  |   |
|           | <input checked="" type="checkbox"/> | 5    | 17.4 | 24.7 | 42.1 | 19.7 | 163.  | 3.928  | 5.37 | -1.04 | 6.08 | 77.3 | 122. | 8.98 | 100. | 26.4  | 800. | 2.50 | -    | 191  |   |
|           | Count                               |      | 5    | 5    | 5    | 5    | 5     | 5      | 5    | 5     | 5    | 5    | 5    | 5    | 5    | 5     | 1    | 5    | 5    | 5    | 5 |
|           | Average                             |      | 28.3 | 19.7 | 48.1 | 17.5 | 169.  | 3.791  | 5.31 | -0.01 | 9.97 | 148. | 121. | 7.69 | 100. | 26.4  | -    | -    | -    | -    |   |
|           | Min.                                |      | 13.0 | 14.1 | 27.5 | 11.6 | 138.  | 2.953  | 3.92 | -1.04 | 3.96 | 77.3 | 98.8 | 5.73 | 100. | 26.4  | -    | -    | -    | -    |   |
|           | Max.                                |      | 72.4 | 24.7 | 93.9 | 22.9 | 217.  | 4.547  | 6.74 | 2.64  | 30.2 | 248. | 170. | 9.85 | 100. | 26.4  | -    | -    | -    | -    |   |
|           | Range                               |      | 59.4 | 10.5 | 66.3 | 11.2 | 79.8  | 1.594  | 2.81 | 3.68  | 26.2 | 170. | 71.5 | 4.11 | 0.00 | 0.00  | -    | -    | -    | -    |   |
|           | σ                                   |      | 24.8 | 5.07 | 26.5 | 4.48 | 29.2  | 0.681  | 1.20 | 1.54  | 11.3 | 75.0 | 29.1 | 1.84 | 0.00 | 0.00  | -    | -    | -    | -    |   |
| 3σ        |                                     | 74.4 | 15.2 | 79.7 | 13.4 | 87.8 | 2.044 | 3.62   | 4.62 | 34.0  | 225. | 87.3 | 5.54 | 0.00 | 0.00 | -     | -    | -    | -    |      |   |
| <b>27</b> | No.                                 | Resu | Rp[μ | Rv[μ | Rz[μ | Rc[μ | Rt[μ  | Ra[μ   | Rq[μ | Rsk   | Rku  | Rsm  | RΔq  | Rδc  | Rmr  | Rzjis | λc[μ | λs[μ | λf[μ | File |   |
|           | <input checked="" type="checkbox"/> | 1    | 61.0 | 66.8 | 127. | 54.8 | 199.  | 10.658 | 15.7 | -1.11 | 5.98 | 161. | 263. | 19.4 | 100. | -     | 800. | 2.50 | -    | 191  |   |
|           | <input checked="" type="checkbox"/> | 2    | 59.3 | 45.3 | 104. | 34.4 | 164.  | 12.373 | 17.3 | 0.51  | 4.87 | 76.4 | 190. | 21.9 | 100. | 39.7  | 800. | 2.50 | -    | 191  |   |
|           | <input checked="" type="checkbox"/> | 3    | 72.5 | 17.8 | 90.3 | 39.3 | 173.  | 5.562  | 10.6 | 3.72  | 20.0 | 144. | 169. | 9.99 | 100. | 39.3  | 800. | 2.50 | -    | 191  |   |
|           | <input checked="" type="checkbox"/> | 4    | 34.2 | 42.0 | 76.2 | 44.9 | 163.  | 7.407  | 10.1 | 0.90  | 4.74 | 100. | 165. | 14.0 | 100. | 49.4  | 800. | 2.50 | -    | 191  |   |
|           | <input checked="" type="checkbox"/> | 5    | 41.1 | 16.4 | 57.5 | 37.2 | 160.  | 6.112  | 9.26 | 1.87  | 7.70 | 242. | 154. | 12.8 | 100. | -     | 800. | 2.50 | -    | 191  |   |
|           | Count                               |      | 5    | 5    | 5    | 5    | 5     | 5      | 5    | 5     | 5    | 5    | 5    | 5    | 5    | 3     | 5    | 5    | 5    | 5    |   |
|           | Average                             |      | 53.6 | 37.7 | 91.3 | 42.1 | 172.  | 8.422  | 12.6 | 1.18  | 8.67 | 145. | 188. | 15.6 | 100. | 42.8  | -    | -    | -    | -    |   |
|           | Min.                                |      | 34.2 | 16.4 | 57.5 | 34.4 | 160.  | 5.562  | 9.26 | -1.11 | 4.74 | 76.4 | 154. | 9.99 | 100. | 39.3  | -    | -    | -    | -    |   |
|           | Max.                                |      | 72.5 | 66.8 | 127. | 54.8 | 199.  | 12.373 | 17.3 | 3.72  | 20.0 | 242. | 263. | 21.9 | 100. | 49.4  | -    | -    | -    | -    |   |
|           | Range                               |      | 38.3 | 50.4 | 70.3 | 20.4 | 38.5  | 6.811  | 8.13 | 4.84  | 15.3 | 166. | 109. | 11.9 | 0.00 | 10.1  | -    | -    | -    | -    |   |
|           | σ                                   |      | 15.6 | 21.0 | 26.8 | 8.09 | 15.8  | 2.965  | 3.66 | 1.78  | 6.48 | 64.2 | 43.9 | 4.90 | 0.00 | 5.74  | -    | -    | -    | -    |   |
| 3σ        |                                     | 46.9 | 63.2 | 80.5 | 24.2 | 47.5 | 8.894 | 11.0   | 5.35 | 19.4  | 192. | 131. | 14.7 | 0.00 | 17.2 | -     | -    | -    | -    |      |   |

## Lampiran 4

### ISO 286 (Grade IT)

Provläsningsexemplar / Preview

ISO 286-2:2010(E)

Table 1 — Values of standard tolerance grades for nominal sizes up to 3 150 mm

NOTE This table, taken from ISO 286-1:2010, has been included in this part of ISO 286 to facilitate the use and understanding of the tables for limit deviations and of Figures 1 and 2.

| Nominal size |                     | Standard tolerance grades |     |     |     |     |     |     |     |     |     |     |      |       |      |      |      |      |      |      |      |
|--------------|---------------------|---------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|-------|------|------|------|------|------|------|------|
| mm           |                     | IT01                      | IT0 | IT1 | IT2 | IT3 | IT4 | IT5 | IT6 | IT7 | IT8 | IT9 | IT10 | IT11  | IT12 | IT13 | IT14 | IT15 | IT16 | IT17 | IT18 |
| Above        | Up to and including | Standard tolerance values |     |     |     |     |     |     |     |     |     |     |      |       |      |      |      |      |      |      |      |
|              |                     | µm                        |     |     |     |     |     |     |     |     | mm  |     |      |       |      |      |      |      |      |      |      |
| —            | 3                   | 0,3                       | 0,5 | 0,8 | 1,2 | 2   | 3   | 4   | 6   | 10  | 14  | 25  | 40   | 60    | 0,1  | 0,14 | 0,25 | 0,4  | 0,6  | 1    | 1,4  |
| 3            | 6                   | 0,4                       | 0,6 | 1   | 1,5 | 2,5 | 4   | 5   | 8   | 12  | 18  | 30  | 48   | 75    | 0,12 | 0,18 | 0,3  | 0,48 | 0,75 | 1,2  | 1,8  |
| 6            | 10                  | 0,4                       | 0,6 | 1   | 1,5 | 2,5 | 4   | 6   | 9   | 15  | 22  | 36  | 58   | 90    | 0,15 | 0,22 | 0,36 | 0,58 | 0,9  | 1,5  | 2,2  |
| 10           | 18                  | 0,5                       | 0,8 | 1,2 | 2   | 3   | 5   | 8   | 11  | 18  | 27  | 43  | 70   | 110   | 0,18 | 0,27 | 0,43 | 0,7  | 1,1  | 1,8  | 2,7  |
| 18           | 30                  | 0,6                       | 1   | 1,5 | 2,5 | 4   | 6   | 9   | 13  | 21  | 33  | 52  | 84   | 130   | 0,21 | 0,33 | 0,52 | 0,84 | 1,3  | 2,1  | 3,3  |
| 30           | 50                  | 0,6                       | 1   | 1,5 | 2,5 | 4   | 7   | 11  | 16  | 25  | 39  | 62  | 100  | 160   | 0,25 | 0,39 | 0,62 | 1    | 1,6  | 2,5  | 3,9  |
| 50           | 80                  | 0,8                       | 1,2 | 2   | 3   | 5   | 8   | 13  | 19  | 30  | 46  | 74  | 120  | 190   | 0,3  | 0,46 | 0,74 | 1,2  | 1,9  | 3    | 4,6  |
| 80           | 120                 | 1                         | 1,5 | 2,5 | 4   | 6   | 10  | 15  | 22  | 35  | 54  | 87  | 140  | 220   | 0,35 | 0,54 | 0,87 | 1,4  | 2,2  | 3,5  | 5,4  |
| 120          | 180                 | 1,2                       | 2   | 3,5 | 5   | 8   | 12  | 18  | 25  | 40  | 63  | 100 | 160  | 250   | 0,4  | 0,63 | 1    | 1,6  | 2,5  | 4    | 6,3  |
| 180          | 250                 | 2                         | 3   | 4,5 | 7   | 10  | 14  | 20  | 29  | 46  | 72  | 115 | 185  | 290   | 0,46 | 0,72 | 1,15 | 1,85 | 2,9  | 4,6  | 7,2  |
| 250          | 315                 | 2,5                       | 4   | 6   | 8   | 12  | 16  | 23  | 32  | 52  | 81  | 130 | 210  | 320   | 0,52 | 0,81 | 1,3  | 2,1  | 3,2  | 5,2  | 8,1  |
| 315          | 400                 | 3                         | 5   | 7   | 9   | 13  | 18  | 25  | 36  | 57  | 89  | 140 | 230  | 360   | 0,57 | 0,89 | 1,4  | 2,3  | 3,6  | 5,7  | 8,9  |
| 400          | 500                 | 4                         | 6   | 8   | 10  | 15  | 20  | 27  | 40  | 63  | 97  | 155 | 250  | 400   | 0,63 | 0,97 | 1,55 | 2,5  | 4    | 6,3  | 9,7  |
| 500          | 630                 |                           |     | 9   | 11  | 16  | 22  | 32  | 44  | 70  | 110 | 175 | 280  | 440   | 0,7  | 1,1  | 1,75 | 2,8  | 4,4  | 7    | 11   |
| 630          | 800                 |                           |     | 10  | 13  | 18  | 25  | 36  | 50  | 80  | 125 | 200 | 320  | 500   | 0,8  | 1,25 | 2    | 3,2  | 5    | 8    | 12,5 |
| 800          | 1 000               |                           |     | 11  | 15  | 21  | 28  | 40  | 56  | 90  | 140 | 230 | 360  | 560   | 0,9  | 1,4  | 2,3  | 3,6  | 5,6  | 9    | 14   |
| 1 000        | 1 250               |                           |     | 13  | 18  | 24  | 33  | 47  | 66  | 105 | 165 | 260 | 420  | 660   | 1,05 | 1,65 | 2,6  | 4,2  | 6,6  | 10,5 | 16,5 |
| 1 250        | 1 600               |                           |     | 15  | 21  | 29  | 39  | 55  | 78  | 125 | 195 | 310 | 500  | 780   | 1,25 | 1,95 | 3,1  | 5    | 7,8  | 12,5 | 19,5 |
| 1 600        | 2 000               |                           |     | 18  | 25  | 35  | 46  | 65  | 92  | 150 | 230 | 370 | 600  | 920   | 1,5  | 2,3  | 3,7  | 6    | 9,2  | 15   | 23   |
| 2 000        | 2 500               |                           |     | 22  | 30  | 41  | 55  | 78  | 110 | 175 | 280 | 440 | 700  | 1 100 | 1,75 | 2,8  | 4,4  | 7    | 11   | 17,5 | 28   |
| 2 500        | 3 150               |                           |     | 26  | 36  | 50  | 68  | 96  | 135 | 210 | 330 | 540 | 860  | 1 350 | 2,1  | 3,3  | 5,4  | 8,6  | 13,5 | 21   | 33   |

## Lampiran 5

### ISO 1302

ISO 1302:2002(E)

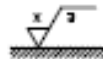


Figure I.1 — Positions “x” and “a”

#### I.3 Content of annex C of ISO 1302:1992

Table I.2 is a reproduction of Table C.1 from Informative annex C of ISO 1302:1992 — Itself taken from clause 4.1.5 of ISO 1302:1976 — and is given here for information... in order to avoid misinterpretation of numerical values and roughness grade numbers on drawings which are not yet in accordance with this edition of ISO 1302 ...”.

Table I.2 — Comparison of arithmetical mean deviation  $R_a$  and roughness grade numbers —  
(Table C.1 of ISO 1302:1992)

| Roughness value $R_a$ |                | Roughness grade numbers<br>(given in the previous edition of ISO 1302) |
|-----------------------|----------------|--|
| $\mu\text{m}$         | $\mu\text{in}$ |  |
| 50                    | 2 000          | N 12   |
| 25                    | 1 000          | N 11   |
| 12,5                  | 500            | N 10   |
| 6,3                   | 250            | N 9  |
| 3,2                   | 125            | N 8  |
| 1,6                   | 63             | N 7  |
| 0,8                   | 32             | N 6  |
| 0,4                   | 16             | N 5  |
| 0,2                   | 8              | N 4  |
| 0,1                   | 4              | N 3  |
| 0,05                  | 2              | N 2  |
| 0,025                 | 1              | N 1  |



# Lampiran 6

## Spesifikasi Pahat

### Gstar 555 Series

MICRO GRAIN CARBIDE END MILLS - Square Type - 2F

#### EPS-FC2

#### EPS-SC2

| Order No.    | Dis  | CL | OAL | Shank | Flute |
|--------------|------|----|-----|-------|-------|
| EPSTC201000T | 1.0  | 3  | 50  | 3     | 2     |
| EPSTC201500T | 1.5  | 4  | 50  | 3     | 2     |
| EPSTC202000T | 2.0  | 5  | 50  | 3     | 2     |
| EPSTC203000T | 3.0  | 8  | 50  | 3     | 2     |
| EPSTC201000T | 1.0  | 3  | 50  | 4     | 2     |
| EPSTC201500T | 1.5  | 4  | 50  | 4     | 2     |
| EPSTC202000T | 2.0  | 5  | 50  | 4     | 2     |
| EPSTC202500T | 2.5  | 6  | 50  | 4     | 2     |
| EPSTC203000T | 3.0  | 8  | 50  | 4     | 2     |
| EPSTC203500T | 3.5  | 9  | 50  | 4     | 2     |
| EPSTC204000T | 4.0  | 10 | 50  | 4     | 2     |
| EPSSC201000T | 1.0  | 3  | 50  | 6     | 2     |
| EPSSC202000T | 2.0  | 5  | 50  | 6     | 2     |
| EPSSC203000T | 3.0  | 8  | 50  | 6     | 2     |
| EPSSC203500T | 3.5  | 9  | 50  | 6     | 2     |
| EPSSC204000T | 4.0  | 10 | 50  | 6     | 2     |
| EPSSC204500T | 4.5  | 11 | 50  | 6     | 2     |
| EPSSC205000T | 5.0  | 13 | 50  | 6     | 2     |
| EPSSC205500T | 5.5  | 14 | 50  | 6     | 2     |
| EPSSC206000T | 6.0  | 15 | 50  | 6     | 2     |
| EPSSC206500T | 6.5  | 16 | 60  | 8     | 2     |
| EPSSC207000T | 7.0  | 18 | 60  | 8     | 2     |
| EPSSC208000T | 8.0  | 20 | 60  | 8     | 2     |
| EPSSC209000T | 9.0  | 22 | 75  | 10    | 2     |
| EPSSC210000T | 10.0 | 25 | 75  | 10    | 2     |
| EPSSC211000T | 11.0 | 25 | 75  | 12    | 2     |
| EPSSC212000T | 12.0 | 30 | 75  | 12    | 2     |
| EPSSC214000T | 14.0 | 30 | 75  | 14    | 2     |
| EPSSC216000T | 16.0 | 35 | 100 | 16    | 2     |
| EPSSC218000T | 18.0 | 40 | 100 | 20    | 2     |
| EPSSC220000T | 20.0 | 45 | 100 | 20    | 2     |
| EPSSC225000T | 25.0 | 45 | 100 | 25    | 2     |

| WORKING MATERIAL | ALLOY STEEL (AISI 52100) | ALLOY STEEL (S50C, S45C) | 4140 (4140) TOOL STEEL | HARDENED STEEL | STAINLESS STEEL | ALUM. (6061) |
|------------------|--------------------------|--------------------------|------------------------|----------------|-----------------|--------------|
| MATERIAL GROUP   | HRc 52-55                | HRc 47-50                | HRc 50-55              | HRc 45-55      | —               | —            |
| Vf               | 0.05mm                   | 0.05mm                   | 0.05mm                 | 0.05mm         | 0.05mm          | 0.05mm       |

| DIAMETER | RPM   | FEED (mm/min) | Vc (m/min) | Fz (mm/tooth) | SFM   | FFR (mm/tooth) | RFW (mm) | FEED (mm/min) | RPM    | FEED (mm/min) | Vc (m/min) | FFR (mm/tooth) |
|----------|-------|---------------|------------|---------------|-------|----------------|----------|---------------|--------|---------------|------------|----------------|
| 1MM      | 25000 | 180           | 1700       | 140           | 14.00 | 100            | 8.00     | 40            | 15,000 | 185           | 25,200     | 140            |
| 2MM      | 12500 | 220           | 8400       | 180           | 7.00  | 0              | 4.320    | 40            | 8,040  | 185           | 12,800     | 170            |
| 3MM      | 7500  | 270           | 5700       | 175           | 4.680 | 20             | 5.020    | 50            | 5,700  | 200           | 8,040      | 160            |
| 4MM      | 5400  | 300           | 4300       | 170           | 3.900 | 20             | 2.780    | 50            | 4,300  | 205           | 6,450      | 150            |
| 5MM      | 4300  | 320           | 3170       | 170           | 2.950 | 20             | 1.820    | 50            | 3,400  | 205           | 5,040      | 140            |
| 6MM      | 3500  | 360           | 2400       | 170           | 2.340 | 20             | 1.440    | 50            | 2,880  | 205           | 4.350      | 130            |
| 8MM      | 2,700 | 380           | 1,800      | 170           | 1.800 | 20             | 1.080    | 50            | 2,180  | 205           | 3,200      | 120            |
| 10MM     | 2,180 | 380           | 1,410      | 170           | 1.440 | 20             | 870      | 50            | 1,710  | 205           | 2,510      | 110            |
| 12MM     | 1,800 | 380           | 1,140      | 170           | 1.070 | 190            | 720      | 50            | 1,440  | 200           | 2,150      | 110            |
| 14MM     | 1,500 | 300           | 1,260      | 150           | 1,140 | 105            | 720      | 50            | 1,300  | 200           | 2,000      | 105            |
| 16MM     | 1,280 | 300           | 1,100      | 140           | 1,000 | 105            | 650      | 60            | 1,100  | 190           | 1,900      | 100            |
| 18MM     | 1,180 | 305           | 1,020      | 140           | 850   | 100            | 620      | 60            | 1,080  | 190           | 1,800      | 100            |
| 20MM     | 1,200 | 260           | 880        | 140           | 800   | 120            | 480      | 60            | 980    | 200           | 1,500      | 100            |

| d (mm)     | tolerance (mm) |
|------------|----------------|
| φ < 3      | 0 ~ -0.02      |
| 3 ≤ φ ≤ 10 | 0 ~ -0.03      |
| φ > 10     | 0 ~ -0.04      |

|                     |   |
|---------------------|---|
| Finishing (精削)      | ○ |
| Semi-Finishing (中削) | ○ |
| Roughing (粗削)       | ○ |

Milling Amount (mm)

Milling Amount (mm)

The Feed & RPM may be changed depending on the MC Conditions, Lubricating & Cooling systems.

17 | GENERAL PURPOSE

## Lampiran 7

### Foto Kegiatan Penelitian



**Gambar 1.** Proses Penyiapan Cetakan pengolesan Wax



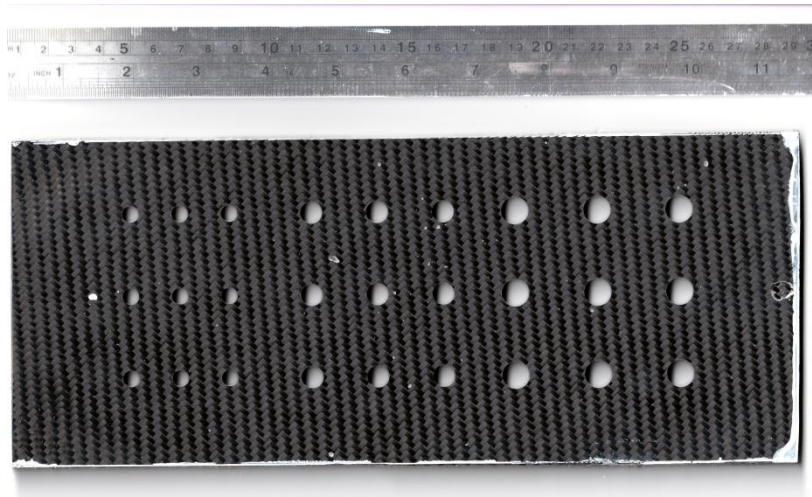
**Gambar 2.** Proses Penuangan resin



**Gambar 3.** Proses Press Hidrolik Material Komposit



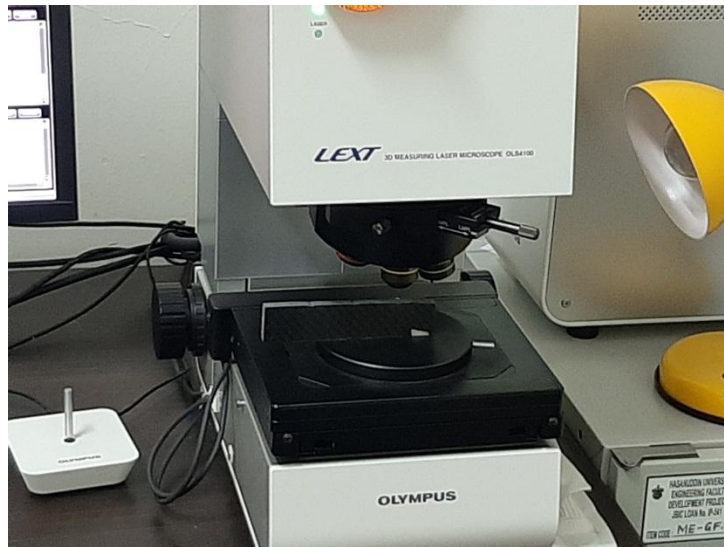
**Gambar 4.** Proses pembukaan cetakan spesimen



**Gambar 5.** spesimen CFRP



**Gambar 6.** Proses Milling (CNC)



**Gambar 7.** Proses pengujian Kekasaran Material Komposit

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