**Table 1.** Insulators parameters.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter | Symbol | Porcelain | Glass | SIR |
| Leakage distance | *Insulator length* | 32 | 34 | 40 |
| High | *H (cm)* | 14.6 | 14.6 | 33 |
| Diameter | *D(cm)* | 25.5 | 28 | 10 |
| Rib diameters | *d1(cm)* | 19.5 | 22.5 | - |
| *d2(cm)* | 14.5 | 16 | - |
| *d3(cm)* | 10.5 | 8 | - |
| Core diameter | *dc(cm)* | 5 | 5 | 8 |

**Table 2.** Pollution severity readings.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameters | Values | | | |
| *σ20*(S/m) | 0.00 | 0.39 | 0.79 | 1.38 |
| SDD (mg/cm2) | 0.00 | 0.05 | 0.12 | 0.20 |
| NSDD (mg/cm2) | 0.00 | 0.15 | 0.25 | 0.35 |
| Wt (l/h) | 0 | 3 | 6 | 9 |
| Contamination level | Clean | Light | Medium | Heavy |

e current under pollution grading

**Table 3.** Leakage current components for different pollution levels under uniform pollution distribution.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  | *Porcelain insulator* | | | | | | | *Glass insulator* | | | | | | | *Polymer insulator* | | | | | | |
| *SDD* | *NSDD* | Wt | *Im* | 3rd | 5th | 7th | 9th | THD | *ϕ* | *Im* | 3rd | 5th | 7th | 9th | THD | *ϕ* | *Im* | 3rd | 5th | 7th | 9th | THD | *ϕ* |
| 0.00 | 0 | 0 | 0.183 | 0.0005 | 0.002 | 0 | 0.002 | 6.76 | 90 | 0.162 | 0.0006 | 0.001 | 0.001 | 0.002 | 6.44 | 89.6 | 0.158 | 0.0004 | 0.003 | 0 | 0.001 | 6.53 | 90 |
| 0.15 | 0 | 0.20 | 0.0006 | 0.003 | 0.001 | 0.0005 | 6.82 | 90 | 0.193 | 0.0005 | 0.002 | 0.001 | 0.0006 | 6.77 | 89.3 | 0.187 | 0.0005 | 0.004 | 0.0007 | 0.0006 | 6.41 | 90 |
| 3 | 0.44 | 0.003 | 0.0151 | 0.03 | 0.0008 | 7.43 | 87.2 | 0.322 | 0.004 | 0.0147 | 0.02 | 0.0007 | 7.23 | 87.6 | 0.268 | 0.005 | 0.017 | 0.03 | 0.0005 | 7.17 | 87.4 |
| 6 | 0.72 | 0.004 | 0.0127 | 0.008 | 0.0007 | 7.52 | 87.13 | 0.96 | 0.005 | 0.0125 | 0.006 | 0.001 | 7.48 | 87.17 | 0.70 | 0.004 | 0.012 | 0.009 | 0.0004 | 7.46 | 87.11 |
| 9 | 0.90 | 0.007 | 0.017 | 0.01 | 0.006 | 8.04 | 86.01 | 0.84 | 0.007 | 0.022 | 0.007 | 0.004 | 7.85 | 85.73 | 0.76 | 0.009 | 0.023 | 0.008 | 0.006 | 8.11 | 84.91 |
| 0.25 | 0 | 0.22 | 0.003 | 0.014 | 0.002 | 0.002 | 6.95 | 88.98 | 0.18 | 0.004 | 0.016 | 0.001 | 0.003 | 6.84 | 88.87 | 0.16 | 0.002 | 0.011 | 0.003 | 0.001 | 6.78 | 88.91 |
| 3 | 0.67 | 0.01 | 0.041 | 0.005 | 0.006 | 7.93 | 87.25 | 0.60 | 0.008 | 0.038 | 0.004 | 0.004 | 7.87 | 87.11 | 0.56 | 0.007 | 0.031 | 0.006 | 0.004 | 7.75 | 87.02 |
| 6 | 0.87 | 0.0108 | 0.04 | 0.008 | 0.007 | 7.99 | 87.34 | 0.83 | 0.012 | 0.03 | 0.01 | 0.005 | 7.72 | 87.03 | 0.75 | 0.01 | 0.02 | 0.006 | 0.008 | 7.55 | 86.85 |
| 9 | 0.97 | 0.017 | 0.06 | 0.01 | 0.008 | 8.38 | 86.45 | 0.93 | 0.016 | 0.05 | 0.011 | 0.008 | 7.8 | 86.05 | 0.88 | 0.015 | 0.05 | 0.008 | 0.009 | 8.12 | 86.14 |
| 0.35 | 0 | 0.41 | 0.0058 | 0.012 | 0.009 | 0.009 | 7.31 | 88.26 | 0.398 | 0.006 | 0.012 | 0.009 | 0.009 | 7.09 | 85.689 | 0.373 | 0.005 | 0.011 | 0.008 | 0.008 | 6.645 | 80.236 |
| 3 | 0.74 | 0.018 | 0.06 | 0.005 | 0.003 | 8.4 | 86.06 | 0.718 | 0.017 | 0.058 | 0.005 | 0.003 | 8.15 | 83.553 | 0.673 | 0.016 | 0.055 | 0.005 | 0.003 | 7.636 | 78.236 |
| 6 | 0.91 | 0.02 | 0.0635 | 0.006 | 0.005 | 8.62 | 85.44 | 0.883 | 0.019 | 0.062 | 0.006 | 0.005 | 8.36 | 82.951 | 0.827 | 0.018 | 0.058 | 0.005 | 0.005 | 7.836 | 77.673 |
| 9 | 1.05 | 0.033 | 0.073 | 0.007 | 0.009 | 8.73 | 85.04 | 1.019 | 0.032 | 0.071 | 0.007 | 0.009 | 8.47 | 82.563 | 0.955 | 0.030 | 0.066 | 0.006 | 0.008 | 7.936 | 77.309 |
| 0.05 | 0.15 | 0 | 0.522 | 0.009 | 0.043 | 0.009 | 0.004 | 8.21 | 82.2 | 0.507 | 0.009 | 0.042 | 0.009 | 0.004 | 7.97 | 79.806 | 0.475 | 0.008 | 0.039 | 0.008 | 0.004 | 7.464 | 74.727 |
| 3 | 0.9 | 0.125 | 0.32 | 0.06 | 0.03 | 10.23 | 79.31 | 0.874 | 0.121 | 0.311 | 0.062 | 0.029 | 9.93 | 77.000 | 0.818 | 0.114 | 0.32 | 0.055 | 0.027 | 9.300 | 72.100 |
| 6 | 1.19 | 0.136 | 0.3 | 0.083 | 0.04 | 11.29 | 67.5 | 1.155 | 0.132 | 0.291 | 0.081 | 0.039 | 10.961 | 65.534 | 1.082 | 0.124 | 0.273 | 0.075 | 0.036 | 10.264 | 61.364 |
| 9 | 1.57 | 0.18 | 0.36 | 0.092 | 0.077 | 14.42 | 57.61 | 1.524 | 0.175 | 0.350 | 0.089 | 0.075 | 14.000 | 55.932 | 1.427 | 0.164 | 0.327 | 0.084 | 0.070 | 13.109 | 52.373 |
| 0.25 | 0 | 0.73 | 0.014 | 0.056 | 0.008 | 0.007 | 8.901 | 80.75 | 0.709 | 0.014 | 0.054 | 0.008 | 0.007 | 8.642 | 78.398 | 0.664 | 0.013 | 0.051 | 0.007 | 0.006 | 8.092 | 73.409 |
| 3 | 1.23 | 0.142 | 0.231 | 0.085 | 0.066 | 10.89 | 66.21 | 1.194 | 0.138 | 0.224 | 0.083 | 0.064 | 10.573 | 64.282 | 1.118 | 0.129 | 0.210 | 0.077 | 0.060 | 9.900 | 60.191 |
| 6 | 1.49 | 0.167 | 0.23 | 0.14 | 0.07 | 12.85 | 54.25 | 1.447 | 0.162 | 0.223 | 0.136 | 0.068 | 12.47 | 52.670 | 1.355 | 0.152 | 0.209 | 0.127 | 0.064 | 11.682 | 49.318 |
| 9 | 1.84 | 0.179 | 0.231 | 0.15 | 0.08 | 15.03 | 42.66 | 1.786 | 0.174 | 0.224 | 0.146 | 0.078 | 14.59 | 41.417 | 1.673 | 0.163 | 0.210 | 0.136 | 0.073 | 13.664 | 38.782 |
| 0.35 | 0 | 0.91 | 0.018 | 0.065 | 0.013 | 0.01 | 9.631 | 78.32 | 0.883 | 0.017 | 0.063 | 0.013 | 0.010 | 9.350 | 76.039 | 0.827 | 0.016 | 0.059 | 0.012 | 0.009 | 8.755 | 71.200 |
| 3 | 1.63 | 0.19 | 0.252 | 0.102 | 0.056 | 13.34 | 56.21 | 1.583 | 0.184 | 0.245 | 0.099 | 0.054 | 12.95 | 54.573 | 1.482 | 0.173 | 0.229 | 0.093 | 0.051 | 12.127 | 51.100 |
| 6 | 2.04 | 0.22 | 0.24 | 0.14 | 0.09 | 15.77 | 40.13 | 1.981 | 0.214 | 0.233 | 0.136 | 0.087 | 15.31 | 38.961 | 1.855 | 0.200 | 0.218 | 0.127 | 0.082 | 14.336 | 36.482 |
| 9 | 2.61 | 0.261 | 0.32 | 0.12 | 0.11 | 18.84 | 33.22 | 2.534 | 0.253 | 0.311 | 0.117 | 0.107 | 18.29 | 32.252 | 2.373 | 0.237 | 0.291 | 0.109 | 0.100 | 17.127 | 30.200 |
| 0.12 | 0.15 | 0 | 0.636 | 0.022 | 0.072 | 0.011 | 0.008 | 8.21 | 71.2 | 0.617 | 0.021 | 0.070 | 0.011 | 0.008 | 7.971 | 69.126 | 0.578 | 0.020 | 0.065 | 0.010 | 0.007 | 7.464 | 64.727 |
| 3 | 1.48 | 0.31 | 0.27 | 0.04 | 0.05 | 15.33 | 55.21 | 1.437 | 0.320 | 0.262 | 0.039 | 0.078 | 14.883 | 53.602 | 1.385 | 0.33 | 0.245 | 0.04 | 0.073 | 13.936 | 50.191 |
| 6 | 1.63 | 0.41 | 0.32 | 0.062 | 0.12 | 18.88 | 38.53 | 1.583 | 0.398 | 0.311 | 0.060 | 0.117 | 18.330 | 37.408 | 1.482 | 0.373 | 0.291 | 0.056 | 0.109 | 17.164 | 35.027 |
| 9 | 1.93 | 0.46 | 0.41 | 0.095 | 0.08 | 23.25 | 27.16 | 1.874 | 0.447 | 0.398 | 0.092 | 0.078 | 22.573 | 26.369 | 1.755 | 0.418 | 0.373 | 0.086 | 0.073 | 21.136 | 24.691 |
| 0.25 | 0 | 0.75 | 0.032 | 0.084 | 0.013 | 0.021 | 9.88 | 75.89 | 0.728 | 0.031 | 0.082 | 0.013 | 0.020 | 9.592 | 73.680 | 0.682 | 0.029 | 0.076 | 0.012 | 0.019 | 8.982 | 68.991 |
| 3 | 1.72 | 0.35 | 0.31 | 0.104 | 0.09 | 21.74 | 52.52 | 1.670 | 0.340 | 0.301 | 0.101 | 0.087 | 21.107 | 50.990 | 1.564 | 0.318 | 0.282 | 0.095 | 0.082 | 19.764 | 47.745 |
| 6 | 1.96 | 0.53 | 0.37 | 0.11 | 0.098 | 25.25 | 30.22 | 1.903 | 0.515 | 0.359 | 0.107 | 0.095 | 24.515 | 29.340 | 1.782 | 0.482 | 0.336 | 0.100 | 0.089 | 22.955 | 27.473 |
| 9 | 2.34 | 0.57 | 0.41 | 0.13 | 0.11 | 31.97 | 25.12 | 2.272 | 0.553 | 0.398 | 0.126 | 0.107 | 31.039 | 24.388 | 2.127 | 0.518 | 0.373 | 0.118 | 0.100 | 29.064 | 22.836 |
| 0.35 | 0 | 0.94 | 0.041 | 0.088 | 0.031 | 0.023 | 9.91 | 70.43 | 0.913 | 0.040 | 0.085 | 0.030 | 0.022 | 9.621 | 68.379 | 0.855 | 0.037 | 0.080 | 0.028 | 0.021 | 9.009 | 64.027 |
| 3 | 1.98 | 0.56 | 0.36 | 0.13 | 0.16 | 30.51 | 39.66 | 1.922 | 0.544 | 0.350 | 0.126 | 0.155 | 29.621 | 38.505 | 1.800 | 0.509 | 0.327 | 0.118 | 0.145 | 27.736 | 36.055 |
| 6 | 2.04 | 0.72 | 0.41 | 0.15 | 0.13 | 34.63 | 20.63 | 1.981 | 0.699 | 0.398 | 0.146 | 0.126 | 33.621 | 20.029 | 1.855 | 0.655 | 0.373 | 0.136 | 0.118 | 31.482 | 18.755 |
| 9 | 2.61 | 0.62 | 0.42 | 0.17 | 0.18 | 42.04 | 14.95 | 2.534 | 0.602 | 0.408 | 0.165 | 0.175 | 40.816 | 14.515 | 2.373 | 0.564 | 0.382 | 0.155 | 0.164 | 38.218 | 13.591 |
| 0.2 | 0.15 | 0 | 0.842 | 0.053 | 0.096 | 0.045 | 0.032 | 9.92 | 56.84 | 0.817 | 0.051 | 0.093 | 0.044 | 0.031 | 9.631 | 55.184 | 0.765 | 0.048 | 0.087 | 0.041 | 0.029 | 9.018 | 51.673 |
| 3 | 2.64 | 0.96 | 0.28 | 0.21 | 0.15 | 36.56 | 32.12 | 2.563 | 0.97 | 0.272 | 0.25 | 0.146 | 35.495 | 31.184 | 2.400 | 0.873 | 0.255 | 0.191 | 0.136 | 33.236 | 29.200 |
| 6 | 2.94 | 0.99 | 0.23 | 0.26 | 0.11 | 41.32 | 17.58 | 2.854 | 0.961 | 0.223 | 0.252 | 0.107 | 40.117 | 17.068 | 2.673 | 0.900 | 0.209 | 0.236 | 0.100 | 37.564 | 15.982 |
| 9 | 3.65 | 1.087 | 0.23 | 0.27 | 0.13 | 43.77 | 11.56 | 3.544 | 1.055 | 0.223 | 0.262 | 0.126 | 42.495 | 11.223 | 3.318 | 0.988 | 0.209 | 0.245 | 0.118 | 39.791 | 10.509 |
| 0.25 | 0 | 1.03 | 0.062 | 0.1 | 0.063 | 0.032 | 10.78 | 42.54 | 1.000 | 0.060 | 0.097 | 0.061 | 0.031 | 10.466 | 41.301 | 0.936 | 0.056 | 0.091 | 0.057 | 0.029 | 9.800 | 38.673 |
| 3 | 2.93 | 0.95 | 0.28 | 0.21 | 0.11 | 45.63 | 26.45 | 2.845 | 0.922 | 0.272 | 0.204 | 0.107 | 44.301 | 25.680 | 2.664 | 0.864 | 0.255 | 0.191 | 0.100 | 41.482 | 24.045 |
| 6 | 3.29 | 1.09 | 0.27 | 0.23 | 0.12 | 47.84 | 10.73 | 3.194 | 1.058 | 0.262 | 0.223 | 0.117 | 46.447 | 10.417 | 2.991 | 0.991 | 0.245 | 0.209 | 0.109 | 43.491 | 9.755 |
| 9 | 3.99 | 1.3 | 0.32 | 0.24 | 0.12 | 53.79 | 1.04 | 3.874 | 1.262 | 0.311 | 0.233 | 0.117 | 52.223 | 1.010 | 3.627 | 1.182 | 0.291 | 0.218 | 0.109 | 48.900 | 0.945 |
| 0.35 | 0 | 1.07 | 0.065 | 0.102 | 0.048 | 0.05 | 10.63 | 32.84 | 1.039 | 0.063 | 0.099 | 0.047 | 0.049 | 10.320 | 31.883 | 0.973 | 0.059 | 0.093 | 0.044 | 0.045 | 9.664 | 29.855 |
| 3 | 3.54 | 1.392 | 0.3 | 0.12 | 0.15 | 51.67 | 3.92 | 3.437 | 1.351 | 0.291 | 0.117 | 0.146 | 50.165 | 3.806 | 3.218 | 1.265 | 0.273 | 0.109 | 0.136 | 46.973 | 3.564 |
| 6 | 5.24 | 1.62 | 0.35 | 0.21 | 0.12 | 59.29 | 2.07 | 5.087 | 1.573 | 0.340 | 0.204 | 0.117 | 57.563 | 2.010 | 4.764 | 1.473 | 0.318 | 0.191 | 0.109 | 53.900 | 1.882 |
| 9 | 6.51 | 1.79 | 0.27 | 0.13 | 0.17 | 60.86 | 0.83 | 6.320 | 1.738 | 0.262 | 0.126 | 0.165 | 59.087 | 0.806 | 5.918 | 1.627 | 0.245 | 0.118 | 0.155 | 55.327 | 0.755 |

**Table 4.** Flashover experimental results under different conditions for porcelain, glass, and SiR insulators.

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Insulator type | | | Porcelain | | | Glass | | | SIR | | |
| Pu/PL | NSDD | Wt  SDD | 3.00 | 6.00 | 9.00 | 3.00 | 6.00 | 9.00 | 3.00 | 6.00 | 9.00 |
| 1/1 | 0.15 | 0.05 | 24.12 | 19.61 | 18.33 | 25.76 | 20.95 | 19.58 | 28.65 | 23.29 | 21.77 |
|  | 0.12 | 18.89 | 15.36 | 14.35 | 20.18 | 16.40 | 15.33 | 22.43 | 18.24 | 17.05 |
|  | 0.2 | 13.81 | 11.23 | 10.49 | 14.75 | 11.99 | 11.21 | 16.40 | 13.33 | 12.46 |
| 0.25 | 0.05 | 21.97 | 18.31 | 16.55 | 23.46 | 19.55 | 17.67 | 26.09 | 21.74 | 19.65 |
|  | 0.12 | 17.20 | 13.80 | 12.00 | 18.37 | 14.74 | 12.82 | 20.43 | 16.39 | 14.25 |
|  | 0.2 | 12.57 | 10.08 | 9.02 | 13.43 | 10.77 | 9.63 | 14.93 | 11.97 | 10.71 |
| 0.35 | 0.05 | 20.58 | 16.73 | 15.64 | 21.98 | 17.87 | 16.70 | 24.44 | 19.87 | 18.57 |
|  | 0.12 | 15.52 | 12.62 | 11.79 | 16.57 | 13.47 | 12.59 | 18.43 | 14.98 | 14.00 |
|  | 0.2 | 11.34 | 9.22 | 8.61 | 12.11 | 9.84 | 9.20 | 13.46 | 10.94 | 10.23 |
| 1/3 | 0.15 | 0.05 | 26.53 | 21.57 | 20.16 | 28.34 | 23.04 | 21.53 | 31.51 | 25.62 | 23.94 |
|  | 0.12 | 20.78 | 16.89 | 15.79 | 22.19 | 18.04 | 16.86 | 24.68 | 20.06 | 18.75 |
|  | 0.2 | 15.19 | 12.35 | 11.54 | 16.22 | 13.19 | 12.33 | 18.04 | 14.67 | 13.71 |
| 0.25 | 0.05 | 24.16 | 20.14 | 17.08 | 25.80 | 21.51 | 18.24 | 28.69 | 23.91 | 20.28 |
|  | 0.12 | 18.92 | 15.18 | 13.11 | 20.21 | 16.22 | 14.00 | 22.47 | 18.03 | 15.57 |
|  | 0.2 | 13.83 | 11.09 | 9.83 | 14.77 | 11.85 | 10.50 | 16.43 | 13.17 | 11.67 |
| 0.35 | 0.05 | 22.64 | 18.40 | 17.20 | 24.18 | 19.66 | 18.37 | 26.88 | 21.86 | 20.43 |
|  | 0.12 | 17.07 | 13.88 | 12.97 | 18.23 | 14.82 | 13.85 | 20.27 | 16.48 | 15.40 |
|  | 0.2 | 12.47 | 10.14 | 9.47 | 13.32 | 10.83 | 10.12 | 14.81 | 12.04 | 11.25 |
| 1/5 | 0.15 | 0.05 | 28.24 | 22.96 | 21.46 | 30.16 | 24.52 | 22.92 | 33.54 | 27.27 | 25.48 |
|  | 0.12 | 20.94 | 17.03 | 15.91 | 22.37 | 18.18 | 16.99 | 24.87 | 20.22 | 18.90 |
|  | 0.2 | 15.55 | 12.64 | 11.81 | 16.61 | 13.50 | 12.62 | 18.47 | 15.01 | 14.03 |
| 0.25 | 0.05 | 25.72 | 21.53 | 18.64 | 27.46 | 23.00 | 19.91 | 30.54 | 25.57 | 22.14 |
|  | 0.12 | 19.07 | 15.81 | 12.93 | 20.37 | 16.89 | 13.81 | 22.65 | 18.78 | 15.36 |
|  | 0.2 | 14.16 | 11.92 | 9.91 | 15.12 | 12.73 | 10.58 | 16.81 | 14.16 | 11.77 |
| 0.35 | 0.05 | 23.52 | 19.12 | 17.87 | 25.12 | 20.42 | 19.08 | 27.93 | 22.71 | 21.22 |
|  | 0.12 | 16.82 | 13.67 | 12.78 | 17.96 | 14.60 | 13.65 | 19.97 | 16.24 | 15.18 |
|  | 0.2 | 12.58 | 10.23 | 9.56 | 13.43 | 10.92 | 10.21 | 14.94 | 12.15 | 11.35 |
| 1/8 | 0.15 | 0.05 | 30.50 | 24.80 | 23.17 | 32.57 | 26.48 | 24.75 | 36.22 | 29.45 | 27.52 |
|  | 0.12 | 22.62 | 18.39 | 17.19 | 24.16 | 19.64 | 18.35 | 26.86 | 21.84 | 20.41 |
|  | 0.2 | 16.79 | 13.65 | 12.76 | 17.93 | 14.58 | 13.63 | 19.94 | 16.21 | 15.15 |
| 0.25 | 0.05 | 27.77 | 23.25 | 19.99 | 29.66 | 24.84 | 21.35 | 32.98 | 27.62 | 23.74 |
|  | 0.12 | 20.60 | 17.08 | 13.89 | 22.00 | 18.24 | 14.83 | 24.46 | 20.28 | 16.50 |
|  | 0.2 | 15.29 | 12.88 | 10.62 | 16.33 | 13.75 | 11.35 | 18.16 | 15.29 | 12.62 |
| 0.35 | 0.05 | 25.40 | 20.65 | 19.30 | 27.13 | 22.05 | 20.61 | 30.16 | 24.52 | 22.92 |
|  | 0.12 | 18.16 | 14.77 | 13.80 | 19.40 | 15.77 | 14.74 | 21.57 | 17.54 | 16.39 |
|  |  | 0.2 | 13.43 | 10.06 | 8.963 | 15.12 | 12.31 | 9.62 | 16.83 | 14.28 | 10.36 |

**Table 5.** LC indicators under various SDD, wetting rate Wt and NSDD for non-uniform polluted porcelain insulator.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Pu/PL | | | *1/3* | | | | | | *1/5* | | | | | | *1/8* | | | | | |
| SDD  mg/cm2 | NSDD  mg/cm2 | Wt  l/h | *C1* | *C2* | *C3* | *C4* | *C5* | *C6* | *C1* | *C2* | *C3* | *C4* | *C5* | *C6* | *C1* | *C2* | *C3* | *C4* | *C5* | *C6* |
| 0.05 | 0.15 | 0 | 0.44 | 88.48 | 0.15 | 1.49 | 8.33 | 7.27 | 0.39 | 90.25 | 0.14 | 1.49 | 8.29 | 8.80 | 0.36 | 90.52 | 0.14 | 1.48 | 8.20 | 9.39 |
| 3 | 0.76 | 85.37 | 0.39 | 1.59 | 10.38 | 3.57 | 0.66 | 87.07 | 0.38 | 1.59 | 10.32 | 3.69 | 0.62 | 87.33 | 0.38 | 1.58 | 10.22 | 3.89 |
| 6 | 1.00 | 72.66 | 0.82 | 1.63 | 11.45 | 3.32 | 0.88 | 74.11 | 0.80 | 1.62 | 11.40 | 3.50 | 0.82 | 74.33 | 0.80 | 1.62 | 11.28 | 3.67 |
| 9 | 1.33 | 62.01 | 1.08 | 1.64 | 14.63 | 3.18 | 1.16 | 63.25 | 1.07 | 1.64 | 14.56 | 3.21 | 1.08 | 63.44 | 1.06 | 1.63 | 14.40 | 3.61 |
| 0.25 | 0 | 0.63 | 86.91 | 0.31 | 1.65 | 9.03 | 7.15 | 0.54 | 88.66 | 0.31 | 1.65 | 8.99 | 8.23 | 0.51 | 88.92 | 0.31 | 1.64 | 8.89 | 8.59 |
| 3 | 1.06 | 71.27 | 0.72 | 1.62 | 11.05 | 2.95 | 0.92 | 72.69 | 0.72 | 1.62 | 10.99 | 3.09 | 0.86 | 72.91 | 0.71 | 1.61 | 10.88 | 3.22 |
| 6 | 1.27 | 58.39 | 1.12 | 1.63 | 13.04 | 2.81 | 1.12 | 59.57 | 1.11 | 1.63 | 12.97 | 2.93 | 1.05 | 59.74 | 1.10 | 1.62 | 12.83 | 3.16 |
| 9 | 1.58 | 45.92 | 3.23 | 1.65 | 15.25 | 2.79 | 1.78 | 46.84 | 2.21 | 1.64 | 15.17 | 2.96 | 1.29 | 46.97 | 3.18 | 1.64 | 15.02 | 2.96 |
| 0.35 | 0 | 0.77 | 84.30 | 0.54 | 1.66 | 9.77 | 6.53 | 0.68 | 85.98 | 0.54 | 1.66 | 9.72 | 7.75 | 0.63 | 86.24 | 0.53 | 1.65 | 9.62 | 8.67 |
| 3 | 1.39 | 60.51 | 0.91 | 1.63 | 13.53 | 2.28 | 1.21 | 61.71 | 0.91 | 1.62 | 13.47 | 2.47 | 1.13 | 61.90 | 0.90 | 1.62 | 13.32 | 2.59 |
| 6 | 1.73 | 43.19 | 3.17 | 1.64 | 16.00 | 2.30 | 1.52 | 44.06 | 3.16 | 1.64 | 15.92 | 2.52 | 1.41 | 44.19 | 3.12 | 1.63 | 15.76 | 2.64 |
| 9 | 2.23 | 35.76 | 5.88 | 1.65 | 19.11 | 2.22 | 1.93 | 36.47 | 5.85 | 1.65 | 19.02 | 2.40 | 1.81 | 36.59 | 5.80 | 1.65 | 18.82 | 2.51 |
| 0.12 | 0.15 | 0 | 0.54 | 76.64 | 0.66 | 1.67 | 8.33 | 5.58 | 0.47 | 78.17 | 0.65 | 1.67 | 8.29 | 6.57 | 0.44 | 78.41 | 0.65 | 1.66 | 8.20 | 8.23 |
| 3 | 1.25 | 59.43 | 2.35 | 1.60 | 15.55 | 1.36 | 1.10 | 60.61 | 2.34 | 1.60 | 15.48 | 1.69 | 1.02 | 60.80 | 2.32 | 1.59 | 15.31 | 2.04 |
| 6 | 1.39 | 41.48 | 4.90 | 1.66 | 19.15 | 1.39 | 1.21 | 42.30 | 4.88 | 1.65 | 19.06 | 1.57 | 1.13 | 42.43 | 4.83 | 1.65 | 18.86 | 1.76 |
| 9 | 1.64 | 29.23 | 8.45 | 2.32 | 23.59 | 1.55 | 1.43 | 29.81 | 8.40 | 2.32 | 23.47 | 1.60 | 1.34 | 29.91 | 8.33 | 2.31 | 23.23 | 1.79 |
| 0.25 | 0 | 0.62 | 81.69 | 0.82 | 2.53 | 10.02 | 5.29 | 0.53 | 83.32 | 0.82 | 2.53 | 9.97 | 5.99 | 0.50 | 83.57 | 0.80 | 2.52 | 9.86 | 7.68 |
| 3 | 1.41 | 56.53 | 5.88 | 1.67 | 22.06 | 1.50 | 1.23 | 57.66 | 5.85 | 1.67 | 21.95 | 1.63 | 1.15 | 57.83 | 5.80 | 1.66 | 21.72 | 1.71 |
| 6 | 1.61 | 32.53 | 7.05 | 2.27 | 25.61 | 1.37 | 1.40 | 33.18 | 7.01 | 2.27 | 25.49 | 1.55 | 1.31 | 33.27 | 6.95 | 2.26 | 25.23 | 1.62 |
| 9 | 1.83 | 27.03 | 8.97 | 2.52 | 32.44 | 1.37 | 1.60 | 27.58 | 8.91 | 2.52 | 32.28 | 1.63 | 1.49 | 27.66 | 8.83 | 2.51 | 31.94 | 1.67 |
| 0.35 | 0 | 0.79 | 75.80 | 0.83 | 2.70 | 10.05 | 4.35 | 0.69 | 77.32 | 0.83 | 2.70 | 10.00 | 4.91 | 0.65 | 77.56 | 0.82 | 2.69 | 9.90 | 6.17 |
| 3 | 1.67 | 42.69 | 5.38 | 1.69 | 30.95 | 1.21 | 1.46 | 43.55 | 5.36 | 1.68 | 30.80 | 1.43 | 1.36 | 43.67 | 5.31 | 1.68 | 30.48 | 1.52 |
| 6 | 1.72 | 22.21 | 7.68 | 2.31 | 35.13 | 1.21 | 1.50 | 22.65 | 7.64 | 2.31 | 34.96 | 1.34 | 1.40 | 22.72 | 7.57 | 2.30 | 34.59 | 1.59 |
| 9 | 2.20 | 16.09 | 10.82 | 2.59 | 42.66 | 1.25 | 1.92 | 16.42 | 10.75 | 2.59 | 42.44 | 1.29 | 1.80 | 16.46 | 10.66 | 2.58 | 42.00 | 1.47 |
| 0.2 | 0.15 | 0 | 0.71 | 61.18 | 1.08 | 2.77 | 10.06 | 3.57 | 0.60 | 62.41 | 1.07 | 2.76 | 10.01 | 3.95 | 0.56 | 62.60 | 1.06 | 2.75 | 9.91 | 4.93 |
| 3 | 2.24 | 34.57 | 6.14 | 1.84 | 37.10 | 0.70 | 1.94 | 35.27 | 6.11 | 1.84 | 36.91 | 0.79 | 1.82 | 35.37 | 6.05 | 1.84 | 36.52 | 0.95 |
| 6 | 2.49 | 18.92 | 7.97 | 2.49 | 41.93 | 0.66 | 2.16 | 19.30 | 7.92 | 2.49 | 41.72 | 0.69 | 2.03 | 19.35 | 7.85 | 2.48 | 41.28 | 0.83 |
| 9 | 3.08 | 12.45 | 11.78 | 2.62 | 44.41 | 0.63 | 2.69 | 12.69 | 11.71 | 2.62 | 44.18 | 0.60 | 2.52 | 12.73 | 11.60 | 2.61 | 43.72 | 0.75 |
| 0.25 | 0 | 0.87 | 45.79 | 1.32 | 2.82 | 10.94 | 3.43 | 0.76 | 46.70 | 1.32 | 2.81 | 10.88 | 3.74 | 0.71 | 46.85 | 1.30 | 2.80 | 10.76 | 4.50 |
| 3 | 2.48 | 28.47 | 9.99 | 1.90 | 46.29 | 0.74 | 2.16 | 29.04 | 9.94 | 1.89 | 46.06 | 0.75 | 2.02 | 29.12 | 9.84 | 1.89 | 45.58 | 0.79 |
| 6 | 2.78 | 11.55 | 11.67 | 2.57 | 48.54 | 0.66 | 2.42 | 11.78 | 11.60 | 2.56 | 48.30 | 0.74 | 2.27 | 11.82 | 11.50 | 2.55 | 47.79 | 0.74 |
| 9 | 3.38 | 1.12 | 15.73 | 2.58 | 54.57 | 0.56 | 2.94 | 1.14 | 15.63 | 2.58 | 54.30 | 0.61 | 2.75 | 1.15 | 15.49 | 2.57 | 53.73 | 0.68 |
| 0.35 | 0 | 0.91 | 35.35 | 0.66 | 2.75 | 10.78 | 3.35 | 0.78 | 36.05 | 0.66 | 2.75 | 10.73 | 3.64 | 0.74 | 36.17 | 0.65 | 2.73 | 10.62 | 4.23 |
| 3 | 3.19 | 4.22 | 10.83 | 2.02 | 52.43 | 0.59 | 2.92 | 4.31 | 10.76 | 2.01 | 52.17 | 0.67 | 1.75 | 4.32 | 10.66 | 2.01 | 51.61 | 0.82 |
| 6 | 4.83 | 2.23 | 13.34 | 2.60 | 60.15 | 0.70 | 3.44 | 2.27 | 13.27 | 2.60 | 59.86 | 0.60 | 2.24 | 2.28 | 13.15 | 2.59 | 59.23 | 0.70 |
| 9 | 5.51 | 0.00 | 20.96 | 2.66 | 61.75 | 0.48 | 4.80 | 0.00 | 19.80 | 2.65 | 61.44 | 0.55 | 4.48 | 0.00 | 17.51 | 2.64 | 60.80 | 0.63 |

**Table 6.** Insulator condition dependent on experimentally determined indicators values.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Indicator | Normal range | Abnormal range | Critical range | Pre-flashover value |
| C1 | < 1.165 | > 1.165and < 2.86 | > 2.86 | > 10 |
| C2 | > 59.3 | > 18.7 and < 59.3 | < 18.7 | - |
| C3 | < 1.53 | > 1.53 and < 5.1 | > 5.1 | > 28 |
| C4 | < 1.6 | > 1.6 and < 2 | > 2 | >2.8 |
| C5 | < 15 | > 15 and < 45 | > 45 | > 65 |
| C6 | > 3 | > 1 and < 3 | < 1 | < 0.4 |
| C7 | <0.62 | >0.62 and <0.73 | >0.73 | >0.85 |

**Table 7.** The indices' sensitivity, specificity, and accuracy for the 936 tests.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Indicator | A | B | C | D | Sensitivity | Specificity | Accuracy |
| C1 | 812 | 62 | 39 | 23 | 0.954 | 0.271 | 0.892 |
| C2 | 793 | 66 | 45 | 32 | 0.946 | 0.327 | 0.881 |
| C3 | 852 | 34 | 27 | 23 | 0.969 | 0.404 | 0.935 |
| C4 | 832 | 43 | 29 | 32 | 0.966 | 0.427 | 0.923 |
| C5 | 801 | 64 | 44 | 27 | 0.948 | 0.297 | 0.885 |
| C6 | 862 | 23 | 24 | 27 | 0.973 | 0.540 | 0.950 |
| C7 | 851 | 35 | 26 | 24 | 0.965 | 0.477 | 0.918 |