# Main type of PIOCELAN particles

## White

| Series | Polymer size | Expansion ratio | Density | | Range of center value of pre-expanded particles diameter | | Description | Major use of molded articles |
|---|---|---|---|---|---|---|---|---|
| | | Times | kg/m³ | PCF | Inch | mm | | |
| S series | D | 40<br>50 | 25.00<br>20.00 | 1.560<br>1.250 | 0.16～0.23<br>0.17～0.24 | 4.0～5.8<br>4.4～6.2 | SP-40D<br>SP-50D | General molded articles |
| S series | E | 40<br>50 | 25.00<br>20.00 | 1.560<br>1.250 | 0.13～0.16<br>0.15～0.17 | 3.4～4.0<br>3.7～4.4 | SP-40E<br>SP-50E | |
| O series | D | 15<br>20<br>30 | 66.70<br>50.00<br>33.33 | 4.160<br>3.120<br>2.080 | 0.11～0.17<br>0.13～0.18<br>0.15～0.20 | 2.9～4.2<br>3.2～4.6<br>3.7～5.2 | OP-15D<br>OP-20D<br>OP-30D | Automotive parts |
| O series | E | 15<br>30 | 66.70<br>33.30 | 4.160<br>2.080 | 0.11～0.13<br>0.12～0.15 | 2.5～3.0<br>3.1～3.7 | OP-15E<br>OP-30E | |
| O series (Antistatic) | E | 15<br>30 | 66.70<br>33.30 | 4.160<br>2.080 | 0.11～0.13<br>0.12～0.15 | 2.5～3.0<br>3.1～3.7 | OP-15ENS<br>OP-30ENS | Packing material/<br>Returnable containers for electronic parts |
| O series (Low VOC, Low odor) | E | 15<br>30 | 66.70<br>33.30 | 4.160<br>2.080 | 0.11～0.13<br>0.12～0.15 | 2.5～3.0<br>3.1～3.7 | OP-15EU<br>OP-30EU | Automotive interior parts |
| L series | E | 40<br>50<br>60 | 25.00<br>20.00<br>16.67 | 1.560<br>1.250<br>1.040 | 0.14～0.20<br>0.15～0.22<br>0.17～0.24 | 3.5～5.2<br>3.9～5.6<br>4.2～6.0 | LP-40E<br>LP-50E<br>LP-60E | General molding articles<br>Packing material for industrial parts<br>Returnable containers for electronic parts |

## BLACK

| Series | Polymer size | Expansion ratio | Density | | Range of center value of pre-expanded particles diameter | | Description | Major use of molded articles |
|---|---|---|---|---|---|---|---|---|
| | | Times | kg/m³ | PCF | Inch | mm | | |
| O series Black | D | 20 | 50.00 | 3.120 | 0.13～0.18 | 3.2～4.6 | OP-20DB | Automotive parts |
| | | 30 | 33.33 | 2.080 | 0.15～0.20 | 3.7～5.2 | OP-30DB | Automotive exterior parts |
| LS series Black | D | 15<br>20 | 66.70<br>50.00 | 4.160<br>3.120 | 0.11～0.17<br>0.13～0.18 | 2.9～4.2<br>3.2～4.6 | LSP-15DB<br>LSP-20DB | |
| LS series Black | E | 30<br>40<br>50 | 33.33<br>25.00<br>20.00 | 2.080<br>1.560<br>1.250 | 0.10～0.15<br>0.11～0.17<br>0.13～0.19 | 2.6～3.8<br>2.9～4.4<br>3.2～4.8 | LSP-30EB<br>LSP-40EB<br>LSP-50EB | Packing material/<br>Returnable containers for electronic parts<br>and Automotive parts |

## High heat resistance, Fire retardant

| Series | Polymer size | Expansion ratio | Density | | Range of center value of pre-expanded particles diameter | | Description | Major use of molded articles |
|---|---|---|---|---|---|---|---|---|
| | | Times | kg/m³ | PCF | Inch | mm | | |
| T series Black | D | 30<br>40 | 33.33<br>25.00 | 2.080<br>1.560 | 0.13～0.19<br>0.13～0.22 | 3.1～5.4<br>3.4～6.0 | TOPF-30DB<br>TOPF-40DB | Automotive interior parts |
| T series Black (Low VOC, Low odor) | D | 30<br>40 | 33.33<br>25.00 | 2.080<br>1.560 | 0.13～0.19<br>0.13～0.22 | 3.1～5.4<br>3.4～6.0 | TOPF-30DUB<br>TOPF-40DUB | |

*Polymer size : D > E

SEKISUI Hybrid Solution PIOCELAN

# Physical properties of PIOCELAN foam Test Method:ASTM

## White

| Item | | Test Method | Unit | S series Polymer size D | | S series Polymer size E | | O series Polymer size E | | L series Polymer size E | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Expansion ratio | | — | Times | 40 | 50 | 40 | 50 | 15 | 30 | 40 | 50 | 60 |
| Density | | ASTM D 3575 | kg/m³ (PCF) | 25.0 (1.561) | 20.0 (1.249) | 25.0 (1.561) | 20.0 (1.249) | 66.7 (4.162) | 33.3 (2.081) | 25.0 (1.561) | 20.0 (1.249) | 16.7 (1.040) |
| Range of center value of pre-expanded particles | | — | Inch | 0.16～0.23 | 0.17～0.24 | 0.13～0.16 | 0.15～0.17 | 0.11～0.13 | 0.12～0.15 | 0.14～0.20 | 0.15～0.22 | 0.17～0.24 |
| Compressive Strength | 25% | ASTM D 3575 | psi (Mpa) | 24.11 (0.2) | 17.45 (0.1) | 21.12 (0.1) | 15.86 (0.1) | 75.66 (0.5) | 30.66 (0.2) | 26.84 (0.2) | 19.67 (0.1) | 16.29 (0.1) |
| | 50% | | psi (Mpa) | 34.20 (0.2) | 26.24 (0.2) | 30.24 (0.2) | 24.19 (0.2) | 101.20 (0.7) | 39.73 (0.3) | 36.01 (0.2) | 28.11 (0.2) | 25.26 (0.2) |
| | 75% | | psi (Mpa) | 67.58 (0.5) | 56.35 (0.4) | 64.42 (0.4) | 52.49 (0.4) | 186.90 (1.3) | 76.59 (0.5) | 73.12 (0.5) | 59.85 (0.4) | 56.46 (0.4) |
| Compression Set | | ASTM D 3575 | % | 41.2 | 41.5 | 42.2 | 38.4 | 45.7 | 43.4 | 44.0 | 41.6 | 38.1 |
| Flexural Strength | | ASTM D 790 | psi (Mpa) | 34.19 (0.2) | 24.58 (0.2) | 33.05 (0.2) | 23.82 (0.2) | 112.32 (0.8) | 51.47 (0.4) | 39.42 (0.3) | 29.36 (0.2) | 24.18 (0.2) |
| Flexural Modulus | | | psi (Mpa) | 1409.4 (9.7) | 990.2 (6.8) | 1247.8 (8.6) | 911.0 (6.3) | 4556.4 (31.4) | 2026.0 (14.0) | 1745.7 (12.0) | 1405.0 (9.7) | 1164.0 (8.0) |
| Tensile Strength | | ASTM D 3575 | psi (Mpa) | 47.18 (0.3) | 40.38 (0.3) | 43.84 (0.3) | 31.62 (0.2) | 114.94 (0.8) | 73.24 (0.5) | 59.94 (0.4) | 49.14 (0.3) | 38.64 (0.3) |
| Tensile Elongation | | | % | 6.4 | 8.3 | 7.1 | 7.3 | 6.1 | 7.2 | 8.8 | 10.0 | 9.4 |

*Physical properties of O series (Antistatic) and O series (Low VOC,Low odor) are the same as those of O series polymer size E.

## BLACK

| Item | | Test Method | Unit | O series Black Polymer size D | | LS series Black Polymer size D | | LS series Black Polymer size E | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Expansion ratio | | — | Times | 20 | 30 | 15 | 20 | 30 | 40 | 50 |
| Density | | ASTM D 3575 | kg/m³ (PCF) | 50.0 (3.121) | 33.3 (2.081) | 66.7 (4.162) | 50.0 (3.121) | 33.3 (2.081) | 25.0 (1.561) | 20.0 (1.249) |
| Range of center value of pre-expanded particles | | — | Inch | 0.13～0.18 | 0.15～0.20 | 0.11～0.17 | 0.13～0.18 | 0.10～0.15 | 0.11～0.17 | 0.13～0.19 |
| Compressive Strength | 25% | ASTM D 3575 | psi (Mpa) | 43.88 (0.3) | 25.33 (0.2) | 80.06 (0.6) | 58.85 (0.4) | 29.74 (0.2) | 23.93 (0.2) | 17.55 (0.1) |
| | 50% | | psi (Mpa) | 56.16 (0.4) | 34.54 (0.2) | 105.85 (0.7) | 75.99 (0.5) | 39.01 (0.3) | 32.78 (0.2) | 26.11 (0.2) |
| | 75% | | psi (Mpa) | 106.80 (0.7) | 70.26 (0.5) | 206.69 (1.4) | 144.78 (1.0) | 74.32 (0.5) | 67.15 (0.5) | 57.29 (0.4) |
| Compression Set | | ASTM D 3575 | % | 41.8 | 40.5 | 45.2 | 44.8 | 38.8 | 33.3 | 32.2 |
| Flexural Strength | | ASTM D 790 | psi (Mpa) | 59.96 (0.4) | 40.67 (0.3) | 117.07 (0.8) | 85.24 (0.6) | 48.83 (0.3) | 37.14 (0.3) | 27.98 (0.2) |
| Flexural Modulus | | | psi (Mpa) | 2563.0 (17.7) | 1825.9 (12.6) | 4956.5 (34.2) | 3581.4 (24.7) | 2075.3 (14.3) | 1718.3 (11.8) | 1259.8 (8.7) |
| Tensile Strength | | ASTM D 3575 | psi (Mpa) | 89.65 (0.6) | 61.18 (0.4) | 132.06 (0.9) | 116.44 (0.8) | 82.76 (0.6) | 64.82 (0.4) | 51.73 (0.4) |
| Tensile Elongation | | | % | 10.5 | 7.8 | 5.5 | 7.7 | 12.5 | 12.1 | 13.4 |

## High heat resistance, Fire retardant

| Item | | Test Method | Unit | T series Black Polymer size D | |
|---|---|---|---|---|---|
| Expansion ratio | | — | Times | 30 | 40 |
| Density | | ASTM D 3575 | kg/m³ (PCF) | 33.3 (2.079) | 25.0 (1.561 ) |
| Range of center value of pre-expanded particles | | — | Inch | 0.12～0.20 | 0.13～0.22 |
| Compressive Strength | 25% | ASTM D 3575 | psi (Mpa) | 36.26 (0.3) | 26.11 (0.2) |
| | 50% | | psi (Mpa) | 49.31 (0.3) | 36.26 (0.3) |
| | 75% | | psi (Mpa) | 87.02 (0.6) | 75.52 (0.5) |
| Compression Set | | ASTM D 3575 | % | 40.0 | 43.0 |
| Flexural Strength | | ASTM D 790 | psi (Mpa) | 44.96 (0.3) | 37.71 (0.3) |
| Flexural Modulus | | | psi (Mpa) | 1885.5 (13.0) | 1305.3 (9.0) |
| Tensile Strength | | ASTM D 3575 | psi (Mpa) | 58.02 (0.4) | 47.86 (0.3) |
| Tensile Elongation | | | % | 5～7 | 6～8 |

*Physical properties of T series BLACK (Low VOC,Low odor) are the same as those of T series BLACK polymer size D.

# Physical properties of PIOCELAN foam Test Method:ISO

## White

| Item | | Test Method | Unit | S series Polymer size D | | S series Polymer size E | | O series Polymer size E | | L series Polymer size E | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Expansion ratio | | — | Times | 40 | 50 | 40 | 50 | 15 | 30 | 40 | 50 | 60 |
| Density | | — | kg/m³ (PCF) | 25.0 (1.561) | 20.0 (1.249) | 25.0 (1.561) | 20.0 (1.249) | 66.7 (4.162) | 33.3 (2.081) | 25.0 (1.561) | 20.0 (1.249) | 16.7 (1.040) |
| Range of center value of pre-expanded particles | | — | mm | 4.0～5.8 | 4.4～6.2 | 3.4～4.0 | 3.7～4.4 | 2.7～3.3 | 3.1～3.7 | 3.5～5.2 | 3.9～5.6 | 4.2～6.0 |
| Compressive Strength | 25% | ISO 844 | Mpa (kgf/cm²) | 0.16 (1.6) | 0.13 (1.3) | 0.15 (1.5) | 0.11 (1.1) | 0.51 (5.2) | 0.20 (2.1) | 0.18 (1.8) | 0.13 (1.3) | 0.11 (1.2) |
| | 50% | | Mpa (kgf/cm²) | 0.23 (2.3) | 0.19 (1.9) | 0.21 (2.1) | 0.17 (1.7) | 0.68 (7.0) | 0.26 (2.7) | 0.24 (2.5) | 0.20 (2.0) | 0.18 (1.8) |
| | 75% | | Mpa (kgf/cm²) | 0.47 (4.8) | 0.41 (4.2) | 0.44 (4.5) | 0.38 (3.9) | 1.28 (13.1) | 0.51 (5.2) | 0.49 (5.0) | 0.42 (4.3) | 0.39 (4.0) |
| Compression Set | | ISO 1856 | % | 17.9 | 16.6 | 18.1 | 17.4 | 19.1 | 17.7 | 17.8 | 15.6 | 16.2 |
| Flexural Strength | | ISO 1209-1 | Mpa (kgf/cm²) | 0.37 (3.8) | 0.35 (3.5) | 0.35 (3.6) | 0.26 (2.7) | 1.12 (11.4) | 0.62 (6.3) | 0.53 (5.4) | 0.44 (4.5) | 0.34 (3.5) |
| Flexural Modulus | | | Mpa (kgf/cm²) | 5.8 (59.2) | 4.8 (49.0) | 6.1 (62.2) | 4.6 (46.9) | 23.3 (237.8) | 10.6 (108.2) | 6.6 (67.3) | 6.2 (63.3) | 4.1 (41.8) |
| Tensile Strength | | ISO 1798 | Mpa (kgf/cm²) | 0.35 (3.6) | 0.27 (2.7) | 0.30 (3.1) | 0.25 (2.6) | 0.86 (8.7) | 0.53 (5.4) | 0.44 (4.5) | 0.38 (3.9) | 0.28 (2.8) |
| Tensile Elongation | | | % | 6.3 | 7.6 | 7.4 | 8.6 | 6.0 | 8.2 | 9.1 | 9.7 | 7.6 |

*Physical properties of O series (Antistatic) and O series (Low VOC,Low odor) are the same as those of O series polymer size E.

## BLACK

| Item | | Test Method | Unit | O series Black Polymer size D | | LS series Black Polymer size D | | LS series Black Polymer size E | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Expansion ratio | | — | Times | 20 | 30 | 15 | 20 | 30 | 40 | 50 |
| Density | | — | kg/m³ (PCF) | 50.0 (3.121) | 33.3 (2.081) | 66.7 (4.162) | 50.0 (3.121) | 33.3 (2.081) | 25.0 (1.561) | 20.0 (1.249) |
| Range of center value of pre-expanded particles | | — | mm | 3.2～4.6 | 3.7～5.2 | 2.9～4.2 | 3.2～4.6 | 2.6～3.8 | 2.9～4.4 | 3.2～4.8 |
| Compressive Strength | 25% | ISO 844 | Mpa (kgf/cm²) | 0.28 (2.9) | 0.18 (1.8) | 0.51 (5.2) | 0.37 (3.8) | 0.20 (2.0) | 0.15 (1.5) | 0.12 (1.2) |
| | 50% | | Mpa (kgf/cm²) | 0.37 (3.8) | 0.24 (2.5) | 0.67 (6.9) | 0.48 (4.9) | 0.26 (2.7) | 0.21 (2.1) | 0.18 (1.8) |
| | 75% | | Mpa (kgf/cm²) | 0.69 (7.1) | 0.49 (5.0) | 1.27 (12.9) | 0.89 (9.1) | 0.52 (5.3) | 0.45 (4.6) | 0.40 (4.0) |
| Compression Set | | ISO 1856 | % | 18.0 | 17.4 | 18.9 | 16.5 | 18.2 | 18.1 | 16.0 |
| Flexural Strength | | ISO 1209-1 | Mpa (kgf/cm²) | 0.80 (8.1) | 0.53 (5.4) | 1.23 (12.5) | 0.90 (9.1) | 0.78 (8.0) | 0.58 (5.9) | 0.44 (4.5) |
| Flexural Modulus | | | Mpa (kgf/cm²) | 11.9 (121.4) | 7.9 (80.6) | 28.1 (286.7) | 18.3 (186.7) | 10.2 (104.1) | 7.3 (74.5) | 5.3 (54.1) |
| Tensile Strength | | ISO 1798 | Mpa (kgf/cm²) | 0.67 (6.8) | 0.44 (4.5) | 1.10 (11.2) | 0.90 (9.2) | 0.59 (6.0) | 0.47 (4.8) | 0.37 (3.8) |
| Tensile Elongation | | | % | 9.7 | 9.9 | 7.4 | 8.5 | 12.5 | 12.4 | 13.4 |

## High heat resistance, Fire retardant

| Item | | Test Method | Unit | T series Black Polymer size D | |
|---|---|---|---|---|---|
| Expansion ratio | | — | Times | 30 | 40 |
| Density | | — | kg/m³ (PCF) | 33.3 (2.079) | 25.0 (1.561) |
| Range of center value of pre-expanded particles | | — | mm | 3.1～5.2 | 3.4～5.7 |
| Compressive Strength | 25% | ISO 844 | Mpa (kgf/cm²) | 0.19 (1.9) | 0.16 (1.6) |
| | 50% | | Mpa (kgf/cm²) | 0.27 (2.8) | 0.22 (2.2) |
| | 75% | | Mpa (kgf/cm²) | 0.52 (5.3) | 0.45 (4.6) |
| Compression Set | | ISO 1856 | % | 19.4 | 19.0 |
| Flexural Strength | | ISO 1209-1 | Mpa (kgf/cm²) | 0.72 (7.3) | 0.62 (6.3) |
| Flexural Modulus | | | Mpa (kgf/cm²) | 15.2 (155.1) | 9.6 (98.0) |
| Tensile Strength | | ISO 1798 | Mpa (kgf/cm²) | 0.29 (2.9) | 0.22 (2.2) |
| Tensile Elongation | | | % | 4.4 | 4.6 |

*Physical properties of T series BLACK (Low VOC,Low odor) are the same as those of T series BLACK polymer size D.

*Above fugures and values are for reference only,and standard or guaranties.