Advanced TPE Compound

EARNESTON™

KURARAY PLASTICS CO., LTD.
About “EARNESTON™”

“EARNESTON™” is high performance thermoplastic elastomer compound with various kind of elastomers, led by styrenic block copolymers, and manufactured by KURARAY PLASTICS based on our polymer production technology and processing technology that has been accumulated over the years.

Various kinds of goods can be made with “EARNESTON™” using conventional molding methods for thermoplastic resins (e.g. injection molding, extrusion and blow molding) without complicated vulcanizing process. It is possible to replace vulcanized rubber in the various fields, for example industrial parts, sports goods, medical goods, and so on. Moreover, “EARNESTON™”’s scrap can be reprocessed without loss of mechanical properties. Therefore, it will be helpful to reduction in total costs.

1. Characteristics of “EARNESTON™”
   1. It has excellent elasticity and tensile strength.
   2. It has excellent low temperature properties.
   3. It has excellent heat, weather and ozone resistance.
   4. It’s possible to mold using conventional molding (Injection molding, Extrusion, Blow etc.)
   5. It’s recyclable.
   6. It has good colorability.
   7. It can reduce article’s weight compared with ordinary vulcanized rubber.  
      (30~40% of weight can be reduced.)

2. Application of “EARNESTON™”

<table>
<thead>
<tr>
<th>Field</th>
<th>Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>Household Appliance</td>
<td>Gaskets for refrigerators, Tubes and hoses for washing machines/ for air conditioners/ for air cleaners, Cushions, Dampers for precision instruments, OA rolls, Camera grip</td>
</tr>
<tr>
<td>Automotive Parts</td>
<td>Grommet, Clamp, Glass run, Interior outer skin, Grip accessories</td>
</tr>
<tr>
<td>Industry</td>
<td>Sheets / Clamps and Covers for automotive parts, Cushions for home units, Drain hoses, Elastic film, Antidust masks, Dumping material, Modifier</td>
</tr>
<tr>
<td>Medical Use</td>
<td>Various tubes, Syringe gaskets, Plugs</td>
</tr>
<tr>
<td>Sports Goods</td>
<td>Straps &amp; eye-pads of swimming goggles, Diving fins, Pads of skiing goggles, Grips (for golf clubs, tennis rackets, motorbikes, etc.), Skipping rope</td>
</tr>
<tr>
<td>Commodities</td>
<td>Gaskets, Grips, Sheets, Artificial Leather, Erasers, Pen grip</td>
</tr>
</tbody>
</table>
# 3. Typical properties of “EARNESTON™”

## 3-1. Injection molding grade (CJ-series)

<table>
<thead>
<tr>
<th></th>
<th>Unit</th>
<th>CJ001N</th>
<th>CJ002N</th>
<th>CJ003N</th>
<th>Test Method</th>
<th>Test Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Specific Gravity</td>
<td></td>
<td>0.90</td>
<td>0.90</td>
<td>0.90</td>
<td>JIS K7112</td>
<td></td>
</tr>
<tr>
<td>Hardness</td>
<td></td>
<td>40</td>
<td>60</td>
<td>80</td>
<td>JIS K6253</td>
<td>Type A</td>
</tr>
<tr>
<td>MFR (g/10min.)</td>
<td></td>
<td>2.0</td>
<td>15</td>
<td>15</td>
<td>JIS K7210</td>
<td>230deg.C, 2.16kg</td>
</tr>
<tr>
<td>100% Modulus (MPa)</td>
<td></td>
<td>0.9</td>
<td>1.7</td>
<td>3.3</td>
<td>JIS K6251</td>
<td>Dumb-bell No.3</td>
</tr>
<tr>
<td>300% Modulus (MPa)</td>
<td></td>
<td>1.3</td>
<td>2.4</td>
<td>4.3</td>
<td></td>
<td>Cross-head Speed:</td>
</tr>
<tr>
<td>Tensile Strength (MPa)</td>
<td></td>
<td>10.7</td>
<td>13.3</td>
<td>17.2</td>
<td></td>
<td>500mm/min.</td>
</tr>
<tr>
<td>Tensile Elongation (%)</td>
<td></td>
<td>1030</td>
<td>930</td>
<td>850</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tear Strength (N/mm)</td>
<td></td>
<td>17</td>
<td>26</td>
<td>44</td>
<td>JIS K6252</td>
<td>Angle Shape</td>
</tr>
<tr>
<td>Compression Set (%)</td>
<td></td>
<td>28</td>
<td>36</td>
<td>48</td>
<td>JIS K6262</td>
<td>70deg.C, 22hrs.</td>
</tr>
<tr>
<td>Permanent Set (%)</td>
<td></td>
<td>8</td>
<td>9</td>
<td>16</td>
<td>Former JIS K6301</td>
<td>100%, 10min.-10min.</td>
</tr>
</tbody>
</table>

Ozone Resistance: Excellent \(50\text{pphm}, 40\text{deg.C, 20}\%\text{ elongation, 500hrs.}\)

Mold Shrinkage (%): 1.5−2.0 \(100\%, 10\text{min.-10min.}\)

Brittle Temperature (deg.C): -60> \(230\text{deg.C, 5kg}\)

Color: Translucent

<table>
<thead>
<tr>
<th></th>
<th>CE001</th>
<th>CE002</th>
<th>CE003</th>
<th>Test Method</th>
<th>Test Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Specific Gravity</td>
<td>0.90</td>
<td>0.90</td>
<td>0.90</td>
<td>JIS K7112</td>
<td></td>
</tr>
<tr>
<td>Hardness</td>
<td>40</td>
<td>60</td>
<td>80</td>
<td>JIS K6253</td>
<td>Type A</td>
</tr>
<tr>
<td>MFR (g/10min.)</td>
<td>7.0</td>
<td>4.0</td>
<td>3.5</td>
<td>JIS K7210</td>
<td>230deg.C, 5kg</td>
</tr>
<tr>
<td>100% Modulus (MPa)</td>
<td>0.8</td>
<td>1.6</td>
<td>5.0</td>
<td>JIS K6251</td>
<td>Dumb-bell No.3</td>
</tr>
<tr>
<td>300% Modulus (MPa)</td>
<td>1.3</td>
<td>2.5</td>
<td>7.9</td>
<td></td>
<td>Cross-head Speed:</td>
</tr>
<tr>
<td>Tensile Strength (MPa)</td>
<td>9.8</td>
<td>16.4</td>
<td>22.2</td>
<td></td>
<td>500mm/min.</td>
</tr>
<tr>
<td>Tensile Elongation (%)</td>
<td>940</td>
<td>920</td>
<td>810</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tear Strength (N/mm)</td>
<td>15.7</td>
<td>28.4</td>
<td>48.0</td>
<td>JIS K6252</td>
<td>Angle Shape</td>
</tr>
<tr>
<td>Compression Set (%)</td>
<td>33</td>
<td>37</td>
<td>47</td>
<td>JIS K6262</td>
<td>70deg.C, 22hrs.</td>
</tr>
<tr>
<td>Permanent Set (%)</td>
<td>6</td>
<td>8</td>
<td>21</td>
<td>Former JIS K6301</td>
<td>100%, 10min.-10min.</td>
</tr>
</tbody>
</table>

Ozone Resistance: Excellent \(50\text{pphm}, 40\text{deg.C, 20}\%\text{ elongation, 500hrs.}\)

Brittle Temperature (deg.C): -60> \(230\text{deg.C, 5kg}\)

Color: Translucent

2: KURARAY PLASTICS Method

These are typical properties only, and are not to be regarded as sales specifications.
### 3-3. Special grade

<table>
<thead>
<tr>
<th></th>
<th>CJ101</th>
<th>CJ102N</th>
<th>CJ103</th>
<th>JS20N</th>
<th>FY35N-01</th>
<th>Test Method</th>
<th>Test Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Specific Gravity</strong></td>
<td>0.90</td>
<td>0.90</td>
<td>0.90</td>
<td>0.89</td>
<td>0.91</td>
<td>JIS K7112</td>
<td>Type A</td>
</tr>
<tr>
<td><strong>Hardness</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>JIS K6253</td>
<td>Type D</td>
</tr>
<tr>
<td><strong>MFR (g/10min.)</strong></td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>15</td>
<td>JIS K7210</td>
<td>190deg.C, 2.16kg</td>
</tr>
<tr>
<td><strong>100% Modulus</strong> (MPa)</td>
<td>0.7</td>
<td>1.0</td>
<td>0.3</td>
<td>0.1</td>
<td>6.4</td>
<td>JIS K6251</td>
<td>Dumb-bell No.3</td>
</tr>
<tr>
<td><strong>300% Modulus</strong> (MPa)</td>
<td>1.4</td>
<td>2.0</td>
<td>0.4</td>
<td>0.2</td>
<td>8.2</td>
<td>JIS K6251</td>
<td>Cross-head Speed:</td>
</tr>
<tr>
<td><strong>Tensile Elongation</strong> (%)</td>
<td>80</td>
<td>930</td>
<td>1100</td>
<td>1100&lt;</td>
<td>800</td>
<td>JIS K6252</td>
<td>Angle Shape</td>
</tr>
<tr>
<td><strong>Compression Set</strong> (%)</td>
<td>80&lt;</td>
<td>80&lt;</td>
<td>18</td>
<td>65</td>
<td>-</td>
<td>JIS K6262</td>
<td>70deg.C, 22hrs.</td>
</tr>
<tr>
<td><strong>Permanent Set</strong> (%)</td>
<td>4</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>-</td>
<td>Former JIS K6301</td>
<td>100%, 10min.-10min.</td>
</tr>
<tr>
<td><strong>Ozone Resistance</strong></td>
<td>Excellent</td>
<td>Excellent</td>
<td>Excellent</td>
<td>Excellent</td>
<td>Excellent</td>
<td>JIS K6259</td>
<td>50pphm, 40deg.C, 20% elongation, 500hrs.</td>
</tr>
<tr>
<td><strong>Mold Shrinkage</strong> (%)</td>
<td>1.5 ~ 2.0</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>KPM²</td>
<td></td>
</tr>
<tr>
<td><strong>Brittle Temperature</strong> (deg.C)</td>
<td>-60&gt;</td>
<td>-60&gt;</td>
<td>-60&gt;</td>
<td>-60&gt;</td>
<td>-10</td>
<td>JIS K6261</td>
<td></td>
</tr>
<tr>
<td><strong>Color</strong></td>
<td>Transparent</td>
<td>Transparent</td>
<td>Transparent</td>
<td>Transparent</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
</tbody>
</table>

**Features:**
- CJ101: Transparent
- CJ102N: High elasticity
- CJ103: Soft
- JS20N: Ultra soft
- FY35N-01: Unplasticized and Transparent

2: KURARAY PLASTICS Method

These are typical properties only, and are not to be regarded as sales specifications.

**Applications of “EARNESTON™”**
4. Basic properties of “EARNESTON™”

4-1. Effect of temperature on the properties of “EARNESTON™”

4-2. Heat aging characteristics of “EARNESTON™”

= CJ001 =

<table>
<thead>
<tr>
<th>Unit</th>
<th>Initial</th>
<th>70deg.C 30 days</th>
<th>70deg.C 60 days</th>
<th>100deg.C 30 days</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hardness (Type A)</td>
<td>41</td>
<td>42</td>
<td>42</td>
<td>41</td>
</tr>
<tr>
<td>Tensile Strength (MPa)</td>
<td>9.1</td>
<td>8.4</td>
<td>8.6</td>
<td>8.5</td>
</tr>
<tr>
<td>Tensile Elongation (%)</td>
<td>990</td>
<td>990</td>
<td>970</td>
<td>990</td>
</tr>
</tbody>
</table>

= CJ002 =

<table>
<thead>
<tr>
<th>Unit</th>
<th>Initial</th>
<th>70deg.C 30 days</th>
<th>70deg.C 60 days</th>
<th>100deg.C 30 days</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hardness (Type A)</td>
<td>65</td>
<td>65</td>
<td>64</td>
<td>63</td>
</tr>
<tr>
<td>Tensile Strength (MPa)</td>
<td>13.8</td>
<td>12.8</td>
<td>12.4</td>
<td>13.8</td>
</tr>
<tr>
<td>Tensile Elongation (%)</td>
<td>910</td>
<td>880</td>
<td>880</td>
<td>870</td>
</tr>
</tbody>
</table>

= CJ003 =

<table>
<thead>
<tr>
<th>Unit</th>
<th>Initial</th>
<th>70deg.C 30 days</th>
<th>70deg.C 60 days</th>
<th>100deg.C 30 days</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hardness (Type A)</td>
<td>81</td>
<td>81</td>
<td>80</td>
<td>80</td>
</tr>
<tr>
<td>Tensile Strength (MPa)</td>
<td>20.2</td>
<td>21.4</td>
<td>19.7</td>
<td>20.5</td>
</tr>
<tr>
<td>Tensile Elongation (%)</td>
<td>820</td>
<td>810</td>
<td>800</td>
<td>810</td>
</tr>
</tbody>
</table>
4-3. Weatherability of “EARNESTON™”

<table>
<thead>
<tr>
<th>Unit</th>
<th>Exposure time (hrs)</th>
<th>0</th>
<th>100</th>
<th>500</th>
<th>1000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hardness</td>
<td>Retention (%)</td>
<td>100</td>
<td>102</td>
<td>100</td>
<td>98</td>
</tr>
<tr>
<td>Tensile Strength</td>
<td>(MPa)</td>
<td>13.8</td>
<td>14.8</td>
<td>13.4</td>
<td>12.9</td>
</tr>
<tr>
<td>Tensile Elongation</td>
<td>(%)</td>
<td>910</td>
<td>920</td>
<td>920</td>
<td>920</td>
</tr>
</tbody>
</table>

Test condition: Xenon weather meter, Black panel temperature 63deg.C, and humidity 63%
Spray cycle 18min./2hrs.

4-4. Oil resistance of “EARNESTON™”

<table>
<thead>
<tr>
<th>Condition</th>
<th>CJ002</th>
<th>CJ003</th>
</tr>
</thead>
<tbody>
<tr>
<td>JIS No.1 oil</td>
<td>Room Temperature 7days</td>
<td>ΔW</td>
</tr>
<tr>
<td>JIS No.1 oil</td>
<td>Room Temperature 7days</td>
<td>ΔV</td>
</tr>
<tr>
<td>JIS No.1 oil</td>
<td>100deg.C 70hrs.</td>
<td>ΔW</td>
</tr>
<tr>
<td>JIS No.1 oil</td>
<td>100deg.C 70hrs.</td>
<td>ΔV</td>
</tr>
<tr>
<td>JIS No.3 oil</td>
<td>Room Temperature 7days</td>
<td>ΔW</td>
</tr>
<tr>
<td>JIS No.3 oil</td>
<td>Room Temperature 7days</td>
<td>ΔV</td>
</tr>
<tr>
<td>JIS No.3 oil</td>
<td>100deg.C 70hrs.</td>
<td>ΔW</td>
</tr>
<tr>
<td>JIS No.3 oil</td>
<td>100deg.C 70hrs.</td>
<td>ΔV</td>
</tr>
</tbody>
</table>

Test method: JIS K6258
ΔW: Weight change (%)
ΔV: Volume change (%)

4-5. Chemical resistance of “EARNESTON™”

<table>
<thead>
<tr>
<th>Condition</th>
<th>CJ002</th>
<th>CJ003</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sulfuric acid</td>
<td>(10% conc.)</td>
<td>ΔW</td>
</tr>
<tr>
<td>Sulfuric acid</td>
<td>(10% conc.)</td>
<td>ΔV</td>
</tr>
<tr>
<td>Hydrochloric acid</td>
<td>(10% conc.)</td>
<td>ΔW</td>
</tr>
<tr>
<td>Sodium hydroxide soln.</td>
<td>(40% conc.)</td>
<td>ΔW</td>
</tr>
<tr>
<td>Methanol</td>
<td>ΔW</td>
<td>1.6</td>
</tr>
<tr>
<td>Methanol</td>
<td>ΔV</td>
<td>0.0</td>
</tr>
<tr>
<td>Ethanol</td>
<td>ΔW</td>
<td>0.8</td>
</tr>
<tr>
<td>Ethanol</td>
<td>ΔV</td>
<td>0.0</td>
</tr>
<tr>
<td>Illuminating kerosene</td>
<td>ΔW</td>
<td>140</td>
</tr>
<tr>
<td>Illuminating kerosene</td>
<td>ΔV</td>
<td>150</td>
</tr>
</tbody>
</table>

Test method: JIS K6258
ΔW: Weight change (%)
ΔV: Volume change (%)
4-6. Electrical characteristics of “EARNESTON™”

<table>
<thead>
<tr>
<th></th>
<th>Unit</th>
<th>CJ002</th>
<th>CJ003</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dielectric Constant</td>
<td>1 MHz</td>
<td>2.15</td>
<td>2.22</td>
</tr>
<tr>
<td>Dielectric Dissipation Factor</td>
<td>1 MHz</td>
<td>&lt;0.001</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Volume Resistivity</td>
<td>Ω cm</td>
<td>$1.0 \times 10^{16}$</td>
<td>$1.0 \times 10^{16}$</td>
</tr>
</tbody>
</table>

Test method: JIS K6911

4-7. Recyclability of “EARNESTON™”

<table>
<thead>
<tr>
<th></th>
<th>Unit</th>
<th>CJ002</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Virgin</td>
</tr>
<tr>
<td>Hardness (Type A)</td>
<td></td>
<td>65</td>
</tr>
<tr>
<td>Tensile Strength</td>
<td>(MPa)</td>
<td>13.8</td>
</tr>
<tr>
<td>Tensile Elongation</td>
<td>(%)</td>
<td>910</td>
</tr>
</tbody>
</table>

Condition:
Molding machine: IS55EPN injection molding machine
Injection temperature: 230 degrees C

4-8. Molding conditions of “EARNESTON™”

= Extrusion =

<table>
<thead>
<tr>
<th></th>
<th>Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rear end</td>
<td>170 ~ 230 deg. C</td>
</tr>
<tr>
<td>Middle</td>
<td>190 ~ 250 deg. C</td>
</tr>
<tr>
<td>Front</td>
<td>190 ~ 250 deg. C</td>
</tr>
<tr>
<td>Die head</td>
<td>190 ~ 250 deg. C</td>
</tr>
</tbody>
</table>

= Injection molding =

<table>
<thead>
<tr>
<th></th>
<th>Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rear end</td>
<td>160 ~ 220 deg. C</td>
</tr>
<tr>
<td>Middle</td>
<td>180 ~ 240 deg. C</td>
</tr>
<tr>
<td>Front</td>
<td>180 ~ 240 deg. C</td>
</tr>
<tr>
<td>Nozzle</td>
<td>180 ~ 240 deg. C</td>
</tr>
</tbody>
</table>

Mold Temperature 30 ~ 70 deg. C

The values of properties in this brochure are not to be regarded as sales specifications.
This brochure is just information for your comprehension of “EARNESTON™”.

There is little difference between the properties of CJ002 and CJ002N. Also there is little difference between CJ003 and CJ003N.

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