PRODUCT CATALOGUE

LOW DENSITY POLYETHYLENE

BRALEN+
TIPOLEN

Published in April, 2017

CERTIFICATES

MOL PETROCHEMICALS

SLOVNAFT

MOLGROUP
MOL Group is an oil, gas and petrochemicals company. Its petrochemical assets are INTEGRATED backwards to crude oil, providing RELIABILITY of supply. We can highly lean on the refinery integration benefits: the secured feedstock supply, the robust financial background and strong position in the regional markets, together with the HIGH QUALITY products provided by STATE OF THE ART TECHNOLOGIES.

We aim to become the FIRST CHOICE of our partners in our core region using the advantage of our location and competitive portfolio of high quality polyolefin products. We offer TAILOR MADE SOLUTIONS for our partners helping to build a SUCCESSFUL RELATIONSHIP.

We pay attention on OPERATIONAL EXCELLENCE, maintain our assets regularly in order to ensure reliable operation, considering safety as key value. Optimising operation with refining, the Division runs its production plants on 2 production sites in Tiszaujváros and Bratislava.

We would like to exceed our customers’ expectations in SERVICE EXCELLENCE throughout Europe. Supporting the fulfilment of this aim we operate several sales offices throughout Europe: in Hungary, Slovakia, Austria, Germany, Italy, Poland, Romania, Croatia and Ukraine.
Low density polyethylene LDPE is ductile and flexible material. It is stable in the temperature range from −50 to 85°C, the melting point is from 105 to 115°C. In the oxygen absence LDPE is stable up to 290 °C. It decomposes within 290 to 350 °C and thermoplastic products of lower molecular weight are formed. Gaseous products are formed in greater quantities above 350 °C and these gases contain as main component rather butene than ethylene. In the oxygen presence LDPE is less stable. During high temperature processing of LDPE in the presence of air thermal oxidation occurs.

During outdoor exposure of LDPE the photochemical oxidation caused by UV radiation occurs. Due to the oxidation by thermal or light effects on the surface of the products fine cracks are formed. They may deteriorate the physical and mechanical properties. In order to eliminate these negative phenomena light stabilizers are added to LDPE.

Non-oxidizing acids, bases, salts and their solutions practically have no effect on polyethylene. However, oxidizing chemicals attack polymer. LDPE is insoluble at normal temperature but is soluble at higher temperatures in aliphatic, aromatic and halogenated hydrocarbons. In the case that articles made of LDPE are exposed to the effect of chemical substances along with mechanical stress, on the surface cracks can be formed – this phenomenon is called environmental stress cracking.

LDPE has advantageous properties in permeability. It practically does not permeate water and steam, but it has a good permeability to carbon dioxide and oxygen. These characteristics are specially used in packaging.

LDPE is an excellent insulator with good dielectrical properties and a high volume resistance. The low dissipation factor predetermines LDPE for the use at high frequencies particularly where very low dielectric loss is required.

The excellent physical and mechanical properties provide the wide range of applications of this polymer. BRALEN+ and TIPOLEN are available in number of grades for all processing technologies as follows:

- films
- injection moulding
- extrusion
- tubes and pipes
- blow moulding
The first letter in the code of BRALEN+ grade indicates the main application area:
F = Film
M = Injection moulding

The second letter in the code of BRALEN+ grade indicates the range of density in kg/m$^3$ at 23°C:
A = 918 – 921
B = 922 – 925
C = 926 – 929
D = 930 and more

The first group of digits indicates MFR in g/10 min at 190°C and 2.16 kg:
– if MFR is below 1, the code is in shape like 02
– if MFR is over 1, then the figure in the code is according to mathematical rounding (e.g. MFR 1.7 = code 2)

The second group of digits represents internal code:
01 – 39 non-additivated grades
40 – 99 additivated grades

BRALEN+ COMMERCIAL GRADES PRODUCED BY LYONDELLBASELL TUBULAR REACTOR PROCESS ARE DESIGNATED BY TWO LETTERS AND TWO GROUPS OF DIGITS. THE SIGNIFICATION IS AS FOLLOWS:

FB 2 - 16

TO IDENTIFY TIPOLEN PRODUCTS MANUFACTURED BY LYONDELLBASELL TUBULAR REACTOR PROCESS A CODE OF TWO LETTERS AND FIVE DIGITS IS APPLIED.

FB 243 - 55

The first letter in the code of TIPOLEN grade indicates the main application area:
F = Film

The first, second and third digits are internal plant codes

The second letter shows MFR range in g/10 min at 190 °C and 2.16 kg:
A = 0.2 – 0.35
B = 0.6 – 0.9
C = 1.7 – 2.2
D = 3.4 – 4.6

The fourth and fifth digits are indicating the presence of additives
<table>
<thead>
<tr>
<th>Grade/Parameter</th>
<th>Melt Mass – Flow Rate (MFR) 190 °C/2.16 kg</th>
<th>Density (23 °C)</th>
<th>Tensile Strength (MD-TD)</th>
<th>Tensile Strain at Break (MD-TD)</th>
<th>Dart Drop</th>
<th>Haze</th>
<th>Tensile Stress at Yield</th>
<th>Vicat Softening Temperature</th>
<th>Additives</th>
<th>Recommended Film Thickness</th>
<th>Recommended Processing Conditions</th>
<th>Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>Units</td>
<td>g/10 min</td>
<td>kg/m³</td>
<td>MPa</td>
<td>%</td>
<td>g</td>
<td>%</td>
<td>MPa</td>
<td>°C</td>
<td>ppm</td>
<td>mm</td>
<td>°C</td>
<td></td>
</tr>
<tr>
<td>Test methods</td>
<td>ISO 1133-1</td>
<td>ISO 1183-1</td>
<td>ISO 527-1,3</td>
<td>ISO 527-1,3</td>
<td>ASTM D1003</td>
<td>ISO 527-1,2</td>
<td>ISO 306/A 50</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FA 03-01</td>
<td>0.25</td>
<td>920</td>
<td>27/25</td>
<td>200/500</td>
<td>200</td>
<td>15</td>
<td>–</td>
<td>93</td>
<td>–</td>
<td>0.070-0.220</td>
<td>170-220</td>
<td>–</td>
</tr>
<tr>
<td>FA 03-02</td>
<td>0.3</td>
<td>924</td>
<td>27/25</td>
<td>200/500</td>
<td>250</td>
<td>14</td>
<td>–</td>
<td>96</td>
<td>–</td>
<td>0.070-0.220</td>
<td>170-220</td>
<td>–</td>
</tr>
<tr>
<td>FA 03-03</td>
<td>0.3</td>
<td>927</td>
<td>30/27</td>
<td>250/600</td>
<td>180</td>
<td>7</td>
<td>–</td>
<td>102</td>
<td>–</td>
<td>0.060-0.220</td>
<td>170-220</td>
<td>–</td>
</tr>
<tr>
<td>FB 08-12</td>
<td>0.8</td>
<td>924</td>
<td>26/24</td>
<td>300/600</td>
<td>150</td>
<td>8</td>
<td>–</td>
<td>96</td>
<td>–</td>
<td>0.025-0.100</td>
<td>170-220</td>
<td>Shopper bags, surface protection films</td>
</tr>
<tr>
<td>FB 08-50</td>
<td>0.8</td>
<td>924</td>
<td>24/22</td>
<td>300/600</td>
<td>150</td>
<td>9</td>
<td>–</td>
<td>96</td>
<td>SAE, 500 AB, 900</td>
<td>0.025-0.080</td>
<td>170-220</td>
<td>–</td>
</tr>
<tr>
<td>FC 08-13</td>
<td>0.8</td>
<td>927</td>
<td>27/22</td>
<td>300/600</td>
<td>150</td>
<td>6.5</td>
<td>–</td>
<td>100</td>
<td>–</td>
<td>0.025-0.080</td>
<td>170-220</td>
<td>–</td>
</tr>
<tr>
<td>FB 2-16</td>
<td>2</td>
<td>924</td>
<td>25/21</td>
<td>250/600</td>
<td>120</td>
<td>8</td>
<td>–</td>
<td>94</td>
<td>–</td>
<td>0.020-0.100</td>
<td>160-200</td>
<td>–</td>
</tr>
<tr>
<td>FB 2-51</td>
<td>2</td>
<td>924</td>
<td>25/21</td>
<td>250/600</td>
<td>110</td>
<td>8</td>
<td>–</td>
<td>94</td>
<td>SAE, 500 AB, 1000</td>
<td>0.020-0.060</td>
<td>160-200</td>
<td>–</td>
</tr>
<tr>
<td>FB 4-52</td>
<td>4</td>
<td>924</td>
<td>19/16</td>
<td>300/600</td>
<td>100</td>
<td>9</td>
<td>–</td>
<td>92</td>
<td>SAE, 600 AB, 1800</td>
<td>0.015-0.040</td>
<td>150-190</td>
<td>–</td>
</tr>
<tr>
<td>FD 4-55</td>
<td>3.5</td>
<td>933</td>
<td>22/20</td>
<td>500/650</td>
<td>90</td>
<td>9</td>
<td>–</td>
<td>109</td>
<td>SAE, 1000 AB, 1000</td>
<td>0.015-0.060</td>
<td>170-220</td>
<td>–</td>
</tr>
<tr>
<td>MB 36-36</td>
<td>36</td>
<td>924</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>10</td>
<td>85</td>
<td>–</td>
<td>–</td>
<td>180-230</td>
<td>Injection moulding, lids, closures</td>
<td></td>
</tr>
</tbody>
</table>

**NOTES**
Typical properties, not be used as specification.

* Typical properties tested using 0.050 mm thick blown film extruded at melt temperature of 180 °C or 200 °C (for MFR 3.5–4), or at 170 °C (for MFR 4), and at blow up ratio 2.5:1.

** Typical properties measured on standard pressed specimens.

**ADDITIVES**
SA (E) Slip agent Erucamide
AB Antiblocking agent
### Grade/Parameter

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Units</td>
<td>g/10 min</td>
<td>kg/m³</td>
<td>MPa</td>
<td>%</td>
<td>°C</td>
<td>g</td>
<td>–</td>
<td>%</td>
<td>ppm</td>
<td>mm</td>
<td>–</td>
</tr>
<tr>
<td>Test methods</td>
<td>ISO 1133-1</td>
<td>ISO 1183-2</td>
<td>ISO 527</td>
<td>ISO 527</td>
<td>ISO 306/A120</td>
<td>ISO 7765-1 method A</td>
<td>ISO 866</td>
<td>ISO 14 782</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>FA 244-51</td>
<td>0.3</td>
<td>920</td>
<td>21/22</td>
<td>300/550</td>
<td>92</td>
<td>290</td>
<td>49</td>
<td>12</td>
<td>–</td>
<td>0.07-0.16</td>
<td>Heavy duty bags, shrink films, carrier bags, packaging films, household films, films for laminating, agricultural films, silage films, blow moulded products, bottles</td>
</tr>
<tr>
<td>FB 243-51</td>
<td>0.8</td>
<td>921</td>
<td>26/22</td>
<td>290/800</td>
<td>96</td>
<td>115</td>
<td>48</td>
<td>12</td>
<td>–</td>
<td>0.04-0.10</td>
<td>Carrier bags, household films, packaging films, films for laminating, small blow moulded products, bottles</td>
</tr>
<tr>
<td>FB 243-55</td>
<td>0.8</td>
<td>922</td>
<td>25/20</td>
<td>230/550</td>
<td>96</td>
<td>115</td>
<td>48</td>
<td>11</td>
<td>SA(E), 400 AB, 300</td>
<td>0.04-0.10</td>
<td>Carrier bags, household films, packaging films</td>
</tr>
<tr>
<td>FC 243-51</td>
<td>2.0</td>
<td>922</td>
<td>24/19</td>
<td>300/580</td>
<td>94</td>
<td>90</td>
<td>48</td>
<td>9</td>
<td>–</td>
<td>0.04-0.08</td>
<td>General purpose films, bubble films, foamed sheets</td>
</tr>
<tr>
<td>FC 243-55</td>
<td>2.0</td>
<td>922</td>
<td>24/19</td>
<td>240/560</td>
<td>94</td>
<td>90</td>
<td>48</td>
<td>9</td>
<td>SA(E), 400 AB, 300</td>
<td>0.04-0.08</td>
<td>General purpose films</td>
</tr>
<tr>
<td>FD 243-51</td>
<td>4.0</td>
<td>922</td>
<td>22/18</td>
<td>280/580</td>
<td>92</td>
<td>80</td>
<td>48</td>
<td>8</td>
<td>–</td>
<td>0.04-0.08</td>
<td>High clarity fine films, caps</td>
</tr>
<tr>
<td>FD 243-55</td>
<td>4.0</td>
<td>923</td>
<td>20/16</td>
<td>270/560</td>
<td>92</td>
<td>80</td>
<td>48</td>
<td>8</td>
<td>SA(E), 700 AB, 1400</td>
<td>0.04-0.08</td>
<td>High clarity fine films, caps</td>
</tr>
</tbody>
</table>

### NOTES

- Haze, Dart Drop, Tensile Strength and Tensile Strain at Break have been measured on film – thickness of 0.07 mm (MFR = 0.3 g/10 min), and 0.04 mm (MFR more than 0.3 g/10 min), blow up ratio 2:1.
- Density, Vicat Softening Temperature and Shore D Hardness have been measured on standard pressed specimens (ISO 293) conditioned at room temperature (ISO 293).

### ADDITIVES

- SA (E) – Slip agent Erucamide
- AB – Antiblocking agent
Polymers are exempt of REACH registration. However, their raw materials which mean monomers and relevant additives have been registered. SLOVNAFT, a.s./MOL Petrochemicals Co. Ltd. is committed to fully respect this legislation and will only use REACH compliant raw materials. At this point in time LDPE BRALEN+/TIPOLEN does not contain any substances specifically identified as SVHC at levels greater than 0.1%.

STORAGE & HANDLING

Pellets are packed in 25 kg PE-LD bags and transported on shrink-wrapped or stretch-wrapped pallets at eligible load of polymer 1375 kg. We use adhesive between the bags in order to avoid their slipping. Pay attention to this fact during the removing of the bags from the pallets. The preferred method is to lift the bag at first without rotation. Heat treated pallets are available as well. Transportation in a road silo or rail silo is also available. For more detailed information please contact SLOVNAFT and MOL Petrochemicals sales representative.

Since polyethylene is a combustible substance, the fire safety rules applicable for combustible materials in warehouses and store rooms should be observed.

If polymer is stored in conditions of high humidity and fluctuating temperatures, then atmospheric moisture can condense inside the packing. If it happened, it is recommended the pellets to be dried before use. During the storage polyethylene should not be exposed to UV radiation and temperatures above 40 °C. Producer does not take responsibility for any damages caused by adverse storage.

REACH STATEMENT

Most TIPOLEN and BRALEN+ grades satisfy the regulations applied by the European countries (EEC). Because several European countries apply restrictive regulations for the allowed migration values of additives in packaging material in contact with food, it is recommended that customers contact MOL Petrochemicals and SLOVNAFT for some special information or product licenses for food industry.

SAFETY

Under normal circumstances, polyethylene is not regarded as hazardous material when in contact with the skin or when inhaled. However, any contact with the molten polymer or the inhalation of the released gases should be avoided in processing. It is recommended to install exhaust units over processing machines and to secure good ventilation of the place. For further information see Material Safety Data Sheet.

APPLICATION FOR FOODS

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The information provided in this publication has been compiled to the best of our present knowledge. However, in view of the various applications of polyethylene resins and the equipment used, the processing conditions may differ.

The recommendations and data herein are to be construed as informatory only and do not relieve users from carrying out their own tests and experiments prior to processing in order to check suitability for a specific use. It is the responsibility of those to whom we supply our products to ensure that any proprietary rights and existing laws and legislation are observed. Our products are under continuous development, therefore we reserve the right to change the information presented in this brochure at our own discretion.

The REACH statement herein does not constitute legal advice. The REACH statement is provided for informational purpose only.