

PRODUCT CATALOGUE LOW DENSITY POLYETHYLENE

BRALEN+
TIPOLEN



Introduction

The Hungarian **MOL Petrochemicals Co. Ltd.** and Slovak **SLOVNAFT, a.s.** are an integrated part of the Downstream division within the MOL Group which is the biggest chemical complex in the region producing ethylene and propylene from naphta and gas oil and processing them into low, medium and high density polyethylene and polypropylene through the application of up-to-date technologies.

MOL Group considers **petrochemicals** as an **important strategic field. We can highly lean** on the refinery integration benefits in the MOL Downstream Division: the secured feedstock supply, the robust financial background and strong position in the regional markets, together with the high quality products of the optimized production

capacities. We keep operational reliability up by regular maintenance programs, carried out at our production units.

Our prime objective is maintaining our petrochemical leadership in the Central and Eastern European polymer market by taking advantage of the **synergies** provided by the ownership structure and making the names of MOL Petrochemicals and Slovnaft as the symbol of stable and reliable quality via exploiting optimized refinery and petrochemical production processes in accordance with the group's philosophy **"from crude oil to plastics"**.

Our advantageous location in the Central European markets and our competitive portfolio of high quality polyolefin products

- optimized in line with customer requirements - provide a firm basis for exploiting the opportunities arising from the surge of demand for polymers in Central and Eastern Europe.

Optimising operation with refining, the Division runs its production **plants** on 2 production sites in **Tiszaújváros** (the plants of MOL Petrochemicals Co. Ltd.) and **Bratislava** (the polymer plants of SLOVNAFT, a.s.), 3 olefin plants and 7 polymer units. We are one of the ten biggest polymer market players in Europe and more than half of our products are sold abroad. We have several **sales offices** throughout **Europe**, in Austria, Germany, Italy, Poland, Romania and the Ukraine. These offices deal with the sales of the products of both companies.

CORPORATE HISTORY

- 1999 MOL acquired minority stake in former TVK Plc.
- 2001 MOL became majority owner in former TVK with a stake over 33.34%
- 2004 MOL acquired majority stake in TVK (44.31%) and in SLOVNAFT (98.4%)
MOL Petrochemicals Division established: the product range has been streamlined and the sales channels integrated in order to provide competitive edge to our customers on their markets
- 2011 Petrochemical business integrated into the Downstream Division of MOL Group
- 2015 MOL acquired 100% of shares in TVK and renamed the company to MOL Petrochemicals Co. Ltd.
The petrochemical production operates on an integrated Group level (MOL Group), using a unified brand name and international background.

BRALEN+ is the registered trademark of SLOVNAFT, a.s.

TIPOLEN is the registered trademark for low density polyethylene produced by MOL Petrochemicals Co. Ltd.

CERTIFICATES SLOVNAFT



MOL Petrochemicals





Low density polyethylene

GENERAL INFORMATION

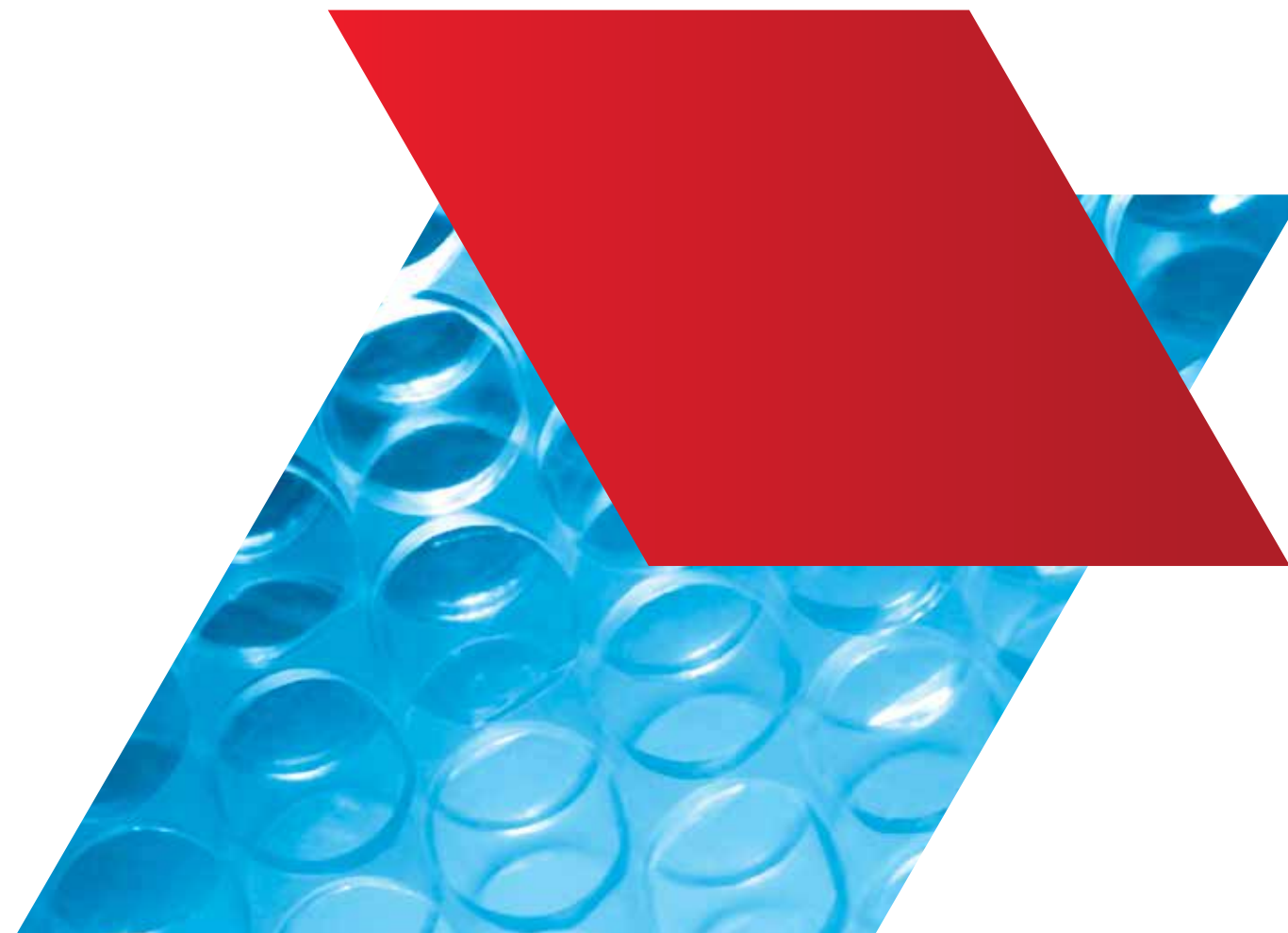
Low density polyethylene LDPE is ductile and flexible material. It is stable in the temperature range from -50 to 85 °C, the melting point is from 105 to 115 °C. In the oxygen absence LDPE is stable up to 290 °C. It decomposes within 290 to 350 °C and thermoplastic products of lower molecular weight 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.



Application

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
- ▶ EXTRUSION COATING AND LAMINATION

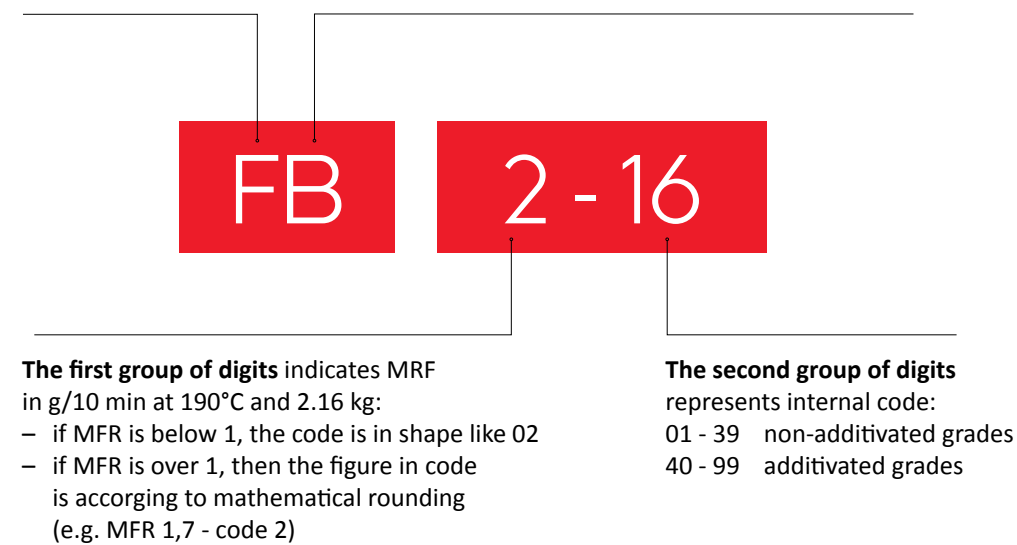
Coding system

Bralen+

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

The **first letter** in the code of **BRALEN+** grade indicates the main application area:
F = film
E = extrusion coating
C = cable
M = injection moulding
G = general purpose

The **second letter** in the code of **BRALEN+** grade indicates the range of density in kg/m³ at 23°C:
A = 918 - 921
B = 922 - 925
C = 926 - 929
D = 930 and more



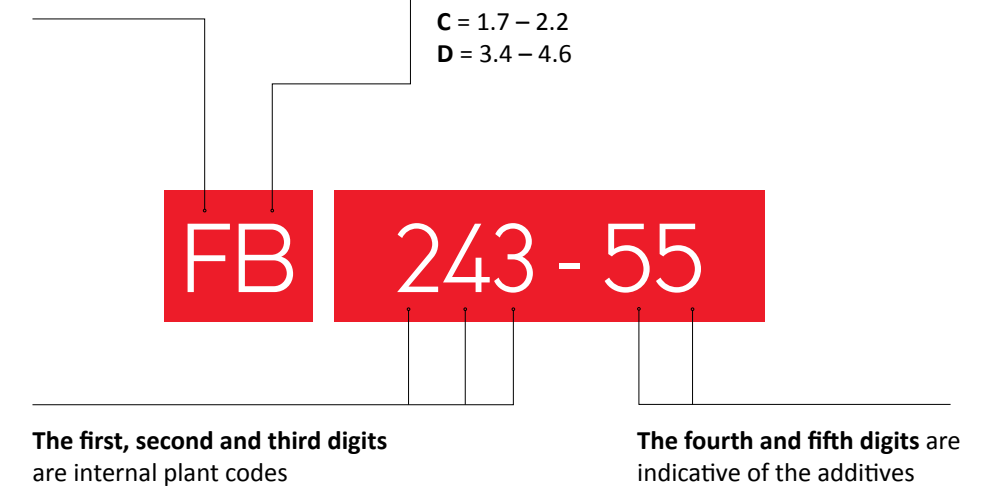
Coding system

Tipolen

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

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

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



Grade/Parameter	Melt Mass - Flow Rate (MFR) 190 °C/2.16 kg	Density (23 °C)	Tensile Strength (MD/TD) *	Tensile Strain at Break (MD/TD) *	Dart Drop *	Haze *	Tensile Stress at Yield	Vicat Softening Temperature	Additives	Recommended Film Thickness	Recommended Processing Conditions	Application
Units	g/10 min	kg/m ³	MPa	%	g	%	MPa	°C	ppm	mm	°C	
Test Methods	ISO 1133-1	ISO 1183-1	ISO 527-1,3	ISO 527-1,3	ISO 7765-1 method A	ASTM D1003	ISO 527-1,2	ISO 306/A 50	-	-	-	

GRADES FOR FILM APPLICATIONS

FA 03-01	0.25	920	27/25	200/500	280	15	-	93	-	0.070-0.220	170-220	heavy duty packaging, shrink hoods, agricultural films
FB 03-02	0.3	924	27/25	200/500	250	14	-	96	-	0.070-0.220	170-220	heavy duty packaging, shrink hoods, agricultural films
FC 03-03	0.3	927	30/27	250/600	180	7	-	102	-	0.060-0.220	170-220	collation shrink films, small blow mouldings
FB 08-12	0.8	924	26/24	300/600	150	8	-	96	-	0.025-0.100	170-220	shopper bags, sanitary films, surface protection films
FB 08-50	0.8	924	24/22	300/600	150	9	-	96	SA(E), 500 AB, 900	0.025-0.080	170-220	freezer films, laminating films, shopper bags
FC 08-13	0.8	927	27/22	300/600	120	6.5	-	100	-	0.025-0.080	170-220	collation shrink films, fine shrink films, high clarity films
FB 2-16	2	924	25/21	250/600	110	8	-	94	-	0.020-0.100	160-200	general purpose films, fine shrink films, high clarity films
FB 2-51	2	924	25/21	250/600	110	8	-	94	SA(E), 500 AB, 1000	0.020-0.060	160-200	general purpose films, freezer films, hygiene and food packaging, FFS films
FB 4-52	4	924	19/16	300/600	100	9	-	92	SA(E), 600 AB, 1800	0.015-0.040	150-190	cast films, high clarity films, clothes protection films, very thin gauge films, thin gauge and laminating films, cling films
FD 4-55	3.5	933	22/20	500/650	90	9	-	109	SA(E), 1000 AB, 1000	0.015-0.060	170-220	fine shrink films, hygienic films

GRADES FOR NON-FILM APPLICATIONS

MB 7-30	7	924	-	-	-	-	9	82	-	-	170-220	injection moulding, partially extrusion coating
MB 19-37	19	924	-	-	-	-	8	80	-	-	180-230	injection moulding
MB 36-36	36	924	-	-	-	-	10	85	-	-	180-230	injection moulding, lids, closures

Additives:
SA (E) slip agent erucamide
AB antiblocking agent

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 (for MFR 0.3-2), or at 170 °C (for MFR 4), and at blow up ratio 2.5:1.

Grade/Parameter	Melt Mass - Flow Rate (MFR) 190 °C/2.16 kg	Density (23 °C) **	Tensile Strength (MD/TD) *	Tensile Strain at Break (MD/TD) *	Vicat Softening Temperature **	Dart Drop *	Shore D Hardness **	Haze *	Additives	Recommended Thickness	Application
Units	g/10 min	kg/m ³	MPa	%	°C	g	-	%	-	mm	-
Test methods	ISO 1133-1	ISO 1183-2	ISO 527	ISO 527	ISO 306 /A120	ISO 7765-1 method A	ISO 868	ISO 14 782	-	-	-
FA 244-51	0.3	920	21/22	300/550	92	270	49	12	-	0.07-0.16	heavy duty bags, shrink films, carrier bags, packaging films, household films, films for laminating, agricultural films, silage films, blow moulded products, bottles
FB 243-51	0.8	921	26/22	270/600	96	111	48	9	-	0.04-0.10	carrier bags, household films, packaging films, films for laminating, small blow moulded products, bottles
FB 243-55	0.8	922	25/20	230/550	96	110	48	6	SA(E), AB	0.04-0.10	carrier bags, household films, packaging films
FC 243-51	2	922	24/19	260/590	94	85	48	9	-	0.04-0.08	general purpose films, bubble films, foamed sheets
FC 243-55	2	922	24/19	230/560	94	92	48	9	SA(E), AB	0.04-0.08	general purpose films
FD 243-51	4	922	22/18	280/580	92	80	48	8	-	0.04-0.08	high clarity fine films, caps
FD 243-55	4	923	20/16	270/560	92	80	48	8	SA(E), AB	0.04-0.08	high clarity fine films, caps

Additives:
SA (E) slip agent erucamide
AB antiblocking agent

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 291)



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

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%.



Application for foods

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.

♻ RECYCLING

Polyethylene resins are suitable for recycling using modern recycling methods. In-house production waste should be kept clean to facilitate direct recycling.

Disclaimer

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 informative 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.

SALES OFFICES

MOL Germany GmbH.
Im Trutz Frankfurt 49, D-60322
Frankfurt am Main
Germany

Telephone:
+49 69 154 04 0

Fax:
+49 69 154 04 41

E-mail:
polymersales@molgermany.de

SLOVNAFT POLSKA S.A.
PetChem Department
Ul. Postępu 17D
02-676 Warszawa, Poland

Telephone:
+48 22 545 70 70

Fax:
+48 22 545 70 60

E-mail:
petchem@slovnaft.pl

SLOVNAFT, a.s.
Vlčie hrdlo 1
824 12 Bratislava
Slovak Republic

Telephone:
+421 2 5859 7515
+421 2 5859 7622
+421 2 5859 7741
+421 2 5859 7231

E-mail:
polymersales@slovnaft.sk

SC. MOL Romania P.P. SRL
Str. Danielopolu 4-6
ET1 Sector 1 Cod 014 134
Bucuresti, Romania

Telephone:
+40 21 204 85 00
+40 21 204 85 02

Fax:
+40 21 232 10 59

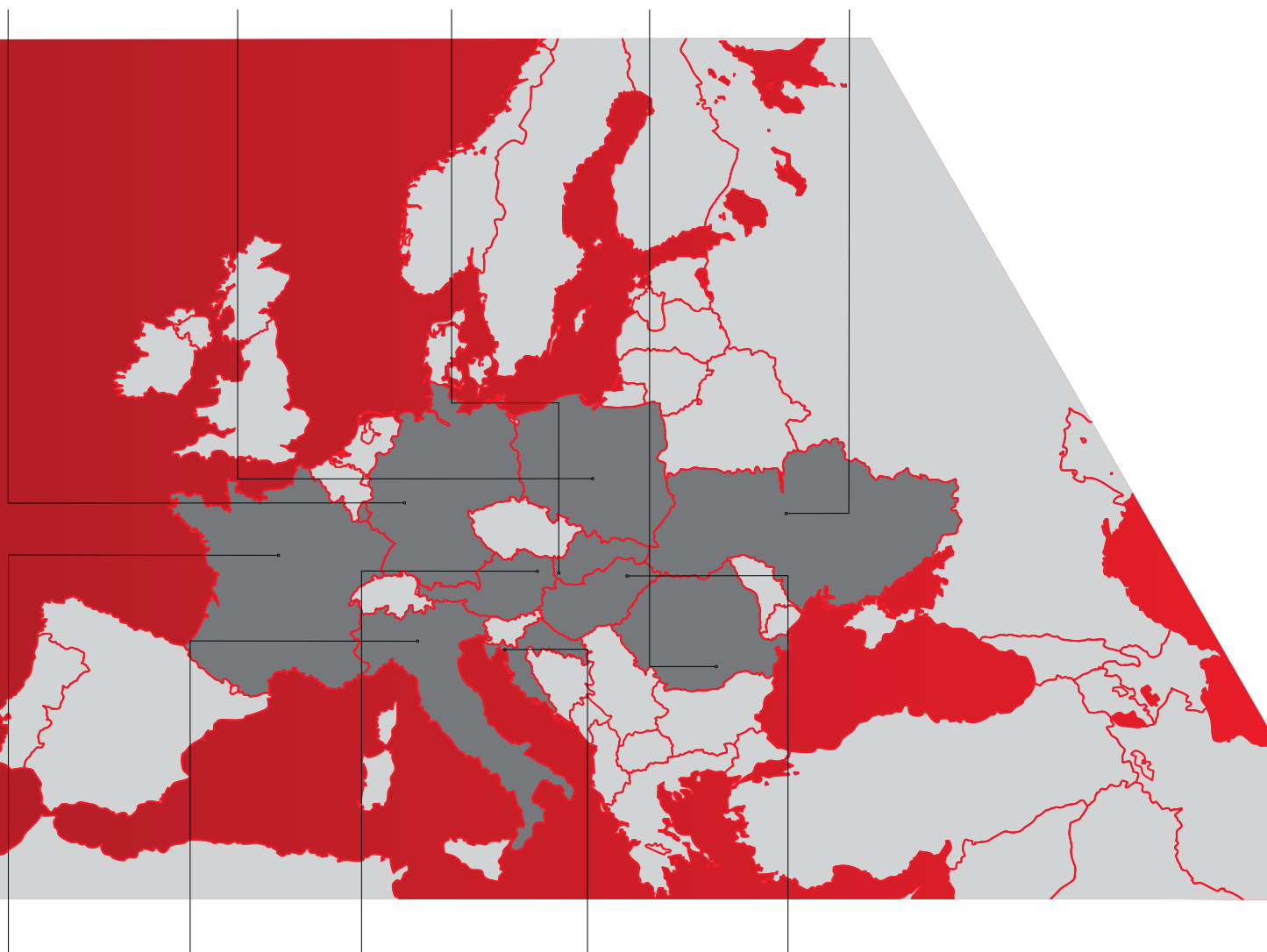
E-mail:
petchem@molromania.ro

MOL Ukraine LLC.
04655 Kiev
Moskovskiy ave., 23, 7th floor
Ukraine

Telephone:
+380 44 374 00 80
+380 67 463 58 69

Fax:
+380 44 374 00 90

E-mail:
JZavojko@mol-ukraine.com.ua



**French Liaison
Representative**
Paris
France

Mobile Phone:
+33 7 89 86 10 64

Telephone:
+33 1 64 32 44 17

E-mail:
husson.iren@fr.tvk.eu

TVK Italia S.r.l.
Via Teulié, 1,
20136 Milano
Italy

Telephone:
+39 02 58 30 5523

Fax:
+39 02 58 30 3492

E-mail:
tvkitaly@it.tvk.eu

MOL-Austria Handels GmbH.
Walcherstrasse 11A, 7.Stock
A- 1020 Wien
Austria

Telephone:
+43 1 211 20 1120

Fax:
+43 1 211 20 1198

E-mail:
JHauk@molaustralia.at

TIFON d.o.o.
Savska cesta 41/XIII
HR-10000 Zagreb
Croatia

Telephone:
+385 1 6160 600

Fax:
+385 1 6160 601

E-mail:
polymersales@tifon.hr

**MOL Plc.
Domestic Polymer Sales**
H-3581 Tiszaújváros,
P.O. Box: 20
Hungary

Telephone:
+36 49 521 355

Fax:
+36 49 886 491

E-mail:
polymersales@mol.hu

Other European Countries

Telephone:
+36 49 521 355
+36 70 458 4563
+36 70 373 9209

Fax:
+36 49 886 491

E-mail:
polymersales@mol.hu

Published in December 2015