# Blow Moulding of Technical Components

![Engine Image]

## Table of Contents

<table>
<thead>
<tr>
<th>Topic</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Why Blow Moulding</td>
<td>2</td>
</tr>
<tr>
<td>DuPont’s offering</td>
<td>2</td>
</tr>
<tr>
<td>Polyester resins</td>
<td>2</td>
</tr>
<tr>
<td>Nylon resins</td>
<td>2</td>
</tr>
<tr>
<td>Under-bonnet components</td>
<td>2</td>
</tr>
<tr>
<td>Air duct system</td>
<td>3</td>
</tr>
<tr>
<td>Cooling circuit system</td>
<td>3</td>
</tr>
<tr>
<td>CVJ-boots and bellows</td>
<td>3</td>
</tr>
<tr>
<td>Fuel tanks</td>
<td>4</td>
</tr>
<tr>
<td>Blow moulding technologies</td>
<td>4</td>
</tr>
<tr>
<td>Applications</td>
<td>8 to 15</td>
</tr>
</tbody>
</table>

---

Start with DuPont
Why Blow Moulding

• Cost and weight reduction
• Recyclability (i.e. replaces rubber)
• Innovation:
  – Multifunctional parts
  – Reduce number of parts in the engine compartment
• Higher temperature under the bonnet
• Easier assembly and disassembly
• Reduce number of materials
• Improve engine performance up to 2% (air intake manifolds; air ducts)
• Reduce noise

DuPont’s offering in Blow Moulding

• Resin
  
  HYTREL* TPE
  CRASTIN* PBT
  ZYTEL® BM PA
  ZYTEL 330 Amorphous nylon
  SELAR® RB Barrier resin

• Design support
• CAD support
• Processing support

Nylon resins for Blow Moulding

ZYTEL BM 7300T HSL
  Unreinforced, toughened PA 6

ZYTEL BM 73G25T HSL
  25% glass reinforced, toughened PA 6

ZYTEL BM 7300 FN
  Unreinforced, PA 6 flexible nylon alloy

ZYTEL BM PA 66 based blow mouldable nylon resins are currently under development:
  – unreinforced, toughened
  – glass reinforced, toughened
  – hydrolysis resistant.

ZYTEL 330
  Transparent, amorphous nylon

SELAR RB
  Nylon barrier resin (for use with polyolefins)

PA 6 and flexible nylon based resins are compatible for sequential and multilayer co-extrusion, to provide hard and soft segment combinations and multi-layer structures.

Typical applications: Cooling circuit parts, air ducts, resonators, etc.

Polyester resins for Blow Moulding

<table>
<thead>
<tr>
<th>Resins</th>
<th>Hardness (shore D)</th>
</tr>
</thead>
<tbody>
<tr>
<td>HYTREL HTR 8105</td>
<td>47D</td>
</tr>
<tr>
<td>HYTREL HTR 5612</td>
<td>50D</td>
</tr>
<tr>
<td>HYTREL HTR 4275</td>
<td>55D</td>
</tr>
<tr>
<td>HYTREL ETP 1383</td>
<td>62D</td>
</tr>
<tr>
<td>HYTREL with higher melt strength (under development)</td>
<td></td>
</tr>
<tr>
<td>CRASTIN XMB6400</td>
<td>Rockwell (M) 75</td>
</tr>
<tr>
<td>CRASTIN with higher melt strength (under development)</td>
<td></td>
</tr>
</tbody>
</table>

HYTREL and CRASTIN PBT are compatible for sequential and multi-layer co-extrusion. They can provide hard and soft segment combinations as well as multi-layer structures.

Typical applications:
Air ducts, CVJ boots and bellows.

Blow moulded under-bonnet components

Current and potential use for blow moulded DuPont engineering plastics include:
• Turbo charge ducts
• Air ducts – Clean air – Recycled air
• Crankcase venting hoses
• Oil cooling pipes and hoses
• Resonators
• Coolant system pipes and hoses
• Coolant reservoirs
• Air conditioning pipes and hoses
Air duct system

1) Clean air
2) Crankcase housing venting hose
3) Recycled air
4) Recycled charged air
   A) Air filter
   B) Charger
   C) Heat exchanger for charged air

Requirements for air ducts
Temperature range
120 – 140 °C petrol engines
140 – 160 °C diesel engines

Pressure range
1,2 – 2 bar charge pressure

Chemical resistance
Oil, blow-by gas and petrol

Typical fatigue test
Stress cycles 1000000
Pulsating pressure range 1,2 – 2 bar
Test medium air
Temperature 132 ± 2 °C
Ambient air temperature 85 ± 5 °C
Test frequency 0,5 – 1 Hz

Suitable polymers
TPE, PBT and nylon depending on individual application.

Cooling circuit system

A) Coolant radiator
   1) Water cooling pipes and hoses
A1) Header tanks in ZYTEL
   2) Oil circuit pipes and hoses
B) Oil cooler
   3) Car interior heating hoses
C) Air duct
   4) Air conditioner pipes and hoses
D) Heat exchanger for car interior
E) Air conditioner

Requirements for cooling circuit
Temperature 130 – 140 °C continuous
Pressure 2 – 4 bar
Chemical resistance 50/50 glycol water mixture

Suitable polymers
Polyamides 6 or 66, unfilled and glass reinforced depending on the application.

CVJ -boots and bellows

Benefits of HYTREL:
• Greater toughness (5 – 10 times vs. rubber)
• Longer life cycle
• Better dimensional stability
• No ballooning at high speed
• Superior low temperature flexibility
• Higher wear resistance
• Lower permeation of oil and grease
• Weight reduction against rubber
Fuel tanks with SELAR* RB

The DuPont patented “laminar barrier technology” uses SELAR RB to blow mould plastic fuel tanks with an integral laminar barrier:
• 5 – 7% SELAR RB is added to HDPE
• Up to 98% reduction of hydrocarbon emissions
• Standard blow moulding equipment can be used
• Industry and government regulations can be met.

Blow moulding technologies

• Continuous extrusion blow moulding
• Accumulator head blow moulding
• Injection blow moulding
• Multi-layer co-extrusion
• Sequential co-extrusion (hard/soft combination)
• 3-dimensional blow moulding
  – 3D Mono layer extrusion
  – 3D Multi-layer co-extrusion
  – 3D Sequential co-extrusion

Petrol tank requirements

Europe:
• Effective Jan. ’93 all EC countries must meet evaporative emission limits of 2 g/2 h/vehicle.
• Switzerland, Austria, Sweden require SHED** test condition.
• Test petrol contains no alcohols.
• Commercial petrol may contain up to 3% methanol, 5% ethanol, 15% ethers, with weight limit of 2.8% oxygen.

Current requirements in USA:
• SHED test 2 g/2 h/vehicle.

Proposed CARB** shed test 2 g/25 h/vehicle for build schedule (by model year): 10% 1995; 30% 1996; 50% 1997; 100% 1998.
• More States to follow with EPA** approval
• EPA requires that a new car fulfills the requirement after 10 years or 100,000 miles
• OEM’s new objectives for petrol tank permeation is up to 0.1 g/25 h (50% isooctane and 50% toluene) Ref.-C test petrol.
• EPA will use EEE petrol without alcohols for the new shed test.
• Testing with methanol fuel blends is only required for alternative fuel vehicles.

Continuous extrusion

The parison is extruded continuously by constantly rotating the screw of the plasticising unit.
The process is very simple but requires the use of high melt strength polymers to be able to make long parts. A limitation is often the weight of the parison, as it has a tendency to elongate or collapse under its own weight while being extruded relatively slowly out of the die. Continuous extrusion machines are generally lower cost vs. other types.

* DuPont’s registered trademark
** SHED = Sealed Hose Emission Determination test
CARB = California Air Resource Bureau
EPA = Environmental Protection Agency
**Accumulator head**

In this process, the screw of the plasticising unit is rotating continuously and accumulates the molten polymer into a cylinder. The melt is then pushed out through the die by a piston in a very short time. This system has one advantage: it allows the use of lower melt strength resins as the parison does not have to hang so long (typically one fifth of the time compared to the continuous process) before being moulded. The machines are however more expensive but it is normally offset by more flexibility.

**Multi-layer extrusion**

Equipment is available for continuous extrusion or with accumulator head. Of importance is that several polymers can be extruded into a multi-layerparison. The thicknesses of the individual layers and the combination of polymers can be varied. The benefit is a structure which only uses the minimum amount of each individual polymer to achieve the required properties at the minimum cost.

**Injection blow moulding**

In this technology, the first step is the injection moulding of a preform. In some types of machines this preform is then blown up in a second stage. In other types of machines, part of the preform (parison) is injected and the rest of the process is like the accumulator head system ("Press blower").

**Sequential blow moulding**

Sequential blow moulding is also beginning to make an impact in the air intake ducting sector. The process is a development of co-extrusion but rather than extruding an inner and outer layer together it involves, as the name suggests, extruding two different but compatible plastic materials in sequence. Most often, the result is to combine hard and soft sections in a single moulding.

**4-stage injection blow moulding machine:**
1) Injection mould
2) Blow mould
3) Stripping
4) Core pin temperature conditioning

**3-stage injection blow moulding machine:**
1) Injection mould
2) Blow mould
3) Stripping

**3-layer coextrusion**
1) Main extruder: Inner layer
2) Satellite extruder 1: Middle layer (e.g. recycled material)
3) Satellite extruder 2: Outer layer (e.g. high heat, abrasion resistant, styling or barrier)

<table>
<thead>
<tr>
<th>Product line</th>
<th>Material combination</th>
</tr>
</thead>
<tbody>
<tr>
<td>Polyesters</td>
<td>C RASTIN®</td>
</tr>
<tr>
<td>Nylons</td>
<td>ZYTEL BM</td>
</tr>
<tr>
<td></td>
<td>HYTREL/ETP</td>
</tr>
<tr>
<td>ZYTEL BM 7300 FN</td>
<td></td>
</tr>
</tbody>
</table>

**Sequential**

Typical sequential moulded part featuring a flexible section.
Sequential and multi-layer test

- Trials where done at a blow moulding machine manufacturer in Bonn, Germany, on a Krupp Kautex Co-Ex machine. The mould is a bellow test mould from Krupp Kautex.

3-dimensional blow moulding

In addition to the above processes, 3-dimensional blow moulding adds the possibility to make complex 3-dimensional parts. In all the conventional processes, the limitation is the basic straight tube shape of the parison from which any part has to be made. With the various 3-dimensional systems (15 patented processes world wide), the parison can be laid or manipulated in a 3-dimensional shape.

Movable Die Mould

Movable Die Head
3-dimensional blow moulding and 3-dimensional sequential Co-Ex

1) Flexibility of design
- Curved and complicated plastic pipes can be made with ease in a single process with different types of resins.
- Different types of resins (hard type and soft type) can be located freely and easily with good adhesion anywhere along the part.

2) Variety of resins
- Example of resin combination

<table>
<thead>
<tr>
<th>Product line</th>
<th>Hard</th>
<th>Soft</th>
</tr>
</thead>
<tbody>
<tr>
<td>Polyesters</td>
<td>C R A S T I N</td>
<td>H Y T R E L / E T P</td>
</tr>
<tr>
<td></td>
<td>XMB6400</td>
<td></td>
</tr>
<tr>
<td>Nylons</td>
<td>Z Y T E L  B M</td>
<td>Z Y T E L  B M</td>
</tr>
<tr>
<td></td>
<td>7300T HSL</td>
<td>7300 F N</td>
</tr>
<tr>
<td></td>
<td>Z Y T E L  B M</td>
<td></td>
</tr>
<tr>
<td></td>
<td>73G25T HSL</td>
<td></td>
</tr>
</tbody>
</table>

3) Basic structure of exchange blow moulding

4) Comparison

<table>
<thead>
<tr>
<th></th>
<th>Parts</th>
<th>Assembly operations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Traditional air flow pipe</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pipe</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Rubber hose</td>
<td>3</td>
<td>6</td>
</tr>
<tr>
<td>Hose band</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Washer</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Bolt</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Total</td>
<td>23 pieces</td>
<td>24 operations</td>
</tr>
</tbody>
</table>

Sequential co-extrusion air flow pipe

<table>
<thead>
<tr>
<th></th>
<th>Parts</th>
<th>Assembly operations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pipe</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Rubber hose</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Hose band</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Washer</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Bolt</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Total</td>
<td>7 pieces</td>
<td>8 operations</td>
</tr>
</tbody>
</table>
**Commercial Application**

**Application:** Air duct/high pressure/charged  
**Moulder:** Helphos  
**OEM:** Audi  
**Grade:** HYTREL HTR 4275 BK  
**Status:** Commercial  
**Comment:** Metal inserts  
VW test temperature 150 °C  
Integrated attachments  
Hot plate welded side stud

**Commercial Application**

**Application:** Air duct  
**Moulder:** Kaiser  
**OEM:** Audi  
**Grade:** HYTREL HTR 4275 BK  
**Status:** Commercial  
**Comment:** Achieved noise reduction  
With integrated seal

**Commercial Application**

**Application:** Air duct  
**Moulder:** Helphos  
**OEM:** VW - Corrado  
**Grade:** HYTREL HTR 4275 BK  
**Status:** Commercial  
**Comment:** Air duct with welded-on attachment and metal inserts

**Commercial Application**

**Application:** Bellow “La Bonette”  
**Moulder:** Véhicules Industriels  
**OEM:** Renault  
**Grade:** ALCRYN 2070 BK  
**Status:** Commercial  
**Comment:** ALCRYN 2070 BK was chosen because of its good processing and weathering characteristics
Commercial Application

**Application:** Venting hose of crank shaft housing  
**Moulder:** Helphos  
**OEM:** VW - Golf A3  
**Grade:** HYTREL HTR 4275 BK  
**Status:** Commercial  
**Comment:** Metal inserts, integrated shoulder for the attachment clip

Commercial Application

**Application:** Air cooling duct (1 and 2)  
**Moulder:** Helphos  
**OEM:** VW  
**Grade:** HYTREL HTR 4275 BK  
**Status:** Commercial  
**Comment:** Duct 1 and 2 are snap-fitted with a blow moulded snap-fit

Commercial Application

**Application:** Venting hose of crank shaft housing  
**Moulder:** Helphos  
**OEM:** VW - Golf A3  
**Grade:** HYTREL HTR 4275 BK  
**Status:** Commercial  
**Comment:** Metal inserts, flanges calibrated in the blow moulding process

Commercial Application

**Application:** Air duct  
**Moulder:** Kaiser  
**OEM:** Audi  
**Grade:** HYTREL HTR 4275 BK  
**Status:** Commercial  
**Comment:** Air duct with integrated moulded-in seals
Commercial Application

**Application:** Air duct  
**Moulder:** Helphos  
**OEM:** VW  
**Grade:** HYTREL HTR 4275 BK  
**Status:** Commercial  
**Comment:** Attachment integrated

Commercial Application

**Application:** Air duct  
**Moulder:** Helphos  
**OEM:** VW  
**Grade:** HYTREL HTR 4275 BK  
**Status:** Commercial  
**Comment:** Moulded on attachment

Commercial Application

**Application:** Air duct  
**Moulder:** Helphos  
**OEM:** VW - Golf A3  
**Grade:** HYTREL HTR 4275 BK  
**Status:** Commercial  
**Comment:** Metal inserts moulded on attachment

Commercial Application

**Application:** Air duct  
**Moulder:** Kaiser  
**OEM:** Audi  
**Grade:** HYTREL HTR 4275 BK  
**Status:** Commercial  
**Comment:** Replaced ECO and saved about 40% of the component cost due to integrated seals and easier assembly
Commercial Application

Application: Air duct
Moulder: Helphos
OEM: VW
Grade: HYTREL HTR 4275 BK
Status: Commercial
Comment: Integrated attachment and welded on attachment

Commercial Application

Application: Air duct
Moulder: Kayser
OEM: Audi
Grade: HYTREL HTR 4275 BK
Status: Commercial
Comment: This duct replaced ECO and saved about 40% of the component cost due to easier assembly and integrated seals

Commercial Application

Application: Air duct
Moulder: Helphos
OEM: VW
Grade: HYTREL HTR 4275 BK
Status: Commercial
Comment: Metal inserts moulded on attachment

Test Application

Application: Test mould steering bellow
Moulder: Krupp Kautex Machine Manufacturer
OEM: 
Grade: HYTREL HTR 5612 BK/
HYTREL ETP 1383
Status: Test
Comment: Co-ex Inside HYTREL HTR 5612 BK for optimal flexibility
Outside HYTREL ETP 1383 for high heat resistance
Commercial Application

**Application:** VW Air ducts  
**Moulder:** Helphos  
**OEM:** VW  
**Grade:** HYTREL HTR 4275 BK  
**Status:** Commercial  
**Comment:** Several different air ducts

---

Commercial Application

**Application:** Air duct  
**Moulder:** Helphos  
**OEM:** VW  
**Grade:** HYTREL HTR 4275 BK  
**Status:** Commercial  
**Comment:** Integrated attachment

---

Commercial Application

**Application:** Air duct  
**Moulder:** Kaiser  
**OEM:** Audi  
**Grade:** HYTREL HTR 4275 BK  
**Status:** Commercial  
**Comment:** Replaced ECO

---

Test Application

**Application:** Test mould  
**Moulder:** Krupp Kautex Machine Manufacturer  
**OEM:**  
**Grade:** ZYTEL BM  
**Status:** Test  
**Comment:** Sequential Co-extrusion

---

Left: HYTREL; Right: ECO (epichlorhydrin rubber)
### Commercial Application

**Application:** Air duct  
**Moulder:** Kautex UK  
**OEM:** Ford - Zeta engine  
**Grade:** ZYTEL BM  
**Status:** Commercial  
**Comment:** Ford prefers ZYTEL for higher temperature requirement

### Commercial Application

**Application:** Air duct  
**Moulder:** Phoenix  
**OEM:** VW  
**Grade:** HYTREL HTR 4275 BK  
**Status:** Commercial  
**Comment:** The crank case vent goes in the studs’ integrated in the part that is why oil resistance at elevated temperature (150 °C) is required

### Commercial Application

**Application:** Resonator  
**Moulder:** Kautex UK  
**OEM:** Ford - Mondeo  
**Grade:** ZYTEL BM  
**Status:** Commercial  
**Comment:** Ford prefers ZYTEL for high temperature requirements

### Test Application

**Application:** Test mould  
**Moulder:** Krupp Kautex Machine Manufacturer  
**OEM:**  
**Grade:** CRASTIN XMB 6400 N C / HYTREL ETP 1383 N C  
**Status:** Test  
**Comment:** Sequential Coex hard ends with CRASTIN XMB 6400 soft bellow made of HYTREL ETP 1383
**Commercial Application**

**Application:** Air duct  
**Moulder:** Kayser  
**OEM:** Audi  
**Grade:** HYTREL HTR 4275 BK  
**Status:** Commercial  
**Comment:** With integrated moulded-in seals

**Commercial Application**

**Application:** Shock absorber sleeve  
**Moulder:** Contitech (Dannenberg)  
**OEM:** Mercedes  
**Grade:** ZYTEL BM  
**Status:** Commercial  
**Comment:** This part had to be in PA 66 to meet HDT requirements. ZYTEL CFE 8005 BK was the only blow moulding nylon 66 resin available to fulfill requirements

**Commercial Application**

**Application:** Crank case venting hose  
**Moulder:** Kayser  
**OEM:** Audi  
**Grade:** HYTREL HTR 4275 BK  
**Status:** Commercial  
**Comment:** Replaced ECO for easier assembly and lower component cost.

**Commercial Application**

**Application:** CVJ Boot  
**Moulder:** Contitech  
**OEM:** PSA  
**Grade:** HYTREL HTR 4275 BK  
**Status:** Commercial  
**Comment:** In use on the wheel sides. HYTREL was chosen because of its excellent low temperature flexibility.
**Commercial Application**

- **Application:** CVJ Boot
- **Moulder:** Contitech
- **OEM:** Ford - Mondeo
- **Grade:** HYTREL HTR 8105 BK
- **Status:** Commercial
- **Comment:** Bellows made from HYTREL are used on wheel and engine side, 4 bellows are used on each vehicle

**Commercial Application**

- **Application:** CVJ Boot
- **Moulder:** Contitech/Möller Werke/Paguag
- **OEM:** VW (Golf)
- **Grade:** HYTREL HTR 8105 BK
- **Status:** Commercial
- **Comment:** VW choose HYTREL because of excellent low temperature flexibility (no service failure at –50 °C).

**Development Application**

- **Application:** Lorry cable duct to the cabine.
- **Moulder:**
- **OEM:** DAF
- **Grade:** HYTREL HTR 4275 BK
- **Status:** Development was not commercialised
- **Comment:**

**Commercial Application**

- **Application:** Cooling pipe
- **Moulder:**
- **OEM:** BMW
- **Grade:** PA 66, 30 % glass reinforced
- **Status:** Commercial
- **Comment:**
For further information contact:

**Benelux**
- Du Pont de Nemours (Belgium)
  - Antoon Spinostraat 6
  - B-2800 Mechelen
  - Tel. (15) 44 14 11
  - Telex 22 554
  - Telefax (15) 44 14 09

**Bulgaria**
- Du Pont Bulgaria
  - 18, Tsikmery Vrab Blvd.
  - Bldg. 2, Floor 5
  - BG-1407 Sofia
  - Tel. (2) 66 066 57 36
  - Telex 24 261 DUPONT BG
  - Telefax (2) 65 63 29/66 56 11

**Ceskoslovensko**
- Du Pont - Conoco CS Spol. S.R.O.
  - Palad Kultury
  - S. Kvetna 65
  - CS-1409 Praha 4
  - Tel. (02) 422 641 to 422 646
  - Telex 33 742 MK UN

**Czechoslovakia**
- Du Pont - Conoco Hungary KFT
  - Theokoly Ut. 137
  - H-1145 Budapest
  - Tel. (1) 183 51 40

**Deutschland**
- Du Pont - Conoco Deutschland GmbH
  - DuPont Straße 1
  - D-61343 Bad Homburg
  - Tel. (43) 63 38 33

**Egypt**
- Medgenco International Trade Co.
  - El Bostan Street
  - ET-Cairo
  - Tel. (02) 392 78 66
  - Telex 93 742 MK UN

**España**
- Du Pont Ibérica S. A.
  - Turcot, 23, 3º
  - E-08006 Barcelona
  - Tel. (3) 209 73 11
  - Telex 50 887 DUPO E

**France**
- Du Pont de Nemours (France) S.A.
  - 137, rue de l’Université
  - F-75334 Paris Cedex 07
  - Tel. (1) 45 50 65 50
  - Telex 206 772 dupon
  - Telefax (1) 47 53 09 67

**Hellas**
- Du Pont de Nemours Italiana S. p. A.
  - Via A. Volta, 16
  - I-20093 Cologno Monzese Mi
  - Tel. (02) 25 302 1

**Israel**
- Gadot Chemical Terminals (1985) Ltd.
  - 22, Shalom Afiechtem Street
  - IL-633 43 Tel Aviv
  - Tel. (1) 328 717

**Italia**
- Du Pont de Nemours Italia S. p.A.
  - Via A. Volta, 16
  - I-20093 Cologno Monzese Mi
  - Tel. (02) 25 302 1

**Magyarország**
- Du Pont - Conoco Hungary KFT
  - Theokoly Ut. 137
  - H-1145 Budapest
  - Tel. (1) 183 51 40

**Maroc**
- Debordet Marcq S. A.
  - Résidence Firdaous
  - 40, boulevard d’Anfa - 10°
  - MA-Casablanca
  - Tel. (2) 77 49 75

**Norge**
- Nordic Polymers AS
  - Niels Leuchvei 99
  - N-1343 Eiksmarka
  - Tel. 67 14 28 70

**Österreich**
- Inteser GmbH
  - Braheaugasse 3-5
  - A-1050 Wien
  - Tel. (1) 512 35 71

**Polska**
- E. I. du Pont de Nemours & Co.
  - Warsaw Branch Office
  - Intraco Bldg. - Floor 12
  - ul. Stawki 2
  - PL-00193 Warszawa
  - Telefax (2) 635 04 01

**Portugal**
- Mario Coelho
  - Rua do Campo Alegre, 672 - 1º
  - P-4100 Porto
  - Tel. (2) 69 24 25/69 26 64

**România**
- Aecra International Ltd
  - Distributor for DuPont
  - Strada Luterană 2 - 4
  - Hotel Bucuresti Corp. D2.
  - Tel. (0953) 97 31 10
  - Telex 413 778 DUMOS SU
  - Telefax (0953) 973 24 40

**Schweiz/Suisse/Svizzera**
- Dolder AG
  - Postfach 14695
  - CH-4004 Basel
  - Tel. (061) 326 66 00

**Suomi/Finnland**
- Suomen Du Pont Oy
  - P.O. Box TST 98851
  - Kowloon, Hong Kong
  - Tel. (852) 734 53 45

**South Africa**
- Du Pont de Nemours International S.A.
  - 1122 New World Office Bldg - East Wing
  - Salisbury Road
  - Kowloon, Hong Kong
  - Tel. (852) 734 53 45

**Türkiye**
- Grillo Maden Ltd.
  - Istanbul, Turkey
  - TR-80090 Taksim-Istanbul
  - Tel. (1) 449 83 10

**United Kingdom**
- Du Pont (U.K.) Limited
  - MAYLANDS Avenue
  - GB-Hemel Hempstead
  - Herts. HP2 7DP
  - Tel. (0492) 21 00

**United States**
- E. I. du Pont de Nemours & Co.
  - Wilmington, Delaware 19898
  - Tel. (302) 774 1000

This information corresponds to our current knowledge on the subject. It is offered solely to provide possible suggestions for your own experiments. It is not intended, however, to substitute for any testing you may need to conduct to determine for yourself the suitability of our products for your particular purposes. This information may be subject to revision as new knowledge and experience becomes available. Since we cannot anticipate all variations in actual end-use conditions, DuPont makes no warranties and assumes no liability in connection with any use of this information. Nothing in this publication is to be considered as a license to operate under or a recommendation to infringe any patent right.