Endex International

Innovation for the Future

Endex™ Chemical Foaming Agents and Process Aids

Molding Guide©

We are dedicated to innovation and excellence in the manufacture of specialty chemical foaming agents. Our innovative products are the leaders in these technologies, and strong technical support complements the quality and versatility of our products. Our commitment to the customer is evident in everything we do.

Endex chemical foaming agents utilize innovative technology to produce superior quality thermoplastic foamed products by generating fine, closed-cell foams. They also act as processing aids to improve flow and compatibility mixed/recycled polymers. They reduce molding cycle time and increase extrusion rates, improving weld-line strength, and reducing warp and sink-marks.

Product Use Information

Endex™ use levels will vary with the application, but the following guidelines can be used as a starting point. Optimization for each application is recommended. Some Endex™ products are listed below. For guidance on the product for a specific application, contact Endex™.

Endex A6C 2750
Endex NBC 2750
Endex 4233
Endex 1010
Endex 1011
Endex 1040
Endex 1041
Endex 1042
Endex 1725
Endex 1750
Endex 2650
Endex 2725
Endex 2775
Endex 3750

Structural Foam Molding	1–2%
Sink Mark Elimination	0.2%
Nitrogen Foam Molding	0.3%
Extrusion & Blow Molding	0.5%
Gas-Assist Molding	0.3%

Multi-Polymer Compatibility

Endex™ is a high efficiency mini-pelletized concentrate, in a thermoplastic resin carrier. It is designed for use in both commodity and engineering thermoplastics, and may be dried with the polymer if necessary. It produces a very fine, closed cell structure and smooth surfaces. It combines its endothermic properties, quality and efficiency, with versatility and cost effectiveness.

Multi-Process Application

Endex™ endothermic chemical foaming agents are intended for use in a wide variety of processes including:

Injection Molding for cycle time reduction, sink marks, warp reduction and shrink control.

Structural Foam Molding (SFM).

Gas Counter-Pressure foam molding.

Nitrogen SFM for finer cell structures and extra weight reduction.

Gas Assist/Gas Injection molding for extra weight reduction and sink elimination.

Moisture Sensitive Thermoplastic Polymers which need to be dried before processing.

Endex ABC 2750™ & Endex 2650™ Product Data

Physical Form: Thermoplastic polymer pellets

Active Ingredients: Acid and base components

Process Temperatures: 148 – 315˚, 300 – 600˚ F

Characteristics: Endothermic decomposition

Physiology: All ingredients are Generally Recognized As Safe (GRAS) by the FDA

Endex ABC 2750™ & Endex 2650™ endothermic chemical foaming agents and process aids are designed for general use in Injection Molding (IM) and Structural Foam Molding (SFM). It may be dried with the polymer if necessary.

Endex 1010™ for Moisture Sensitive Polymers

Endex 1010™ is a very high efficiency, mini-pelletized concentrate, in a thermoplastic resin carrier, designed for use in very moisture sensitive engineering thermoplastics, for example polycarbonate and PET, and may be dried with the polymer. It produces a very fine, closed cell structure and smooth surfaces. It combines its endothermic properties, quality and efficiency, with versatility and cost effectiveness.

Endex 1010™ Product Data

Physical Form: Thermoplastic polymer pellets

Active Ingredients: Acid and base components

Process Temperatures: 205 – 315˚, 400 – 600˚ F

Characteristics: Endothermic decomposition

Physiology: All ingredients are Generally Recognized As Safe (GRAS) by the FDA

Endex 1010™ endothermic chemical foaming agent and process aid is designed for IM and SFM in moisture sensitive polymers, where the polymer must be dried prior to use.

Injection Molding

Sink Marks and Warp: Endex ABC 2750™, Endex 2650™ and Endex 1010™ can be used at low levels (0.1–0.3%) to remove sink marks and to reduce warp. However, in the use of high holding pressure and cushion can prevent the expansion of the gas while the melt is soft enough to allow the sink marks to be "pushed out" and the same high injection pressure can increase the tendency to warp during cooling. The following technique has been successful in overcoming sink and warp problems:

Inject a short-shot (about 10% short) with minimum holding pressure and cushion and gradually increase the shot size until the mold is full. This allows the gas in the melt to complete the filling of the mold with minimum pressure on the melt. With the proper level of Endex™ and adjustment of the shot size, the part will have no surface effects or splay, and the injection stresses will be minimal.

Cycle Time: The internal gas pressure improves contact with the mold cooling surfaces, while the endothermic properties of Endex™ contribute to the cooling of the part, and there is usually no increase in cycle time. In some cases there will be significant reduction in cycle time due to the positive contact with the mold cooling and the nucleating effects of Endex™ in crystalline and semi-crystalline polymers.

Temperatures and Clamp: Use of Endex™ may also allow a reduction in processing temperatures and a reduction in the mold clamping force.

Use of Polymer Regrind: The decomposition products of Endex™ do not affect the use of regrind since there is no residual activity in the regrind.

Structural Form Molding

Use Level: Use levels will vary with the application, but a 1% level for Endex ABC 2750™ & Endex 2650™, or 0.5% for Endex 1010™ is a good starting point. The use level can then be optimized for maximum efficiency and cost effectiveness.

Venting of the Mold: In SFM, venting is usually in the range of 0.005–0.010 inches to permit fast air escape and thus avoid compressing the foam structure. It is the gas pressure in the melt which require extra venting can be identified by watching the fill pattern. Temporary vents can be made using adhesive-backed aluminum or lead tape (available in 0.005 and 0.010 inch thickness from 3M).

Shot Size: Start with a shot about 25% less than the mold capacity and adjust to fill the mold over several shots. The target weight can be adjusted by a combination of Endex™ use level and shot size adjustment.

Holding Pressure and Cushion: Since it is the gas pressure in the melt which fills the mold, the use of holding pressure will prevent the mold from filling properly. Do not use holding pressure and ensure that the screw bottoms out (i.e. do not use a cushion during injection).

Injection Pressure and Speed: Set the injection pressure high enough to achieve the maximum available injection speed. High speed injection usually gives the best surface quality, but some resins are sensitive to the high shear generated during fast injection and the speed may have to be adjusted to suit these materials.

Back Pressure and Screw Speed: The use of back pressure (usually 100–200 psi) improves mixing and consistency in the polymer melt. Screw speed is normally 20–50 RPM.

Temperature Profile: The temperature profile should be set to achieve a suitable melt temperature for the polymer, however the rear zone/hopper temperature should not be so high as to cause premature decomposition of Endex™ and thus loss of gas back through the hopper. A temperature range of 380–420˚ F (193–215˚ C) at the rear zone/hopper is suitable for most polymers.

Mold Temperatures: Surface finish, skin thickness and cycle time are all affected by the mold temperatures. Hot molds usually produce thinner skins, smoother surfaces and longer cycle times than cool molds. The normal range is 60–140˚ F (16–60˚ C), and the polymer manufacturer's recommendations are usually appropriate.

Use of Polymer Regrind: The decomposition products of Endex™ do not affect the use of regrind, since there is no residual activity in the regrind.

Metric to US & Temperature Conversion

Pressure, Force

to convert	to	multiply by
Bar	psi	14.51
kPa	psi	0.145
MPa	psi	145
CPa	psi	145.038
N/m	ft/lb	0.735
J/m	ft-lb/in	0.0187
kN	ton	0.1124
˚C	˚F	x 1.8 then add 32
˚F	˚C	- 32 then divide by 1.8

Temperature Conversion Table

˚F	˚C	˚F	˚C
200	93.3	430	221.1
215	101.7	440	226.7
230	110	450	232.2
240	115.6	460	237.8
280	137.8	470	243.3
290	143.3	480	248.9
300	148.9	490	254.4
310	154.4	500	260
320	160	510	265.6
330	165.6	520	271.1
340	171.1	530	276.7
350	176.7	540	282.2
360	182.2	550	287.8
370	187.8	560	293.3
380	193.3	570	298.9
390	198.9	580	304.4
400	204.4	590	310
410	210	600	315.6
420	215.5	610	321.0

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