Endex International

Innovation for the Future

Endex™ Chemical Foaming Agents and Process Aids

Extrusion 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.

Extrusion Guide

General: Extruded thermoplastics can be foamed to 50% or more, of their original densities. Successful extrusion depends upon adjusting temperature and pressure profiles of the extruder to use Endex™ most efficiently. Pressure must be maintained on the melt to prevent foaming in the extruder. This can be done using a high compression screw, fine screen packs or temperature reduction in the front extruder zones to produce back-pressure. Pressure can also be controlled by adjusting screw speed. The die temperature is normally lower than for solid extrusions to enhance surface appearance.

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

Dies: Use a die with minimum land-length ratio, preferable no larger than 10:1 to ensure high pressure on the extrudate, thus preventing premature cell formation. If the pressure drops too low within the die land, cells can form while there is still shear stress on the melt, causing irregular cell formation and poor surface appearance.

Screws: A conventional single-stage, unvented screw is normally used. To ensure adequate mixing of polymer and Endex™ the Length: Diameter (L/D) ratio of the screw should be at least 16:1. If the screw has a vent it should be sealed if this is not possible then zone temperatures prior to the vent must be kept below the decomposition temperature of Endex™ (less than 300˚ F, 149˚ C), which may not be practical on short L/D screws.

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 of 360˚ F (139˚ C) at the rear zone/hopper is suitable for most polymers.Take-Off Equipment: It is essential to use take-off equipment capable of achieving the desired quality of extrudate. Normal take-off equipment may be used, with extra cooling being advantageous. The distance from the die lip to the take-off equipment is critical to maximum expansion consistent with the desired surface appearance. Foamed sheet should be passed through chill rolls to polish the surface and set the dimensional stability, and the roll spacing should be adjusted to avoid over-compression of the sheet. Drawdown and vacuum sizing (if used) should be regulated for consistent foam.

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.

Extrusion Processes

Expanded Sheet: Expanded Sheet can be thermo-formed, but because there is a reduction in the polymer weight, thermo-forming time is usually shortened.

Co-Extrusion: Co-extrusion of high quality can be made with Endex™. Because of its endothermic properties, there is no "bleed-through" or "pin-holding" of the solid skins.

Blow Molding: The general principles for successful extrusion apply to the extrusion of a parison. A parison can be made in one of two ways: A) Continuous extrusion or B) Intermittent extrusion.
In the intermittent extrusion, the melt must be kept under pressure to prevent premature expansion. As soon as the parison exits the die, it expands as cell formation takes place. The die and pin should be adjusted to compensate, with the die diameter being reduces, and the pin diameter being increased. Stationary, reciprocating, or rotary dies may be used, and blow pressure is normally reduced to avoid wall rapture. Mold release may be needed on the hot knife or wire to obtain a clean cutt-off.

Wire Coating: Control of the wire temperature is very important. If it is too low, the foam will be reduced; if it is too high, large cells may foam around it. Rapid cooling of the extrudate will prevent sagging, particularly in thick-wall insulation.

Pipe & Profile Extrusion: Annular, or pipe dies, generally perform better than straight dies, as the flow is more uniform around the annulars than in straight slits. Streamlined flow causes rapid cell formation as the extrudate exits the die. The distance from the die lip to the cooling/sizing equipment controls the expansion rate; the greater the distance.

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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