SMB Extrusion Melt Blender

High Quality melt flow means ……

…….better cash flow.

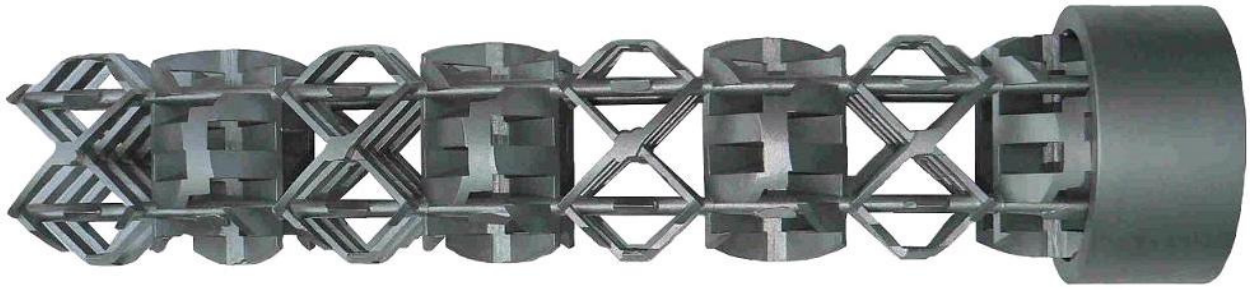


Fig. #1: *SMB-GXS* Extruder Melt Blender cast in one piece*
(For details see our brochure:"The New Extrusion Melt Blender SMB-GXS"

INTRODUCTION

We are living in a world of consumption. Product and Extrusion Specialists have to deal on a daily basis with many different tools, formulations, colors and additives mastebatches. Production rate, yield and high quality are Keys for Success.

The STAMIXCO Extrusion Melt Blender SMB-R consists of eight (8) very efficient static mixing elements that homogenize the polymer melt as it enters the extruder die. The homogenization is achieved by a continuous division of the molten polymer and its recombination when pushed through the geometric structure of the mixing bars (figure #2).

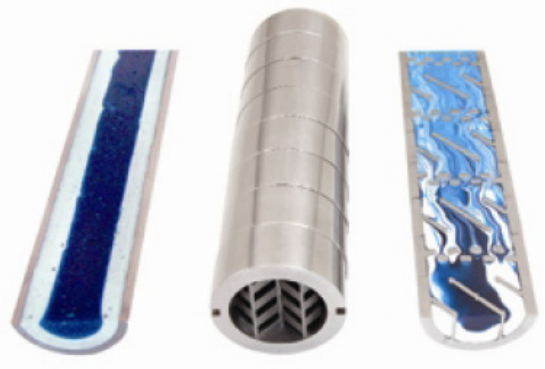


Fig. #2: *Mixing of blue and white epoxy resins. Empty tube (left) provides no mixing. Eight (8) SMB-R mixing elements (center and right) provide an almost perfect mix.*

The SMB-R mixing elements are extremely resistant due to their monolithic cast construction where the mixing bars are joined to each other and to the external ring wall via a single molten metal pour. They are made of heat treated high strength 17-4 PH stainless steel and hence are virtually indestructible creating a low pressure drop.

The figure #2 shows the laminar behaviour of two resins (white and blue) when processed into an empty pipe (left) and through eight (8) SMB-R static mixing elements (right). These eight STAMIXCO SMB-R static mixer elements reduce the non-uniformity by a factor 6.
The figure #3 illustrates a ready to install Stamixco SMB-R Extrusion Melt Blender with flanged housing and heater bands.

Fig. #3: *A Ready-to-Install Stamixco SMB-R Extrusion Melt Blender with flanged housing and heater bands.*

* The Static Melt Blender SMB-GXS is not offered for sale in the USA.

MIXING QUALITY

The optimum melt polymer quality for extrusion is reached when at each location inside the polymer melt volume a well-uniform distribution of colorant, additives and melt temperature is measured. Using the STAMIXCO SMB-R mixing elements, 80% of mixing (CoV = 0.2) is reached after eight elements and 97% (CoV = 0.03) after 16 elements as shown in Figure #4.

Fig. #4: *Mixing evolution through the SMB-R Static Mixer Elements of a Blue and White resins (1:1 volumetric ratio). After 8 elements 80% and after 16 elements 97% mixing efficiency is achieved.*

The mixing efficiency of a SMB-R and SMB-GXS is identical for same number of mixing element. Outstanding mixing of the polymer melt prior to extrusion results in the following benefits:

BENEFITS

- Homogenous melt with small differences in temperature and concentration (Fig. #6)
- Reduced colorant usage (up to 40% less) (Fig. #5) with comparable extrudate color density
- Streak free product
- Improved admixing of regrind material
- Uniform melt flow in the die reduces time needed for die adjustment (Fig. # 7 & 8)
- Foam cell size and cell distribution uniformity in foamed products
- Improved surface quality and mechanical characteristics
- Stabilizes the entire extrusion process

Payback of the Melt Blender investment is usually less than 2 months based on savings achieved from its installation.

ILLUSTRATION OF BENEFITS MASS HOMOGENEIZATION

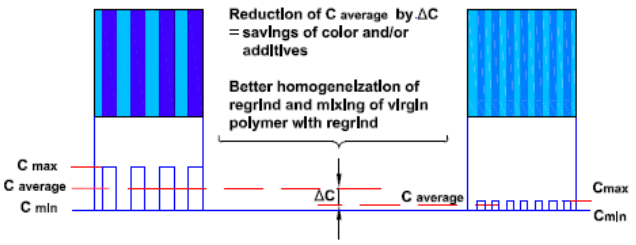
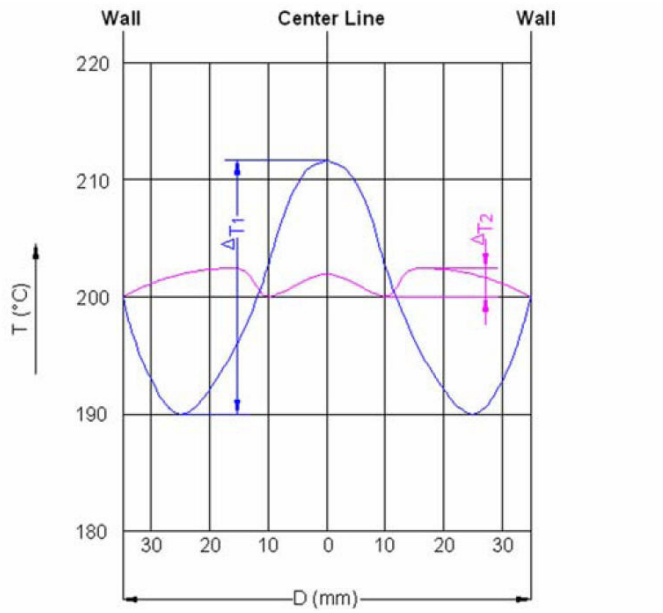


Fig. #5: *Illustration of the color concentration distribution profile achieved WITHOUT a STAMIXCO static mixer (left) and WITH our STAMIXCO SMB-R static mixer elements (right).*

HOMOGENEIZATION OF TEMPERATURE



ΔT1: Typical 22°C(40°F) Barrel Temperature Profile
ΔT2: Typical 2°C(3°F) Static Mixer Exit Temperature Profile

Fig. #6: *An extruder screw (blue line) typically delivers molten polymer with a high Temperature gradient which effects product quality. The type SMB-R and GXS mixing elements reduce the temperature variation to less than 2°C.*

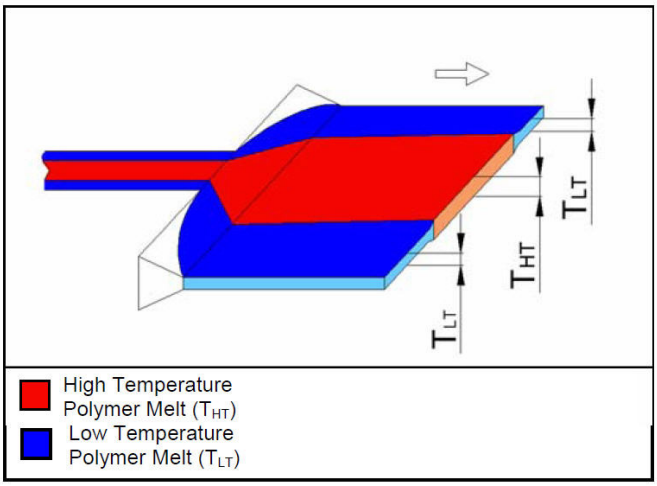


Fig. #7: *Polymer melt in a sheething process WITHOUT a static mixer resulting in a high sheet thicknesses variation = HIGH REJECT RATES.*

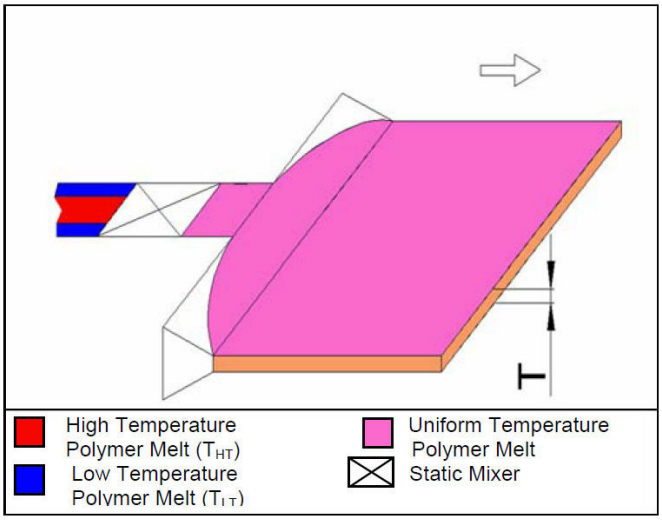


Fig. #8: *An homogeneous polymer melt temperature at the die face results in a even sheet thickness enabling to operate continuously at minimum thickness specifications.*

MELT BLENDER SELECTION

The standard arrangement of the Melt Blender SMB-R is eight (8) mixing elements (licensee of Bayer AG, Germany). The length is approximately 4-times the diameter. The number of mixing elements can vary depending on the application. The mixing elements are made of high strength heat treated stainless steel 17-4 PH (DIN 1.4542).

All neighboring bars of the mixing grid are connected to each other and their end to the outer ring.

The size of the melt blender is a function of flow rate and viscosity of the polymer melt. The approximate melt blender size can be determined in the table below. For customer inquiries, please fill out the technical specification questionnaire.

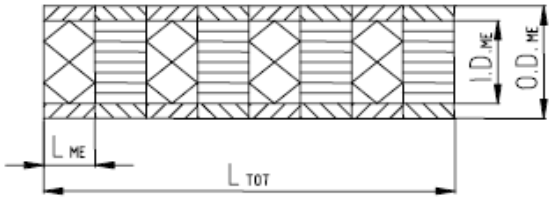


Figure #9: *Main dimension of Melt Blender SMB-R; For typical values see table below.*

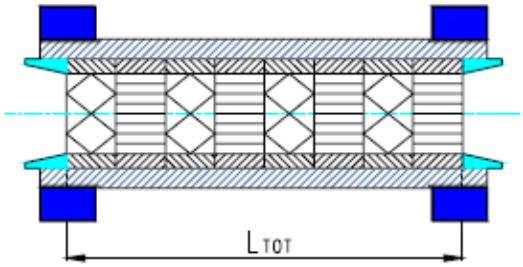
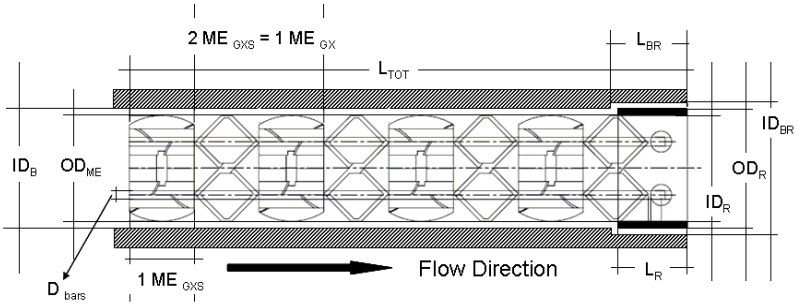


Figure #10*: Longitudinal section of Melt Blender SMB-R and housing.*

Extruder Screw Diameter [mm]		**Melt Blender**	**Mixing Elements**				**Housing**
High Viscosity Material	Low Viscosity Material	Type **SMB-R**	ID [mm]	OD [mm]	L_{ME} [mm]	8 Mixing Elements L_{TOT} [mm]	Bore [mm]
25	**30**	**SMB-R25**	**20**	**25**	**12.5**	**100.0**	**25**
25	**45**	**SMB-R32**	**27**	**32**	**16.0**	**128.0**	**32**
50	**60**	**SMB-R48**	**40**	**48**	**24.0**	**192.0**	**48**
60	**75**	**SMB-R60**	**52**	**60**	**30.0**	**240.0**	**60**
75	**100**	**SMB-R75**	**66**	**75**	**37.5**	**300.0**	**75**
90	**120**	**SMB-R90**	**80**	**90**	**45.0**	**360.0**	**90**
120	**150**	**SMB-R115**	**102**	**115**	**57.5**	**460.0**	**115**
150	**200**	**SMB-R140**	**126**	**140**	**70.0**	**560.0**	**140**
These sizes are specially well suited for the extrusion of foamed products		**SMB-R175**	**154**	**175**	**90.0**	**720.0**	**175**
		SMB-R200	**175**	**200**	**102.5**	**820.0**	**200**
		SMB-R225	**200**	**225**	**115.0**	**920.0**	**225**
		SMB-R250	**225**	**250**	**130.0**	**1040.0**	**250**
Tolerances (category/mm):			**-**	**f7**	**0/-0.1**	**0/-0.8**	**H7**

For larger sizes, please contact us. All dimensions are approximate. Tolerances are recommendations only.

DIMENSIONS of SMB-GXS



Extruder Screw Diameter [mm]		**Melt Blender**	**Ring**		**Mixing Elements**		**Bore**			**Length**
High Viscosity Polymer	Low Viscosity Polymer	Type **SMB-GXS**	DN [mm]	OD_R x ID_R x L_R [mm]	OD_{ME} [mm]	D_{bars} [mm]	ID_B [mm]	ID_{BR} [mm]	L_{BR} [mm]	$L_{tot.}$ [mm]
25	**45**	**25/32 - 8**	**25**	32.0 x 26 x 20.0	24.7	2.1	26.0	32.0	20.0	138
50	**60**	**40/48 - 8**	**40**	48.0 x 41.5 x 30.0	40.6	3.3	41.5	48.0	30.0	211
60	**75**	**50/60 - 8**	**50**	60.0 x 52.0 x 35.0	50.7	4.2	52.0	60.0	35.0	268
75	**100**	**65/75 - 8**	**65**	75.0 x 68.0 x 42.0	66.5	5.5	68.0	75.0	42.0	351
90	**120**	**80/90 - 8**	**80**	90.0 x 82.0 x 53.0	80.0	6.7	82.0	90.0	53.0	435
120	**150**	**100/115 - 8**	**100**	115.0 x 103.5 x 63.0	101.2	8.5	103.5	115.0	63.0	528
150	**200**	**125/140 - 8**	**125**	140.0 x 129.5 x 68.0	126.2	10.5	129.5	140.0	68.0	684

Tolerances: OD_R: +0/-0.20; ID_R: +0/-0.2; L_R :-0.1/-0.2; L_{BR}: +0/-0.2; OD_{ME}: +0/-0.2; ID_B : +0/-0.2; ID_{BR} : +0.1/+0.2; $L_{tot.}$: +5/-5

→ FOR CONDENSED VERSION OF "START-UP AND OPERATING GUIDELINES" SEE NEXT PAGE. ←

START-UP AND OPERATING GUIDELINES

(Condensed Version – for more information refer to the Installation & Operation brochure)

Maximum Operating Conditions

A standard SMB-R Mixing Element Assembly with eight (8) static mixing elements (Fig. #6) is designed for the following maximum operating conditions:

a) 300 °C (572 °F) maximum continuous operating temperature
b) 80 bar (1,160 psi) maximum allowable pressure drop
Where these limits are expected to be exceeded, special Melt blender are available.

Installation Direction of Mixing Elements

The Mixing elements may be installed with flow in any direction under the condition that no alignment pins extends beyond the front and rear rings of the mixing elements.

Temperature Sensor

The Melt Blender housing should be equipped with a temperature sensor to control housing heater band operation on a dedicated circuit.

Start-Up and Operation of SMB Melt Blender

The SMB Melt Blender must be allowed to soak at the operating temperature so that all internal parts of the mixing element fingers and frozen polymer within the mixing elements is melted and is at operating temperature prior to processing polymer. ***Proper heat-up is required to prevent a cold-start induced mixing element failure.***

a) Heat the Melt Blender until it reaches its normal operating working temperature and the controller switches on-and-off regularly for 5 minutes. Wait for an additional amount of time to allow complete melting of the polymer inside the melt blender: Recommended additional heating time ranges from 10 min for our SMB-R-12-8 up to 60 min for our SMB-R-175-8.

Extreme caution is required for any location upstream of the melt blender where a solid “rod” of frozen polymer exists. Extreme caution is required because a frozen slug of solid polymer takes longer to melt that the same frozen slug of polymer within the mixing elements. A “dead-head-cold start” event can cause destruction and tear-out of the mixing element fingers that may cause subsequent damages.

b) When the additional heat-up time has elapsed, force molten polymer continuously while extruding at low rpm at approximately 20% of the normal flow rate. If any major resistance of the melt is felt, stop and soak for another 5 minutes and start again. Compare temperature of molten polymer and housing set point temperature. As soon as the difference is only slight, normal production may begin.

Cold Start Protection

A Upstream Breaker Plate will prevent a “rod” of frozen polymer from upstream equipment striking the mixing elements. A downstream Breaker Plate will protect the downstream die from a possible damage during cold start mixing element failure induced by start up with frozen polymer.

Interruption of Extrusion Operations

For brief interruptions of extrusion operations, temperature to the Melt Blender housing may be lowered about 10-20°C (~20-40°F). During longer interruptions, the heating should be stopped to avoid burning of polymer. For normal and emergency shutdowns when thermally sensitive polymers are being processed, normal purge procedures prior to shut-down should be followed.

Color Changes

The SMB-R Mixing Elements have a very narrow residence time distribution as compared to an empty pipe. This means that when changing polymers or color, the contents of the mixing elements will be purged completely in a short period of time by the new material (~ 5 mixing element volume residence times).

For cleaning of the mixing elements fluidized bed bath or vacuum pyrolysis can be applied. Heating above 400 ºC and open flame/blow torch cleaning is not allowed. Otherwise the strength of the heat treated mixing element material will be affected.

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