

Plastic Disposable Static Mixers with Novel X-Grid Design

For Demanding Mixing and Dispersing Requirements with 2-Component Resins for Adhesives, Sealants, Varnishes and other Applications

Characteristics of the X-Grid Family of Static Mixers

The designation GX represents the family of StaMixCo Technology Ltd. static mixing elements that have the characteristic feature of an X-Grid crossing bar structure. This proven static mixer structure was invented by Bayer AG (called the BKM mixer) and used extensively and successfully for the processing of viscous polymers in difficult applications such as for the mixing of fluids with large differences in viscosity or volumetric ratio. With the GX mixing structure, a high degree of mixing is created in a short mixer length and with a small volume hold-up. This GX structure was available only in expensive metal construction for the first 25 years since its invention.

A significant manufacturing innovation was recently made that allows for the GX structure to be injection molded in inexpensive plastic construction. A family of GX mixing elements are now available in Polypropylene and high strength 50% Glass-Filled Nylon PA66 construction.

Figure #1 shows the GXP structure (left side) in 50% glass-filled Nylon PA66 (black) and in Polypropylene (white) construction. The industry standard lower performance Helical static mixer design, also supplied by StaMixCo, is shown on the right in Polypropylene (white bow-tie) construction. One (1) GXP mixing element (left side) creates the same degree of mixing as three (3) Helical mixing elements (= HME, on the right side).

Figure #2 shows the GXP-LMXR structure that is characterized by a ring on the OD of the X-Grid mixing structure which is integrally connected to the mixer grid. This ring feature dramatically increases the maximum allowable pressure drop of the fundamental X-Grid structure. In addition, the ring allows for a strong non-deforming structure to be pounded upon when fouled/polymerized mixing elements must be removed from the housing without damage for inspection and cleaning. The white (left) mixing elements in Figure #2 are made of Polypropylene and the black mixing elements (right) are made of high strength 50% glass-filled Nylon PA66.

Figure #3 (left side-orange color) shows the most significant cost saving manufacturing innovation with the GXF mixing element design. The GXF features the X-Grid structure and the high strength ring around the mixing grid structure (as the GXP-LMXR in Figure #2) where it is made by an innovative (patent pending) technique where an entire chain of mixing elements are injection molded in one shot with a hinge between each element so that when they are folded together, a complete mixing element assembly is created (Figure #3, left-bottom). Figure #3 (right side-white) shows the traditional lower performance HME's which is also supplied by StaMixCo.

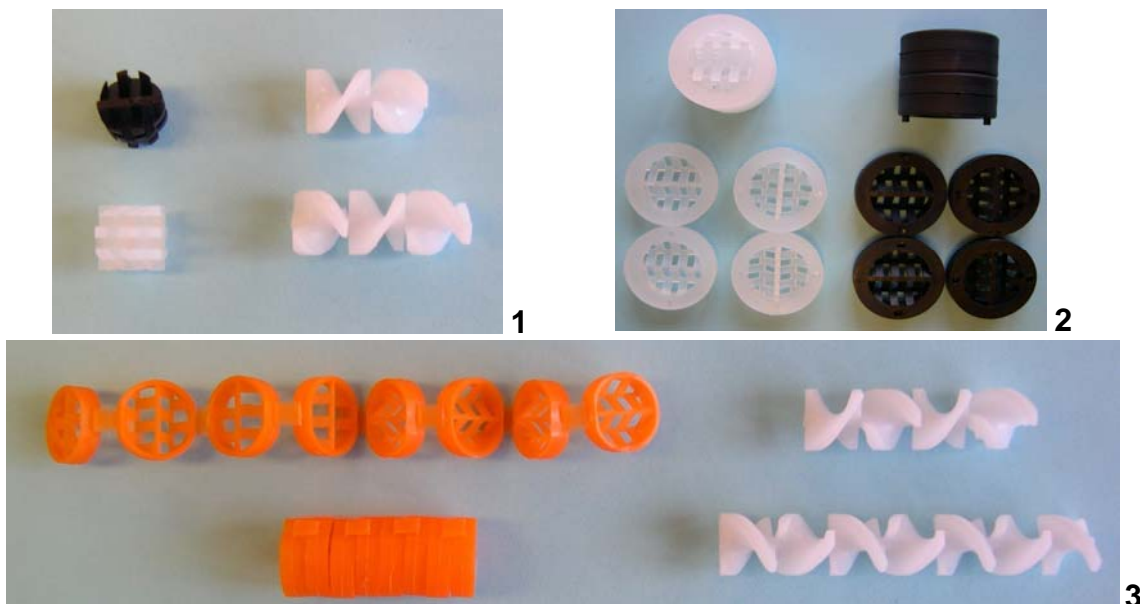


Figure #1: GXP Mixing element (black:50% Glass-Filled Nylon PA66), white (Polypropylene).

Mixing Efficiency comparison: 1 GXP (left) = 2 – 3 helices (right)

Figure #2: GXP-LMXR-21 Mixing element with support ring: black: 50% GF Nylon PA66), and white (PP).

Figure #3: GXF Mixing element (PP) with 8 rings hinged to each other (top left) and folded (bottom left) to make a 2-mixing element assembly

Availability of X-Grid Family of Static Mixers

GXP Static Mixing Elements (see Figure #1)

The following GXP mixing elements are available:

- | | | | |
|----------------|-------------|-----------------------|---------------------------------|
| - GXP-9.4-PP | OD = 9.3 mm | Length = 9.3 – 9.4 mm | Max Pressure Drop ≈ 50 - 80 bar |
| - GXP-9.4-PA66 | OD = 9.4 mm | Length = 9.4 – 9.5 mm | Max. Pressure Drop ≈ 300 bar |
- Larger and smaller sizes of the GXP mixing element are in various stages of manufacturing development.

GXP-LMXR Static Mixing Elements (see Figure #2 & Figure #4)



Figure #4:

GXP-LMXR-21 mixing elements can be installed inside metal pipes with an I.D. of 30 mm and with ERMETO/PARKER pipe fittings. They can also be fit into inexpensive plastic pipe and rod which has been machined to 30 mm I.D.

Such mixers are suitable for mixing 2-component systems such as Liquid Silicone Rubber (LSR).

The following GXP-LMXR mixing elements are available:

- | | | | |
|--------------------|---------------|--------------------------|------------|
| - GXP-LMXR-21-PP | Dao = 29.7 mm | D _i = 20.2 mm | L = 6.7 mm |
| - GXP-LMXR-21-PA66 | Dao = 30.1 mm | D _i = 20.9 mm | L = 6.7 mm |
- 4 rings are assembled to form a GXP-LMXR mixing element (see Figure #2).

Static Mixing Elements GXF (see Figure #3 and Figure #5)



Figure #5:

The basic GXF part consists of 8-rings, which are hinged. Each ring contains a part of the mixer grid structure.

By folding the 8 rings together, a 2-mixing element structure is created.

GXF mixing elements (Figure #5-3rd from top and Figure #6) are fitted into a housing made of PP with standard bell connection and stepped tip. These disposable mixers are available in several standard lengths.

GXF mixing elements are also available in loose form for fitting into steel pipes and tubes for high pressure applications.

The following loose GXF mixing elements are available (additional sizes are in various stages development)

- GXF-10/6 O.D._{ME} : = 11.7 mm I.D.: = 10.0 mm L (folded double-ME GXF = 2 ME GXF): = 26.3 mm
Net volume: 1 double-ME GXF: = 1.65 ml; 1 ME GXF: = 0.83 ml

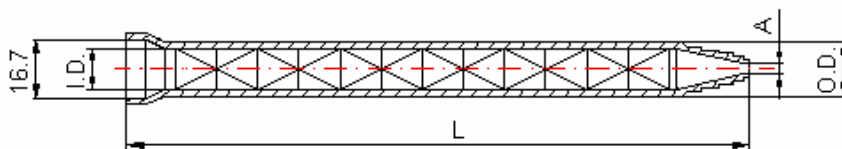


Figure #6

Plastic Disposable Static Mixer in a plastic housing

Part	D _{inside} I.D. mm	No. of ME GXF	D _{outside} O.D. mm	Length L mm	D _{Nozzle} A mm	Net vol. ca. ml
GXF-10/6-6	10.0	3 x 2 = 6	15.2	115	3	5.0
GXF-10/6-9	10.0	4.5 x 2 = 9	15.2	155	3	7.5
GXF-10/6-12	10.0	6 x 2 = 12	15.2	192	3	9.9

Comparison of GXF-Mixer with Helix-Mixer (approximate values):

- Mixing efficiency: 1 GXF Mixing Element = 2 – 3 HME, 6 GXF = ~15 HME; 9 GXF = ~24 HME, 12 GXF = ~32 HME
- Mixer length: With identical I.D., GXF is ~50 % shorter than the HME and with identical pressure drop the GXF is ~20 -30 % shorter than the HME.
- Pressure drop: Comparing Pressure Drop of the GXF and Helical Mixing Element (HME):
To achieve a similar pressure drop with the GXF and HME (at identical throughput, viscosity and mixing efficiency), the I.D. of the GXF mixer must be approximately 25% larger than the I.D. of the corresponding HME.