stamixco mix it up.....

2-Component Resin Mixing Technology

Plastic Disposable & Metal Static Mixers for Mixing Viscous Materials

Introduction

For more than 40 years, static mixers (also known as motionless mixers) have been used successfully in 2-Component Resin applications for the mixing of viscous urethanes, adhesives and foam systems. The static mixers are available as plastic disposable units for one-time use and as metal units that may be cleaned and reused.

Principles of Operation:
A static mixer has no moving parts. It consists of individual static mixing elements with highly defined special geometric structures that are stacked end-to-end and inserted inside tubes and pipes. When fluids are processed through the mixing unit, the fluids are forced to follow the geometric structure of the mixing elements that repeatedly divide, stretch and transposes the materials to be mixed until a mixture at the desired level of homogeneity results (Figure #1).

Static mixers are capable of mixing materials with equal or very large differences in viscosity and volumetric flow rates. The static mixer design best suited for a specific application is highly dependent on the degree of mixing required and the viscosity and volumetric ratio of the materials to be mixed.

Types of Static Mixers
StaMixCo 2-Component Resin static mixers are available in plastic disposable and reusable metal construction. We offer two fundamental geometric configurations that have widely differing mixing capabilities, costs and advantages and disadvantages:

- High Performance X-Grid Crossing Bar structure static mixer
- Moderate Performance Helical Twist structure static mixer

Mixing Requirements
Mixing requirements in 2-Component Resin applications generally fall into three fundamental categories: Easy, Moderately Difficult and Difficult mixing applications. The static mixer most suitable for a specific application is a function of the difficulty of the mixing task, degree of mixing required, material characteristics, operating pressure and temperature and process conditions.

Static Mixer Type & Mixing Requirements

- Easy Mixing Applications
  Easy mixing applications represent about 30% of 2-K industry requirements. Easy applications are those where the viscosity and volumetric ratios of the materials to be mixed are approximately 1:1. In these applications, the Helical type static mixer is recommended because it can create Very Good Quality Homogeneity (99% Degree of Mixing) in a small diameter and acceptable length and is inexpensive at $0.50-$1.50 per unit in plastic disposable construction and less than $200 per unit in reusable metal construction.

- Moderate Difficulty Mixing Applications
  Moderate difficulty applications represent about 50% of 2-K industry requirements. Moderate difficulty applications are those where the viscosity and volumetric ratios of the materials to be mixed are approximately 10:1. In these applications, the Helical type static mixer is recommended when Good Quality Homogeneity (95% Degree of Mixing) is required. It is sometimes possible to achieve Very Good Quality Homogeneity (99% Degree of Mixing) but the mixer length becomes very long and requires larger diameter units with shrouds where costs range from $1.50-$3.00 per unit in plastic disposable construction and less that $400 per unit in reusable metal construction.

- Difficult Mixing Applications
  Difficult mixing applications represent about 20% of 2-K industry requirements. Difficult applications are those where the viscosity and volumetric ratio of the materials to be mixed are 10:1 -1,000:1 and where the viscosity ratio of the materials are 10:1-1 million:1. In these applications, the Helical static mixer is not acceptable regardless of the number of mixing elements used. For these Difficult Mixing Applications, the X-Grid type static mixer is recommended as the only design that is capable of producing Very Good Quality Homogeneity (99% Degree of Mixing) or Excellent Quality Homogeneity (99.9% Degree of Mixing. X-Grid static mixers range in price from $3.00 - $6.00 per unit in the GXF plastic disposable construction, $24-$200 in the GX-P and GXR-P plastic construction and from $800-$4,000 in reusable metal construction.

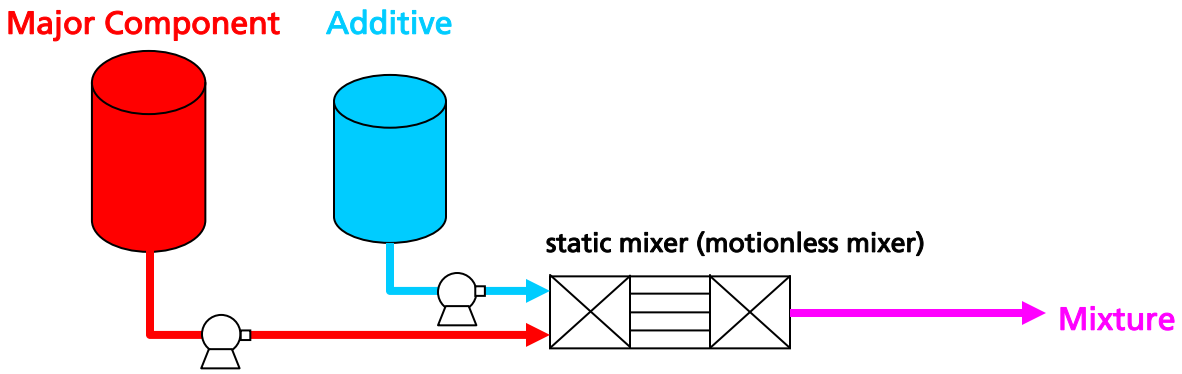
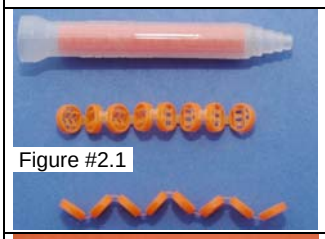
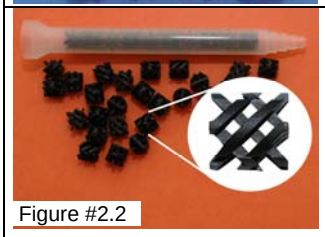


***Figure #1*:** Static mixers create a homogeneous mixture in a short length with no moving parts.

Scope of Supply

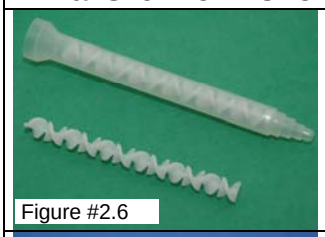
Figures #2.1 – 2.12

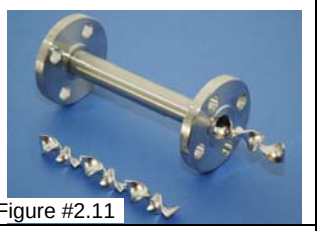
High Performance X-Grid Static Mixers

Plastic Construction	
 Figure #2.1	**Type GXF** (page 6) Plastic Disposable Double Roof Chain Disk with X-Grid Crossing-Bar Structure (polypropylene construction throughout). Patent Pending .
 Figure #2.2	**Type GX-P** (page 7) Plastic Disposable X-Grid Crossing-Bar Structure with very high strength (50% Glass-Filled Nylon PA66 and polypropylene construction)
 Figure #2.3	**Type GXR-P** (page 7) Plastic Disposable Double Roof Disk with X-Grid Crossing-Bar Structure with very high strength (50% Glass-Filled Nylon PA66 construction)

Metal Construction	
 Figure #2.4	**Type GX** (page 4, 10) Metal Construction X-Grid Crossing Bar Structure (316 S/S, heat treated 17-4 PH S/S or any alloy construction)
 Figure #2.5	**Type GXR** (page 10) Metal Construction Double Roof Disk with X-Grid Crossing-Bar Structure and very high strength (Heat Treated 17-4 PH S/S construction). Licensee of Bayer A.G.

Medium Performance Helical Static Mixers

Plastic Construction	
 Figure #2.6	**Type HT-10** (page 8) Plastic Disposable Helical Twist static mixer (Acetal elements & polypropylene housing construction)
 Figure #2.7	**Type HT-11** (page 9) Plastic Disposable Helical Twist static mixer (Acetal elements & Nylon housing with brass MNPT threaded ends construction))

Metal Construction	
 Figure #2.8	**Type HT** (page 11) Metal Construction Helical Twist static mixer (316 S/S or any alloy construction)
 Figure #2.9	 Figure #2.11
 Figure #2.10	 Figure #2.12

Homogeneity Achieved with Static Mixers

High Performance X-Grid Static Mixers

In the early development of static mixing technology (1970's), the quality of mix achieved was defined by the number of layers formed by a particular static mixer design. Claims of the formation of millions of layers we made which in reality could only be optically verified up to about 200 layers. In the 1980's, a tremendous amount of research was conducted resulting in a technically rigorous and rational method of quantifying homogeneity. The method involved local measurement of a meaningful variable such as temperature, concentration, electrical conductivity, color, light passage, etc. After gathering the data, a statistical evaluation followed regarding the deviation of the measured variable from the mean value. This statistical standard deviation measure from the mean value is called the Coefficient of Variation (CoV) which has become the basis for determining static mixer performance. The smaller the value of CoV, the better the quality of mix achieved.

To quantify and visualize CoV, Tables #1 and Figure #3 are useful. Table #1.1 and #1.2 shows performance data for the Type GX static mixer. It specifies the number of mixing elements required to achieve a specific level of homogeneity as a function of the volumetric and viscosity ratio of the components to be mixed. Figure #3 shows the results of an experiment with the Type GX mixing element revealing the mix quality at the outlet of each mixing element, the corresponding CoV value and a ~100 time magnification of the same spot in the flow stream at the exit of each mixing element.

***Table #1.1**: Required Number of Type GX Mixing Elements in Laminar Flow Conditions*

Volumetric Ratio Of Components A : B	Viscosity Ratio Of Components A:B	Pre-Mix Quality Homogeneity CoV = 0.20 (80% Mixed)	Good Quality Homogeneity CoV = 0.05 (95% Mixed)	Very Good Quality Homogeneity CoV = 0.01 (99% Mixed)
1 : 1	1 : 1 – 100 : 1	**4**	**6 - 7**	**9 - 10**
9 : 1	1 : 1 – 100 : 1	**6**	**9**	**12**
99 : 1	1 : 1 – 100 : 1	**9**	**12**	**15**

***Table #1.2**: As the viscosity ratio of the materials to be mixed increases, the number of additional mixing elements required to achieve the CoV noted in Table #1.1 is shown in Table #1.2 below.*

	Viscosity Ratio A : B			
	> 100 - 300	> 300 – 1,000	> 1,000 – 3,000	>3,000 – 10,000
Additional Type GX Mixing Elements Required above a Viscosity Ratio of 1:1 : 100:1	**2 - 3**	**3**	**3 - 4**	**4**

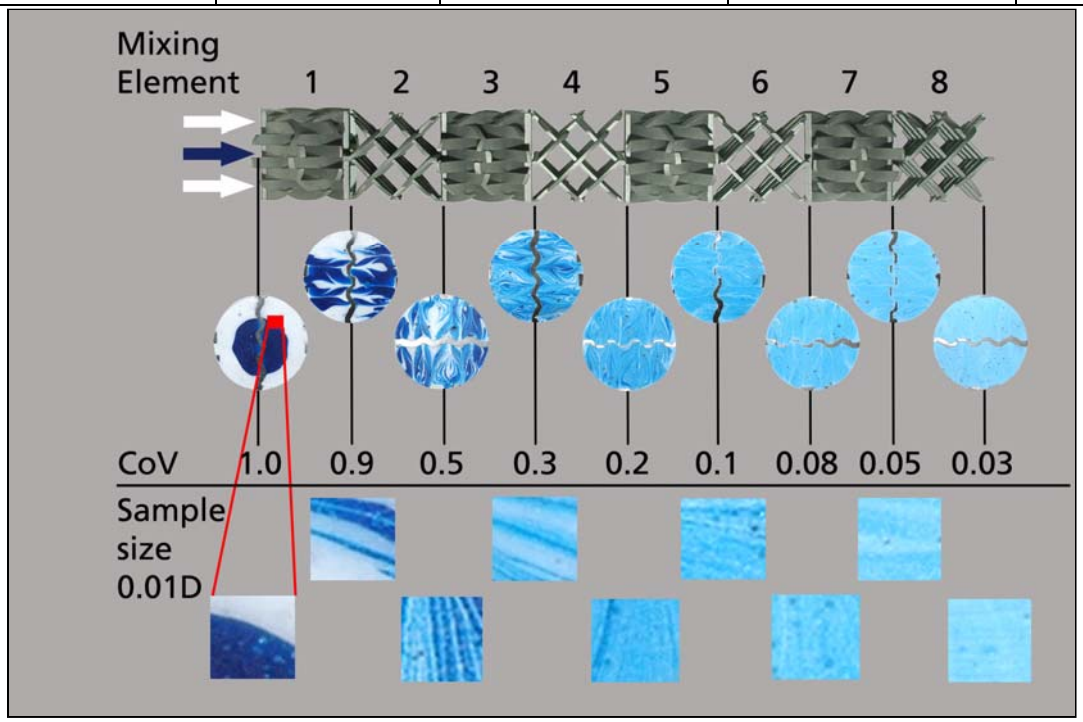


***Figure #3**: The Coefficient of Variation of mixing (CoV) for the Type GX static mixer in laminar flow is visualized in the above experiment. Blue and white viscous resin (1:1 volumetric and viscosity ratios) are pumped through eight (8) static mixing elements, allowed to harden and cross-sectional cuts are made at the outlet of each mixing element. Notice how rapidly the streams are mixed. The magnified sample of 0.01D reveals that homogeneity is achieved in both the macro and micro scale.*

Medium Performance Helical Static Mixers

The Helical static mixer (Figure #4) is suitable and cost effective for Easy and Moderated Difficulty mixing applications which represent about 80% of 2-Component Resin Industry requirements. The definition of Easy and Moderate Difficulty applications is discussed noted on page 2 (right column) which encompasses applications where the volumetric and viscosity ratio of the materials to be mixed are less than 10:1 and where Good Homogeneity (95% mix) or lower is acceptable.

The Helical static mixer is not suitable for Difficult applications as noted on page 2 (right column) where the volumetric and viscosity ratio of the materials to be mixed exceeds 10:1 and where Very Good Homogeneity (99% mix) is required. The high performance GX static mixer structure (Figure #3) is the best available technology for these difficult mixing tasks

When comparing Figure #3 and #4, it is evident that even for the Easy mixing task of the experiment (1:1 volumetric and viscosity ratio of the materials to be mixed), approximately 3 Medium Performance Helical static mixing elements are required to achieve the same degree of mixing as 1 High Performance X-Grid static mixing element.

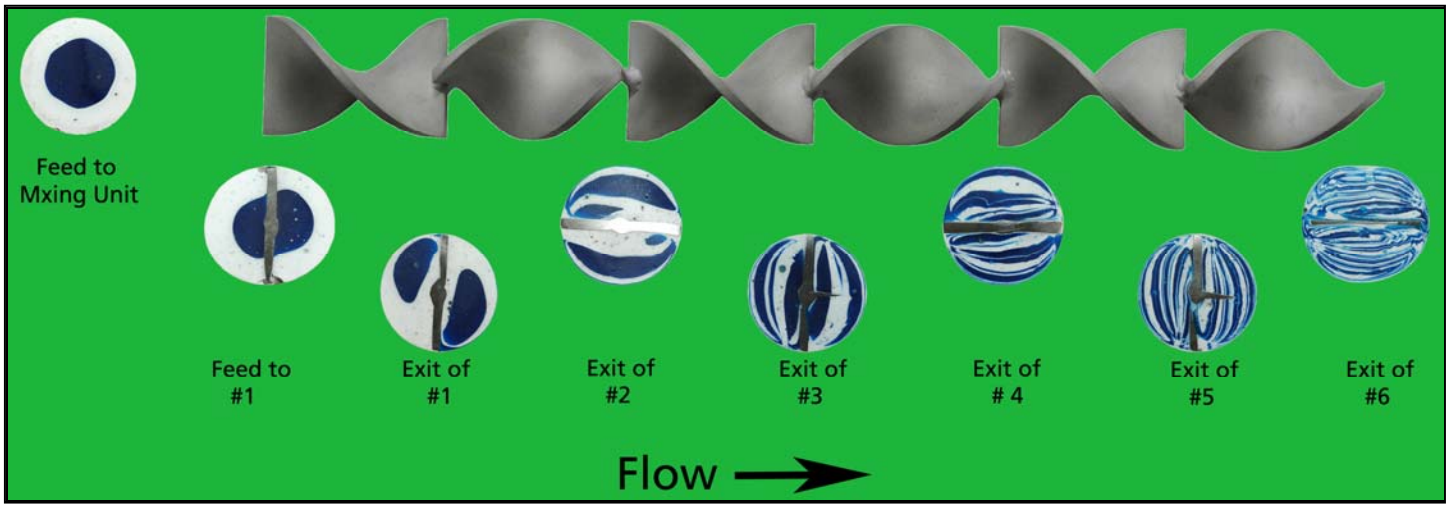


Figure #4*: Blue and white viscous resin (1:1 volumetric and viscosity ratios) are pumped through six (6) Helical static mixing elements, allowed to harden and cross-sectional cuts are made at the outlet of each mixing element. The Helical static mixer is considered a Medium Performance mixing device and is therefore used for non-demanding applications. Striations of blue and white continue to exist even after 36 mixing elements with poor mixing at all wall surfaces and at the junction of the blade and wall.*

Technical Comparison: X-Grid Static Mixer vs. Helical Static Mixer

Table #2: *Comparison of High Performance X-Grid and Medium Performance Helical Static Mixers*

Feature	High Performance X-Grid Mixer	Medium Performance Helical Mixer
General Attributes		
Fabrication	Complex fabrication tooling & fit up to housing	Simple fabrication tooling & easy fit up to housing
Cost	Expensive	Inexpensive
Product Range	Few sizes in plastic construction Broad size range in metal construction	Broad size range in plastic construction Broad size range in metal construction
Availability	In stock at all times	In stock at all times
Technical Comparison		
Mixing Efficiency	1 X-Grid GX Element = ~2 – 3 Helical Elements	Base for Analysis
Mixer Length a) For Identical I.D. b) For Identical Pressure Drop	a) X-Grid GX is ~ 50% shorter than Helical b) X-Grid GX is ~20% - 30% shorter than Helical	Base for Analysis
Pressure Drop For identical pressure drop at identical throughput, viscosity and mixing efficiency	X-Grid GX diameter must be approximately 25% larger than the I.D. of the corresponding Helical static mixer.	Basis for Analysis
Easy Mixing Applications: (see page 2 right column)	Helical design is best unless very short lengths are required	Best Available Technology with moderate to long length units
Moderate Difficulty Mixing Applications (see page 2-right column)	Best Available Technology when better than Good Homogeneity (≥95 % mix) is required or when short length and small net volume are important.	Best Available Technology when Good Homogeneity (≤ 95% mix) is acceptable with long lengths and large net volume hold-up
Difficult Mixing Applications (see page 2-right column)	Best Available Technology	Not suitable for the application

Plastic Disposable Static Mixers

Plastic X-Grid Disposable Static Mixers (High Performance Design)

X-Grid plastic disposable static mixers are available in three (3) configurations (GXF, GXP and GXR-P). Due to their high cost relative to the Helical static mixer design, they are recommended only for Difficult Mixing Applications (see page 2-right column) where a standard Helical Static Mixer has demonstrated that it is not acceptable for the service.

Benefits of X-Grid plastic static mixers are their ability to mix materials with very large differences in viscosity and volumetric ratio and to create very high degrees of mixing in a short length with small product hold-up volume.

The Helical Static Mixer is recommended for Easy and Moderate Difficulty Applications (page 2-right column) and where a maximum of ~95% Degree of Mixing (Table #1.1) and where long mixing lengths with large product hold-up volumes are acceptable.

Type GXF

The GXF plastic disposable static mixer (patent pending), has the same fundamental X-Grid crossing bar structure as the GX static mixer shown in Figure #3. The GXF has an added constructional feature of a hinged support ring that surrounds the X-bar mixing grid structure that allows for complete chains to be injection molded and folding into a mixing structure. To determine the number of GXF mixing elements required for a specific task, Table #1.1 & #1.2 are guidelines. The GXF static mixer is available at present in a 12 mm OD size. Scope of supply may be as individual loose element chains (Orange parts-Figure #5 & #6) for installation into a customer supplied housing (element dimensions in Table #3); as Complete GXF Plastic Disposable Static Mixing Units in a plastic housing with bell connection and stepped tip (Figure #5, #7 & Table #3); and in metal tubing with any customer desired end connections (Figure #6).

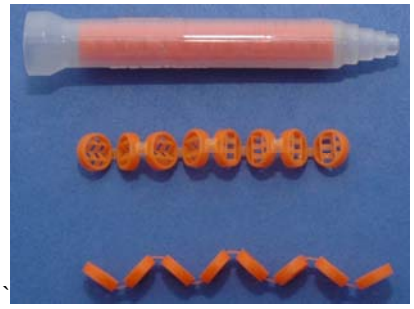


***Figure #5**: GXF plastic mixing elements in a plastic disposable housing with bell connection and stepped tip.*

***Figure #6**: For high pressure applications, GXF mixing elements are installed in standard metric tubing (16 mm OD x 2 mm wall) with Parker® or Swagelok® end connections.*

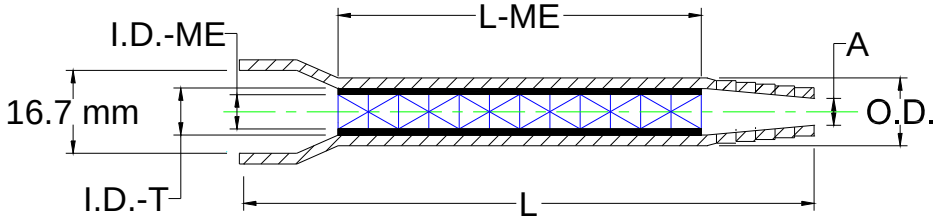


***Figure #7:** Complete GXF Plastic Disposable Static Mixer in a Plastic Housing*

***Table #3:** Dimensions showed below for Complete GXF Plastic Disposable static mixing units (Figure #5 and #7) in housing with bell connection & stepped tip. Individual loose GXF mixing element chains are also available with dimensions shown below in last row.*

		LENGTH		DIAMETER					
Model #	Number of GXF Mixing Elements	L Total Length	L-ME Mixing Element Length	O.D. Tube O.D.	I.D.-T Tube I.D	Mixing Element O.D.	I.D.-ME Mixing Element Passage I.D.	A Nozzle I.D.	Net Volume
GXF-10-6	6	115 mm	78.9 mm	15.2 mm	11.7 mm	11.7 mm	10 mm	3 mm	5.0 ml
GXF-10-9	9	155 mm	118.4 mm	15.2 mm	11.7 mm	11.7 mm	10 mm	3 mm	7.5 ml
GXF-10-12	12	182 mm	157.8 mm	15.2 mm	11.7 mm	11.7 mm	10 mm	3 mm	9.9 ml
GXF-10-2-ME (Mixing Elements only)	Single Chain of two (2) Mixing Elements only	- - -	26.3 mm	- - -	- - -	11.7 mm	10 mm	- - -	1.65 ml

Type GXP

The GXP plastic disposable static mixer has the identical X-Grid crossing bar structure as the GX static mixer shown in Figure #3. To determine the number of GXP mixing elements required for a specific task, Table #1.1 and #1.2 are guidelines.

The GXP static mixer is available at present in a 9.4 mm OD size. Scope of supply may be as individual loose elements (black parts-Figure #8, #9) for installation into a customer supplied housing (element dimensions in Table #4); as Complete GXP Plastic Disposable Static Mixing Units in a plastic housing with bell connection and stepped tip (Figure #8); or in metal tubing with any customer desired end connections (Figure #9).

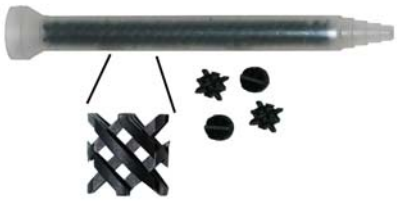


***Figure #8**: GXP plastic mixing elements in a plastic disposable housing with bell connection and stepped tip*

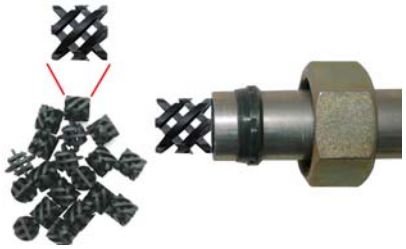


***Figure #9**: For high pressure applications, GXP mixing elements are mounted in standard metal tubing (1/2" OD x 0.065" wall) with Parker® or Swagelok® end connections.*

***Table #4:** Dimensions of Individual GXP Static Mixing Elements are noted below.*

Model Number	Material of Construction	Number of GXP Mixing Elements	Outside Diameter of GXP Mixing Element	Length of one (1) GXP Mixing Element	Maximum Allowable Pressure Drop at Room Temperature
GXP-9.4-PA66	50% Glass Filled Nylon PA 66	1	9.3 mm	9.4 – 9.5 mm	~4,350 psi
GXP-9.4-PP	Polypropylene	1	9.4 mm	9.3 – 9.4 mm	~725 psi

Type GXR-P

The GXR-P plastic disposable static mixer (Figure #10) has the same fundamental X-Grid crossing bar structure as the GX metal static mixer (Figure #3) and GXP plastic static mixer (Figure #8). The GXR-P however has an added constructional feature of a support ring surrounding the X-bar mixing grid structure. This support ring greatly enhances strength and allows for safe hydraulic press ram removal of the mixing elements from the housing with resin cured inside the static mixer structure.

To determine the number of GXR-P mixing elements required for a specific application, Table #1.1 & #1.2 are guidelines (Mixing Performance of 1 GX Mixing Element = Mixing Performance of 2 GXR-P Mixing Elements). The GXR-P mixing elements are available at present in a 30 mm OD size and are used for large flow rate applications. Dimensions are shown in Table #5. Each mixing element contains a pin & hole arrangement for proper alignment of adjacent mixing elements where a stack of eight (8) mixing elements are shown in Figure #10 (top photo). Mixing elements only (Figure #10) or complete units with pipe housing and end connections (Figure #11) are available.

***Figure #10**: Stack of 8 GXR-P plastic mixing elements (top photo) in 50% Glass Filled Nylon PA66 construction*

***Figure #11**: GXR-P mixing elements mounted in standard metal tubing (38 mm OD x 4 mm wall) with Parker® or Swagelok® end connections.*

***Table #5:** Dimensions of Individual (one) GXR-P Static Mixing Element*

Model Number	Material of Construction	Number of GXR-P Mixing Elements	Outside Diameter of GXR-P Mixing Element	Length of One (1) GXR-P Mixing Element
GXR-P21/30-PA66	50% Glass Filled Nylon PA 66	1 Mixing Element	29.6 mm	13.3 mm
GXR-P21/30-PP	Polypropylene	1 Mixing Element	29.7 mm	13.4 mm

Plastic Disposable Static Mixers, ……continued……

Model HT-10 Helical Plastic Disposable Static Mixers

Model HT-10 Helical Plastic Disposable Static Mixers provide cost effective solutions for meter-mix-dispense applications. The Helical static mixer structure is suitable for simple to medium difficulty applications. Other StaMixCo X-Grid static mixers described in other sections of this brochure are recommended for difficult applications that require high degrees of mixing or when materials must be mixed with large differences in viscosity or volumetric ratio.

Specifications & Accessories

- Materials of Construction:
  Mixing Elements: Acetal; Housing: Polypropylene
- Mixing Element Geometry: Length-to-Diameter Ratio (L/D) of individual mixing elements = ~0.8
- Accessories: Retaining Nuts (plastic & metal), jackets, Luer Lock fittings & needles, Bell Inlet Sleeve, Support washer, Pipe adaptor.

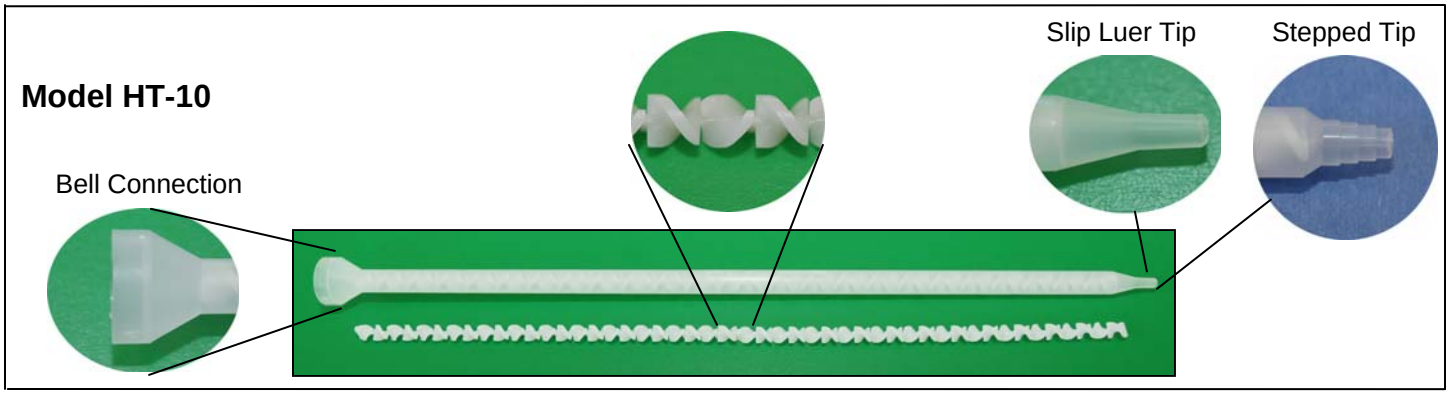


***Figure #12**: Model HT-10 Helical Plastic Disposable Static Mixer with Bell Connection and Stepped/Slip Luer Tip*

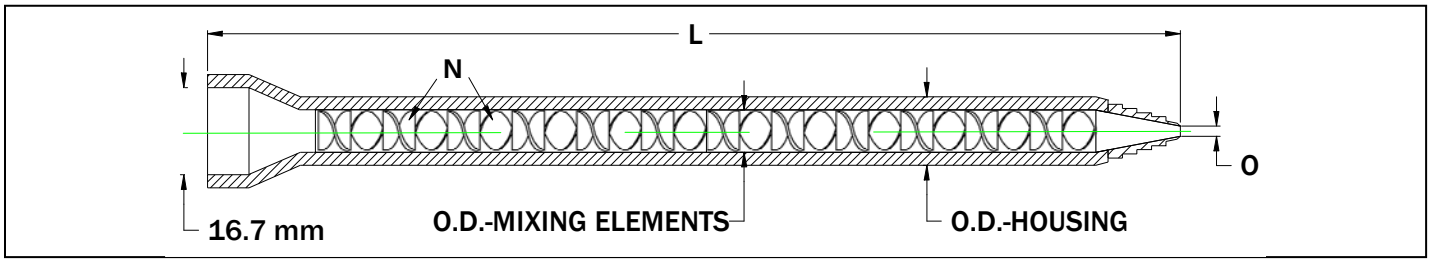


***Figure #13**: Dimensions of Model HT-10 Helical Plastic Disposable Static Mixer*

***Table #6:** Dimensions of Model HT-10 Helical Plastic Disposable Static Mixers (See Figure #13) are noted below.*

Model #	**O.D.** Mixing Element	**N** Number of Mixing Elements	**L** Total Length	**O.D.** Housing	Outlet Tip Type	**O** Orifice Diameter	Burst Pressure Limit at 70 °F
HT-10-4.8-8	4.8 mm	8	6.8 cm	7.6 mm	Slip Luer	1.8 mm	500 psi
HT-10-4.8-16	4.8 mm	16	10.0 cm	7.6 mm	Slip Luer	1.8 mm	500 psi
HT-10-4.8-24	4.8 mm	24	13.3 cm	7.6 mm	Slip Luer	1.8 mm	500 psi
HT-10-4.8-32	4.8 mm	32	16.5 cm	7.6 mm	Slip Luer	1.8 mm	500 psi
HT-10-4.8-48	4.8 mm	48	23.1 cm	7.6 mm	Slip Luer	1.8 mm	500 psi
HT-10-6.3-8	6.3 mm	8	9.1 cm	9.4 mm	Slip Luer	2.3 mm	360 psi
HT-10-6.3-16	6.3 mm	16	14.0 cm	9.4 mm	Slip Luer	2.3 mm	360 psi
HT-10-6.3-24	6.3 mm	24	19.2 cm	9.4 mm	Slip Luer	2.3 mm	360 psi
HT-10-6.3-32	6.3 mm	32	24.2 cm	9.4 mm	Slip Luer	2.3 mm	360 psi
HT-10-6.3-48	6.3 mm	48	33.6 cm	9.4 mm	Slip Luer	2.3 mm	360 psi
HT-10-8.0-18	8.0 mm	18	17.9 cm	11.7 mm	Stepped	2.5 mm	330 psi
HT-10-8.0-24	8.0 mm	24	22.7 cm	11.7 mm	Stepped	2.5 mm	330 psi
HT-10-8.0-32	8.0 mm	32	29.3 cm	11.7 mm	Stepped	2.5 mm	330psi
HT-10-9.3-12	9.3 mm	12	14.1 cm	13.0 mm	Stepped	3.1 mm	300 psi
HT-10-9.3-18	9.3 mm	18	18.7 cm	13.0 mm	Stepped	3.1 mm	300 psi
HT-10-9.3-24	9.3 mm	24	23.5 cm	13.0 mm	Stepped	3.1 mm	300 psi
HT-10-9.3-30	9.3 mm	30	28.5 cm	13.0 mm	Stepped	3.1 mm	300 psi
HT-10-9.3-40	9.3 mm	40	36.0 cm	13.0 mm	Stepped	3.1 mm	300 psi
HT-10-9.3-60	9.3 mm	60	57.0 cm	13.0 mm	Stepped	3.1 mm	300 psi
HT-10-9.3-64	9.3 mm	64	61.1 cm	13.0 mm	Stepped	3.1 mm	300 psi
HT-10-12.7-12	12.7 mm	12	17.2 cm	16.8 mm	Stepped	4.6 mm	270 psi
HT-10-12.7-18	12.7 mm	18	23.2 cm	16.8 mm	Stepped	4.6 mm	270 psi
HT-10-12.7-24	12.7 mm	24	30.1 cm	16.8 mm	Stepped	4.6 mm	270 psi
HT-10-12.7-30	12.7 mm	30	35.9 cm	16.8 mm	Stepped	4.6 mm	270 psi
HT-10-12.7-36	12.7 mm	36	42.4 cm	16.8 mm	Stepped	4.6 mm	270 psi

Plastic Disposable Static Mixers, ……continued……

Model HT-11 Helical Plastic Disposable Static Mixers with NPT End Connections

Model HT-11 Plastic Disposable Helical Static Mixers provide cost effective solutions for meter-mix-dispense applications. The brass NPT threaded end connection allow for ease of connecting to standard pipe fittings. The helical static mixer structure is suitable for simple to medium difficulty applications. Other StaMixCo X-Grid static mixers described earlier in this brochure are recommended for difficult applications that require high degrees of mixing or when materials must be mixed with large differences in viscosity or volumetric ratio.

Specifications & Accessories

- Materials of Construction:
  Mixing Elements: Acetal
  Housing: Nylon
  End Connections: Brass Male NPT
- Mixing Element Geometry: Length-to-Diameter Ratio (L/D) of Individual Mixing Elements = ~0.8
- Accessories: None

Model HT-11

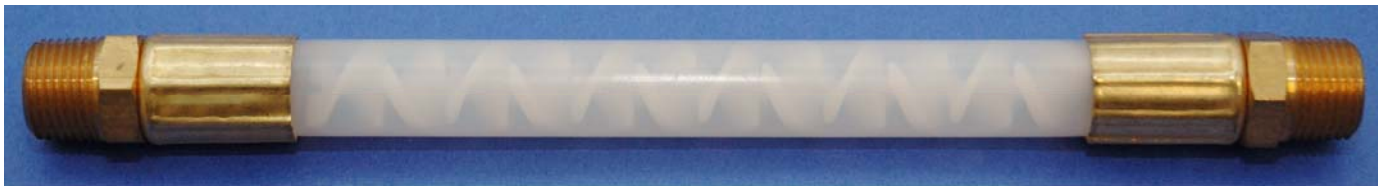


***Figure #14**: Model HT-11 Helical Plastic Disposable Static Mixer with NPT End Connections*

***Table #7:** Dimensions of Model HT-11 Helical Plastic Disposable Static Mixers with NPT End Connections (See Figure #14)*

Model #	**O.D.** Mixing Elements	Number of Mixing Elements	**L** Total Length	**O.D.** Housing	Outlet Connection	Burst Pressure Limit at 70 ^{o}F
HT-11-8.0-12	8.0 mm	12	18.2 cm	11.1 mm	1/4” MNPT	540 psi
HT-11-8.0-18	8.0 mm	18	23.1 cm	11.1 mm	1/4” MNPT	540 psi
HT-11-8.0-24	8.0 mm	24	27.2 cm	11.1 mm	1/4” MNPT	540 psi
HT-11-8.0-30	8.0 mm	30	32.4 cm	11.1 mm	1/4” MNPT	540psi
HT-11-9.4-12	9.4 mm	12	19.1 cm	12.7 mm	1/4” MNPT	450 psi
HT-11-9.4-18	9.4 mm	18	24.5 cm	12.7 mm	1/4” MNPT	450 psi
HT-11-9.4-24	9.4 mm	24	29.3 cm	12.7 mm	1/4” MNPT	450 psi
HT-11-9.4-30	9.4 mm	30	34.4 cm	12.7 mm	1/4” MNPT	450 psi
HT-11-12.6-12	12.6 mm	12	21.7 cm	16.0 mm	3/8” MNPT	340 psi
HT-11-12.6-18	12.6 mm	18	28.4 cm	16.0 mm	3/8” MNPT	340 psi
HT-11-12.6-24	12.6 mm	24	34.5 cm	16.0 mm	3/8” MNPT	340 psi
HT-11-12.6-30	12.6 mm	30	40.7 cm	16.0 mm	3/8” MNPT	340 psi
HT-11-16.0-10	16.0 mm	10	23.9 cm	19.3 mm	1/2” MNPT	290 psi
HT-11-16.0-20	16.0 mm	20	36.6 cm	19.3 mm	1/2” MNPT	290 psi
HT-11-16.0-30	16.0 mm	30	50.1 cm	19.3 mm	1/2” MNPT	290 psi
HT-11-19.9-8	19.9 mm	8	25.7 cm	23.4 mm	3/4” MNPT	230 psi
HT-11-19.9-16	19.9 mm	16	38.5 cm	23.4 mm	3/4” MNPT	230 psi
HT-11-19.9-24	19.9 mm	24	52.1 cm	23.4 mm	3/4” MNPT	230 psi
HT-11-19.9-32	19.9 mm	32	65.1 cm	23.4 mm	3/4” MNPT	230 psi

Metal Static Mixers

Metal X-Grid Static Mixers (High Performance Design)

Metal X-Grid static mixers are used when process conditions of pressure, temperature, flow rate or viscosity exceed the capabilities of plastic static mixers. In certain instances, these much more expensive metal mixers are cost effective if they can be chemically or thermally cleaned and reused.

The high performance X-Grid static mixers are available in two (2) configurations (GX and GXR). Due to their high cost, they are recommended only for Difficult Mixing Applications (see page 2-right column) where a metal Helical Static Mixer has demonstrated that it is not acceptable for the service.

Benefits of X-Grid static mixers are their ability to mix materials with very large differences in viscosity and volumetric ratio and to create very high degrees of mixing in a short length with small product hold-up volume.

The Helical Static Mixer is recommended for Easy and Moderate Difficulty Applications where a maximum of ~95% Degree of Mixing (Table #1.1) and where long mixing lengths and large product hold-up volumes are acceptable.

Type GX

The GX static mixer (Figure #15) is a high performance design. To determine the number of GX static mixing elements required for a specific task, Table #1.1 and #1.2 are guidelines. For detailed product information, see the GX Product Bulletin.

Availability:

- Diameter: 3/8" Sch. 40 and larger pipe and tubing sizes
- Materials: 316 S/S, 17-4 PH Heat Treated S/S and virtually any metal material available in sheet or plate form
- Housing: Standard sizes are Sch. 40 pipe and common tubing sizes with Standard End Connections of MNPT, Flanged and Parker®/Swagelok®

***Figure #15**: Type GX Static Mixer In metal construction available in virtually all sizes, materials and housing types*

Type GXR

The GXR static mixer (Figure #16) is a high performance design. To determine the number of GXR static mixing elements required for a specific task, Table #1.1 and #1.2 are guidelines. The GXR has an added constructional feature (vs. GX) of a support ring surrounding the X-bar mixing grid structure. This ring greatly enhances strength and allows for safe hydraulic press ram removal of the mixing elements with cured polymer inside the structure. For detailed information, see the GXR Product Bulletin.

Availability:

- Diameter: 18 mm diameter and larger in metric sizes
- Materials: 17-4 PH Heat Treated S/S
- Housing: Machined housings with Standard End Connections of MNPT, Flanged and Parker®/Swagelok®

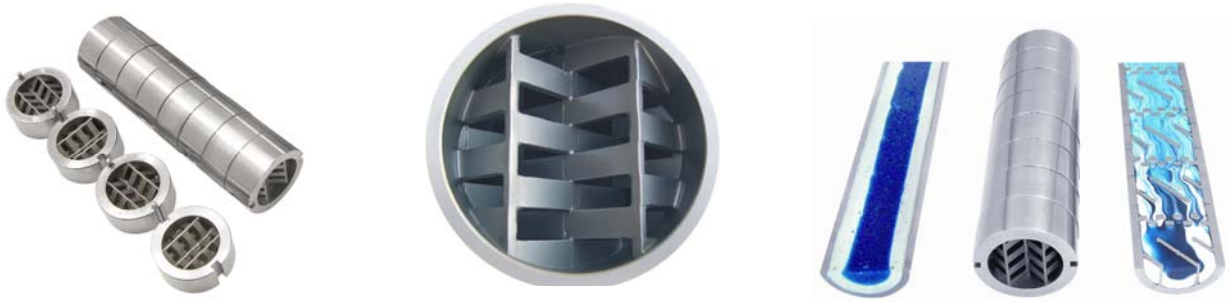


***Figure #16**: Type GXR Static Mixer In metal construction. Right Photo – mixing of blue & white resins (left side empty pipe)*

Metal Helical Static Mixers (Medium Performance Design)

Metal Helical static mixers are used when process conditions of pressure, temperature, flow rate or viscosity exceed the capabilities of plastic static mixers. In certain instances, the much more expensive metal mixers are cost effective if they can be chemically or thermally cleaned and reused.

The Helical Static Mixer is recommended for Easy and Moderate Difficulty Applications (see page 2 right column) where a maximum of ~95% Degree of Mixing is acceptable (Table #1.1) and where long mixing lengths and large product hold-up volumes are acceptable. For detailed product information, see the Metal Helical Static Mixer Product Bulletin.

Product Availability:

- Twist of Helix: In metal construction, the standard Helical twist of a individual mixing element is L/D=~1.6 which is fabricated by traditional means of twisting metal sheet/plate material and welding opposite twist helixes together. For special applications with length limitations requiring as many mixing elements as possible to fit into the allowable length, the Helix twist L/D can be reduced to as little as L/D=~0.6 via machining the Helix from a solid rod of metal which also provides mirror polish surface finishes with no additional hand labor.
- Diameter: 1/8" Sch. 40 pipe sizes and larger. 3/16" tubing sizes and larger.
- Materials: Standard 316 S/S, Teflon® coated S/S and virtually any metal material available in sheet, rod or plate form
- Housing: Standard sizes are 1/8" Sch. 40 and larger pipe sizes and 3/16" tubing and larger sizes with Standard End Connections of MNPT, Flanged and Parker®/Swagelok®

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***Figure #17**: Left Side Photo: Standard Type HT Helical Static Mixer In metal construction in pipe with MNPT End Connections. Right Side Photo – Teflon® coated 316 S/S mixing element to minimize fouling with materials that cling to metal surfaces.*

***Figure #18**: Type HT Helical Static Mixer in metal construction in pipe housing with flanged end connections.*

***Figure #19**: Type HT Helical Static Mixer in metal jacketed tubing for heating/cooling viscous polymers.*

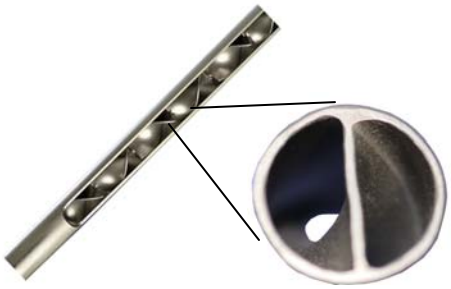
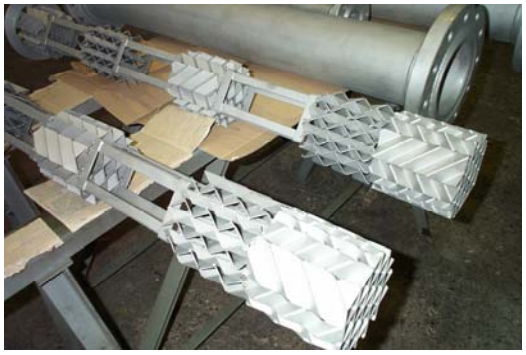
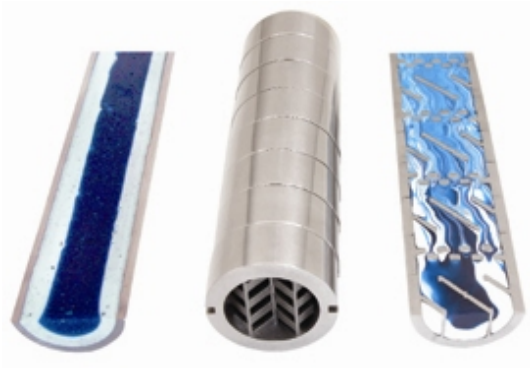
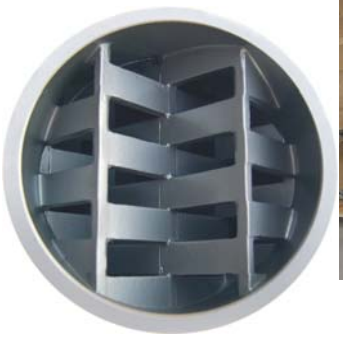


***Figure #20**: Type HT Helical Static Mixer in metal tubing with mixing elements brazed to tube wall for improved mixing and heat transfer.*







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