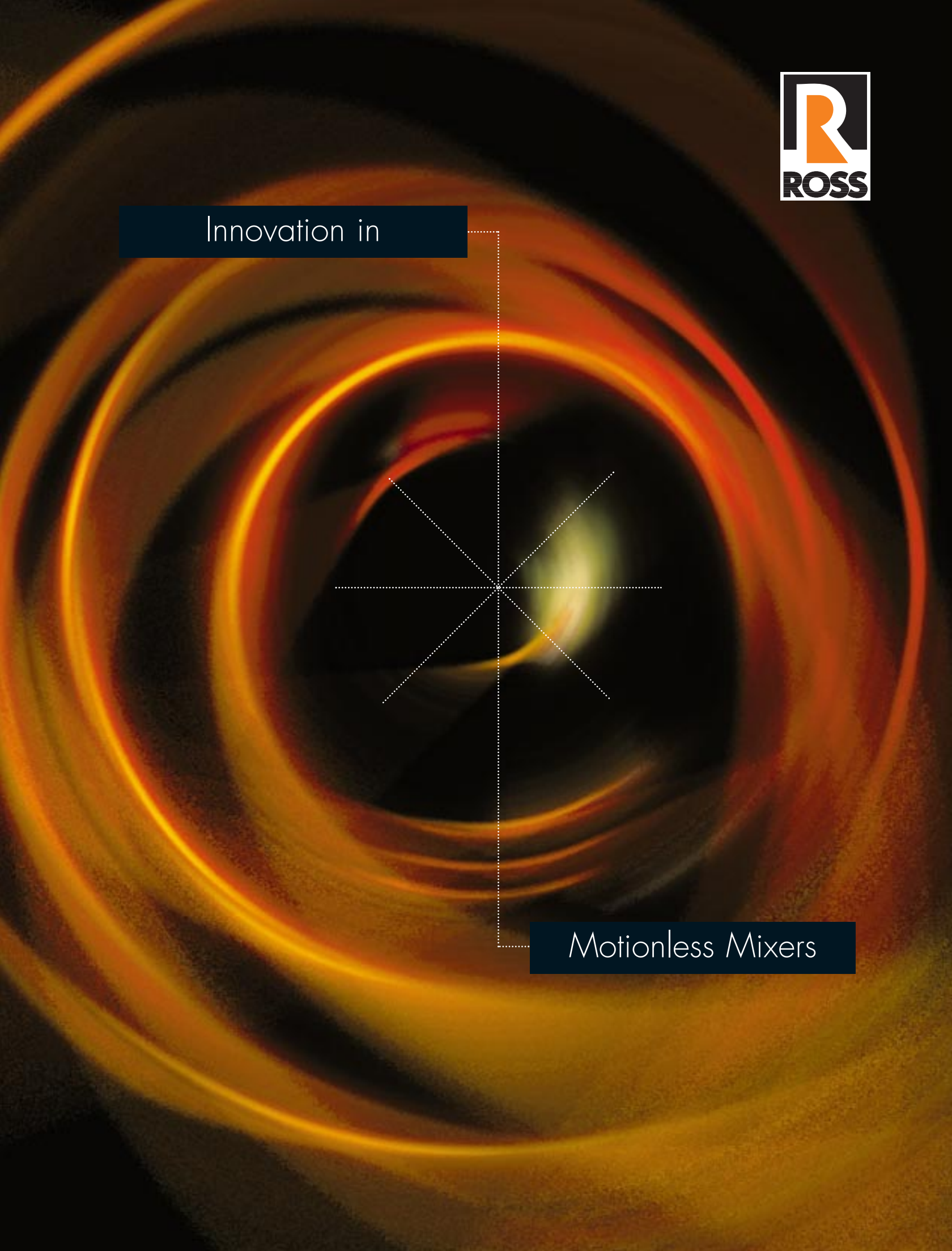

ROSS
Innovation in
Motionless Mixers

Ross Motionless Mixers

PIONEERING TECHNOLOGY. INCOMPARABLE QUALITY. WORLDWIDE LEADERSHIP.

Serving all the process industries in virtually every industrialized country around the world, Ross can offer experience and production capacity that no other manufacturer of specialty mixing and blending equipment can match. In the USA alone, Ross operates five plants, an analytical laboratory and a vigorous R&D program. Overseas, Ross equipment is being built in our own plants in China and in licensed manufacturing facilities in Japan, Europe, Africa and the Indian Sub-continent.

ROSS

Ross LPD/LLPD (low pressure drop) and ISG (interfacial surface generator) Motionless Mixers are well known for their wide ranging uses in turbulent and laminar flow mixing applications. Each design can be supplied as complete plug-in modules or as individual elements for installation into your preferred housing design. The choice is yours — have it your way!

LPD/LLPD Motionless Mixers

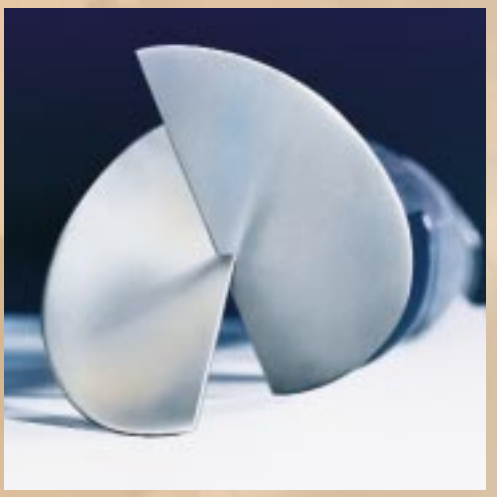


Fig. 1 LPD Element

The **LPD** (Low Pressure Drop) Motionless Mixer is an exceptionally efficient in-line mixer that contains no moving parts. It is easily installed in new and existing pipelines and offers both low installation and low operating costs. With no moving parts to wear out, it is completely trouble free, requires no maintenance and has an infinite life. Its patented design provides mathematically predictable mixing results of liquids or gases with very low pressure drop. There are virtually no viscosity limitations.

Mixing Principle – The LPD Mixer consists of a series of semielliptical plates which are discriminately positioned in a tubular housing. A single element consists of two plates perpendicular to each other (Fig. 1). The mixing operation is based on splitting and then diverting input streams. In laminar flow, the number of layers (L) formed by (E) elements with an initial input of (N) components is given by $L = N(2)^E$.

In turbulent flow, the elements enhance the random dispersion of substreams so that an LPD with six elements is sufficient for most low viscosity mixing requirements.

Construction – Figures 2 and 4 show an assembly of elements and the method of construction used to connect them before being inserted in a pipe. The mixing elements are normally welded to the housing but as an option are removable.

LPD Mixers are available in standard pipe from 1" to 30" diameter in 2-element to 36-element modules. There is no limit to how large the mixer can be. The mixer is fabricated in stainless steel type 316 and carbon steel. Other construction materials are also available. The mixer can be ordered with plain, threaded or flanged ends or with special end connections. It can also be furnished with a heating or cooling jacket.

Fig. 3 LLPD for lower pressure drop applications

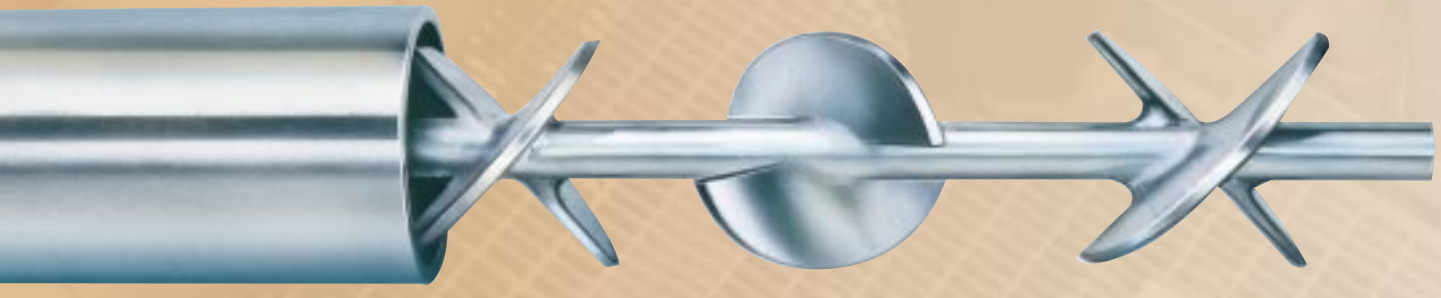


Fig. 2 Standard LPD mixer up to 2" diameter

TABLE 1

LPD Dimensions

Diameter of Mixer	Length of 4-element module	Length of 6-element module	Add for Flanged Unit	Flange* O.D.
1"	6"	9"	1/4"	4-1/4"
1-1/2"	9"	13-1/2"	1/2"	5"
2"	12"	18"	1/2"	6"
3"	18"	27"	1/2"	7-1/2"
4"	24"	36"	1/2"	9"
6"	36"	54"	1/2"	11"
8"	48"	72"	3/4"	13-1/2"
10"	60"	90"	3/4"	16"
12"	72"	108"	3/4"	19"

**All flanges ASA - 150#*

Applications – The diameter and number of elements in an assembly depend on the degree of mixing required. As a general rule, the diameter of the mixer should be the same size as the process pipeline. Where available pressure drop is limited, select a larger diameter mixer. The number of elements required and the pressure drop for a given application may be determined from the data and tables shown.

LLPD Mixer

The **LLPD** is designed to mix liquids or gases with very low pressure drop in either high or low turbulence. As few as two elements are effective for very low viscosity mixing. The LLPD's element is made of two inclined semi-elliptical plates opposite to each other. The mixing operation is based on the splitting and diverting of input streams. Mixer elements through 2.5" diameter are welded to a central retaining rod, larger diameter elements are welded to four outside retaining rods to provide added rigidity.

TABLE 2

Typical Applications

Application	*Type of Flow*	*Number of Modules*
1. Blend one grade of oil (or gasoline) into another oil	Turbulent	1 six-element module
2. Generate liquid-liquid dispersions (droplets)	Highly Turbulent $N_{Re} > 100,000$ Low Turbulence $N_{Re} < 100,000$	2 six-element modules 3 six-element modules
3. Blend out thermal gradient in a viscous stream.	Laminar	1 six-element module
4. Blend two resins to form a homogeneous mixture	Laminar	4 six-element modules
5. Dilution of molasses stream with water	Low Turbulence	1 or 2 six-element modules. Number of modules depends on the flow rate and viscosity ratio
6. pH control. Neutralization and treatment of waste water streams	Turbulent	1 two, four or six-element module depending on reaction conditions
7. BOD treatment of water	Turbulent	1 six-element module
8. Gas-Liquid dispersions	Turbulent	1 or 2 six-element modules
9. Solvent dilution	Turbulent	1 six-element module
10. Pipeline reactor for gaseous or liquid phase reactions	Turbulent	1 or 2 six-element modules

TABLE 3

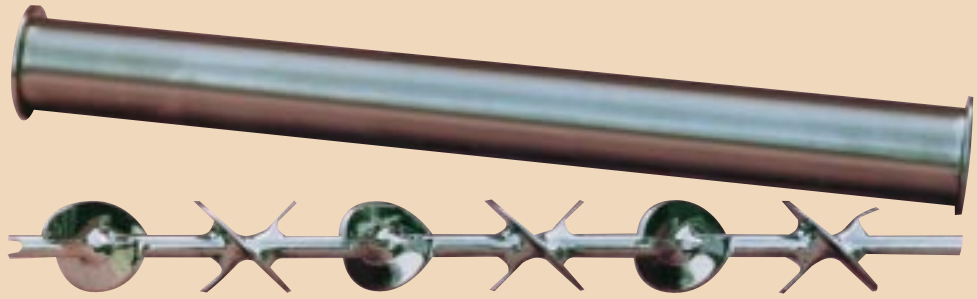
LLPD Dimensions

Diameter of Mixer	Length of 4-element module	Length of 6-element module
1"	7"	10-1/2"
1-1/2"	10-1/2"	15-3/4"
2"	14"	21"
3"	21"	31-1/2"
4"	28"	42"
6"	42"	63"
8"	56"	84"
10"	70"	105"
12"	84"	126"

Fig. 4 Standard LPD/LLPD mixer 3" diameter & larger

Sanitary Motionless Mixers

The "LPD" SANITARY Motionless Mixer is used in the food, pharmaceutical and cosmetic industries and is specifically designed for those processing applications that require quick take-apart construction for frequent cleaning. Sanitary units can be provided with quick disconnect or sanitary threaded end connections to enable fast removal from a system for cleaning and inspection. The mixing elements are housed in a sanitary tubing.



Sanitary "LPD" Mixers are manufactured in type 316 stainless steel. The mixing elements and the standard housings have a #4 finish but are available in mirror finish both internally and externally. All welds are ground smooth and are free of cracks and crevices. For lower pressure drop, the LLPD model is also available.

Dimensions

Tubing O.D.	Tubing I.D.	Length of LPD module	Length of LLPD module
1"	0.870"	9"	11"
1-1/2"	1.370"	13-1/4"	16-1/4"
2"	1.870"	17-1/2"	21-1/2"
2-1/2"	2.370"	21-3/4"	26-3/4"
3"	2.870"	26"	32"
4"	3.834"	34-1/2"	42-1/2"
6"	5.782"	51-1/2"	63-1/2"

LPD Heat Exchanger

The close-tolerance, semi-elliptical plates of the LPD mixer systematically split the input stream and accelerate heat transfer by 300-500%. Viscosity is virtually unlimited. For retrofit or new installations. Standard or custom to meet your requirements!

LPD motionless mixer elements are combined with conventional shell and tube heat exchangers to increase operating efficiencies up to five times. LPD elements boost heat transfer and allow the heat exchanger to be used for higher viscosity applications than normal. Each LPD element set is crafted to fit close to the tube walls. The element sets are custom built to permit installation into existing heat exchangers at a lower cost than required when purchasing an entirely new unit.

Advantages

- Internal fouling reduced due to self-cleaning and flushing action
- Manufactured in virtually any material to meet your requirements
- Sizes available from 1" through 12" diameter
- No center channeling
- Not limited by viscosity of product

ISG Motionless Mixers

The **ISG** (Interfacial Surface Generator) Mixer is a continuous process, in-line mixer having no moving parts. It offers mathematically predictable layer generation in a wide variety of liquid-liquid, liquid-solid, and gas-liquid mixing applications. The mixer can quickly be installed in new and existing pipelines at low initial and operating costs. Since it has no moving parts, there is no wear and as a result, no maintenance is required.

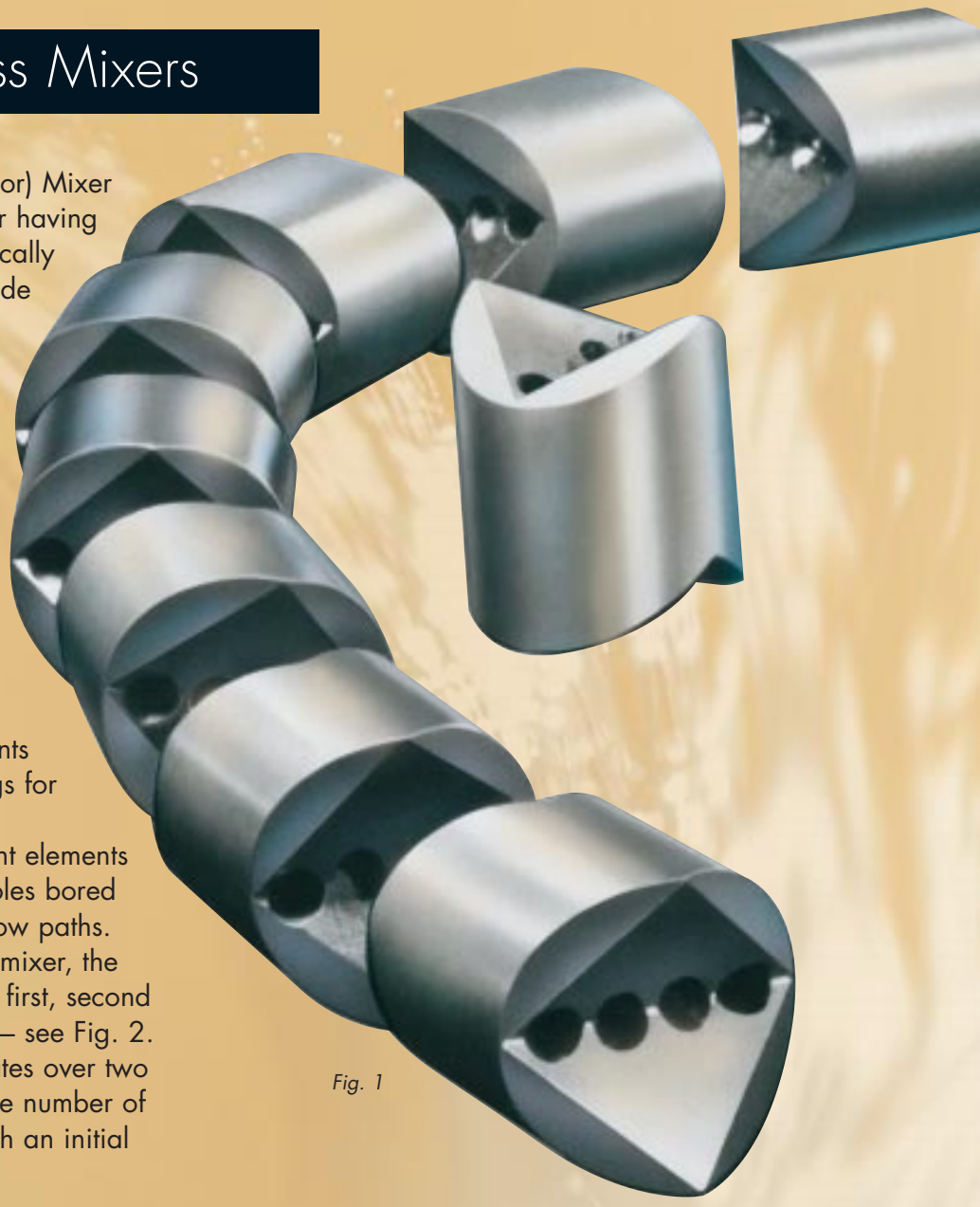
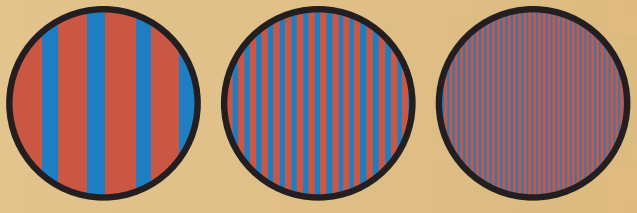


Fig. 1

Mixing Principle — The ISG Mixer consists of mixing elements enclosed in a pipe housing. Typical elements are shown in Fig. 1. Elements can be easily removed from housings for individual cleaning. The ends of the elements are shaped so that adjacent elements form a tetrahedral chamber. Four holes bored through each element provide the flow paths.

If two input streams enter an ISG mixer, the number of layers emerging from the first, second and third elements are 8, 32, 128 — see Fig. 2. This exponential progression generates over two million layers in just 10 elements. The number of layers (L) formed by (E) elements with an initial input of (N) streams is $L = N(4)^E$.

Fig. 2



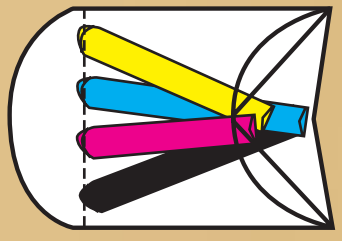


Fig. 3

The four holes in each ISG element are at oblique angles so that material near the periphery (i.e. near the pipe wall) on the inlet side of the element emerges near the center on the outlet side — see Fig. 3. This radial mixing eliminates the wall smearing effect often encountered otherwise.

Construction — ISG mixers are available in nominal pipe sizes from ½" to 24" dia. Units are constructed of stainless steel, teflon or polypropylene. Other materials and larger sizes can be fabricated to specifications.

Threaded ends are standard on the ½" and 1" diameter stainless steel mixers. All other sizes are supplied with ASA-150# flanges.

Application —

The Ross ISG mixer is ideal for applications where mixing elements must be removed for fast, easy cleaning — such as for sanitary requirements.

The mixer is unsurpassed in blending materials with large viscosity ratios, as high as 250,000:1 and more.

The number of elements required to obtain a predetermined degree of mixing may be estimated by comparing your present application with the typical examples shown in Table 1.

TABLE 1

Typical Applications

Application	*Type of Flow*	*Number of Elements*
1. Blending catalyst, dye or additive into a viscous fluid	Laminar	Usually 10 - 14. The exact number of elements will depend on the viscosity ratio.
2. Delustering of polymer dope	Laminar	10
3. Blend out thermal gradients of polymer melt stream from extruder or heat exchanger	Laminar	4 - 6
4. Disperse solid particles in a viscous fluid	Laminar	10
5. Liquid-liquid blending to a homogeneous product	Turbulent Flow	4 - 6
6. Solid-solid blending of food products, explosives	up to 2500 lbs/hr	6 elements placed in a vertical position
7. Waste water neutralization	Turbulent	4 - 6
8. Pipeline reactor to provide selectivity of product	Laminar	10
9. Multi-component epoxy dispensing systems	Laminar	10 - 14
10. Concrete or clay mixing	Laminar	10
11. Manufacture of powder coating	Laminar	4 - 6. Mixer located downstream of extruder
12. Thermal and color dispersion in blow molding machinery	Laminar	4 - 6. Mixer located downstream of extruder
13. Manufacture of liquid or solid foods requiring sanitary construction	Laminar or Turbulent	4 - 10

TABLE 2

Length of ISG Mixer Module

Dia. of Mixer	4-elements	6-elements	10-elements
5 / 8"	2-3/4"	4"	6-1/4"
1"	4"	6"	9-3/4"
1-1/2"	5-1/4"	8-1/4"	14"
2"	6-3/4"	10-1/2"	18-1/4"
3"	10-1/4"	16"	27-1/2"
4"	13-3/4"	21-1/2"	37"
6"	21"	32-1/2"	55-1/2"

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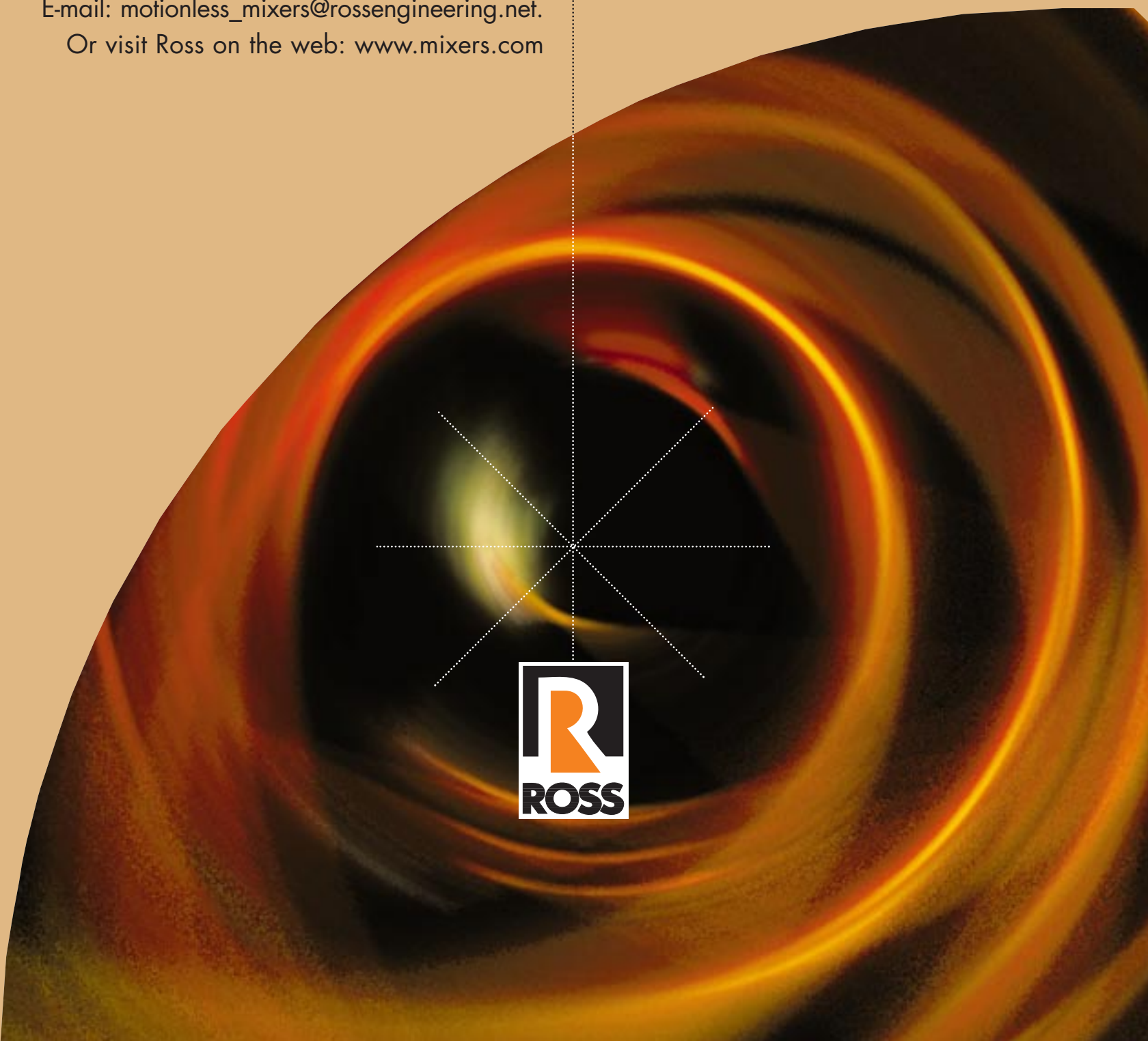
Or visit Ross on the web: www.mixers.com



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