STATIC MIXER

1) CONCEPT

When the MIXING BLADE is not rotating it is a Static Mixer. Static Mixing is achieved by placing a series of well-designed obstructions (mixing elements) in a flowing stream. Static Mixers are "Inline" that is they are placed in pipe line. Static Mixers are generally used for "Continuous Mixing". They may be used in "Batch" mode by providing a recirculation line.

There are several advantages of 'Static Mixers' such as :

- Low Maintenance
- Low Capital Cost and
- Low Energy Requirement.

It is a special skill to design Static Mixers for a given job such a mixing, blending, Gas - liquid contacting, viscous reaction, heat transfer, mass transfer, dispersion, emulsification, extraction and all those operations where usually agitation is employed.

2) DESIGN, APPLICATION AND SELECTION

Mamko has developed several Static Element Designs totally 48 Nos. The selection depends on several factors, merely the 'Application' that is where it is used, that is the precise function. This is followed by physical properties of the materials. Physical properties such as density, viscosity or if it is solid particle sizes or if it is emulsion the droplet size and interfacial properties. Mamko Engineers are trained for this job.

Selection also depends on major criterion that is Pressure Drop.

Data on Pressure Drop is given here for some of the Static Mixers. Pressure Drop in Static Mixer is best described by comparison with Pipe Flow.

Data Required

(a) Physical Properties	:	Viscosity (η), Density (ρ).
(b) Geometrical Parameters	:	Diameter (d).
		Type of Static Mixer constant (K).
		Length ( )
(c) Process variable	:	Flowrate (Q).

Units

η	:	Pas
ρ	:	kg/m^3
d	:	m
ℓ	:	m
Q	:	m^3/S
Δp	:	Pa

PRESSURE DROP CALCULATIONS

(a) Velocity (V) :

$$V = \frac{Q}{\frac{\pi}{4} d^2}$$

$$V^2 = \frac{16}{\pi^2} \frac{Q^2}{d^4}$$

(b) Reynold's Number (Re) :

$$Re = \frac{dV\rho}{\eta}$$

(c) Pressure Drop (Δ p) :

For Re < 50 $\Delta p = K_1 \eta \frac{\ell}{d} \frac{Q}{d^3}$

K_1 = Laminar flow constant.

For Re > 10^3 $\Delta p = K_2 \rho \frac{\ell}{d} \frac{V^2}{2}$

$= K2\ Q \frac{\ell}{d} \frac{8}{\pi^2} \frac{Q^2}{d^4}$

K_2 = Turbulent flow constant.

TABLE : CONSTANT

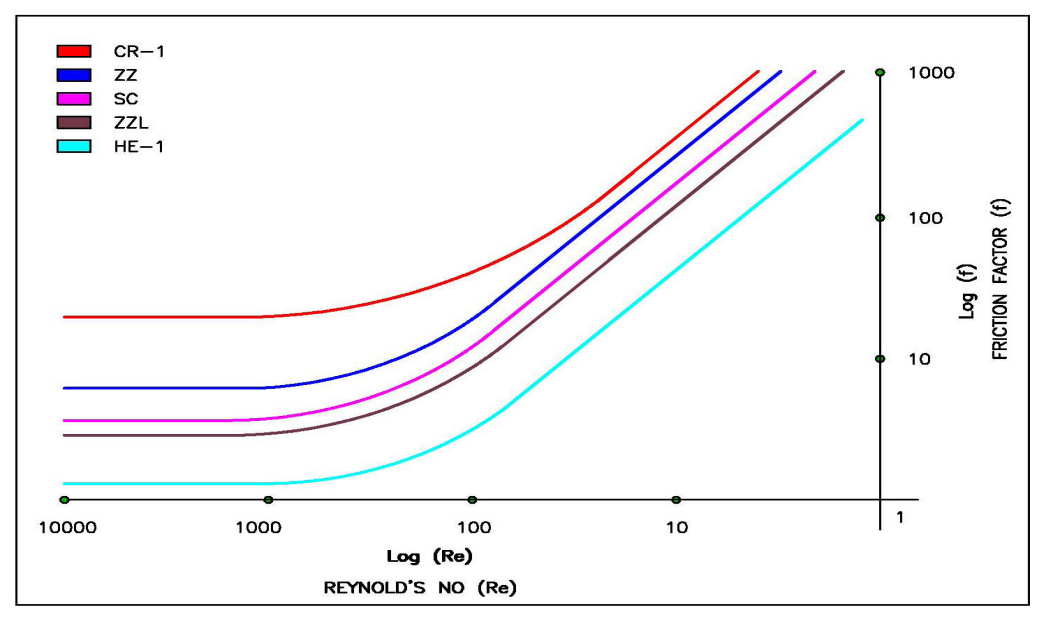
	K_1	K_2
Pipe	41	0.02
Element 'he1' series	330	3
Element 'SC1' series	1050	7
Element 'ZZ' series	1600	11
Element 'ZZXL' series	-	5
Element 'ZZL' series	-	6
Element 'WH' series	2000	30
Element 'CR' Series	2200	35

For low Pressure Drop Mixer generally Orders are for Pressure Drop of 0.1 and 0.2 Bar. For immediate reference to Final Pipe dia graph are prepared for ZZXL series.

For selection of No. of Elements see the following Table.

Condition	**he – Series**	**ZZ – Series**
Re <10	24	20
Re <10^3	18	15
Re < 2 x 10^3	12	10
Re < 5 x 10^3	9	8
Re > 5 x 10^3	6	3
Re >10^5	4	2

GRAPH



3) MATERIAL OF CONSTRUCTION

- Carbon Steel.
- Carbon Steel + Rubber Lined.
- Carbon Steel + PTFE Lined.
- Stainless Steel.
- SS304
- SS304L
- SS316
- SS316L
- SS904L
- Alloy Steel of all types.
- Hastealloy.
- Titanium.
- Aluminium + Monel.
- Nickel Alloy.
- Fiber Reinforcement Plastic (FRP).
- Polypropylene (PP).
- Polyvinyl Chloride (PVC).
- Unplasticized Polyvinyl Chloride (UPVC).
- Chlorinated Polyvinyl Chloride (CPVC).
- High Density Polyethylene (HDPE).
- Teflon

4) END CONNECTIONS

- Flanges as per ANSI B16.5
- Flanges as per ANSI B16.9
- Flanges as per DIN Std.
- Threaded connections.
- Wedgeloke connection.
- Sanitary Fittings.
- SMS Unions.

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