APPLICATION GUIDE

FLANGED/INLINE SERIES 35F & 3505F

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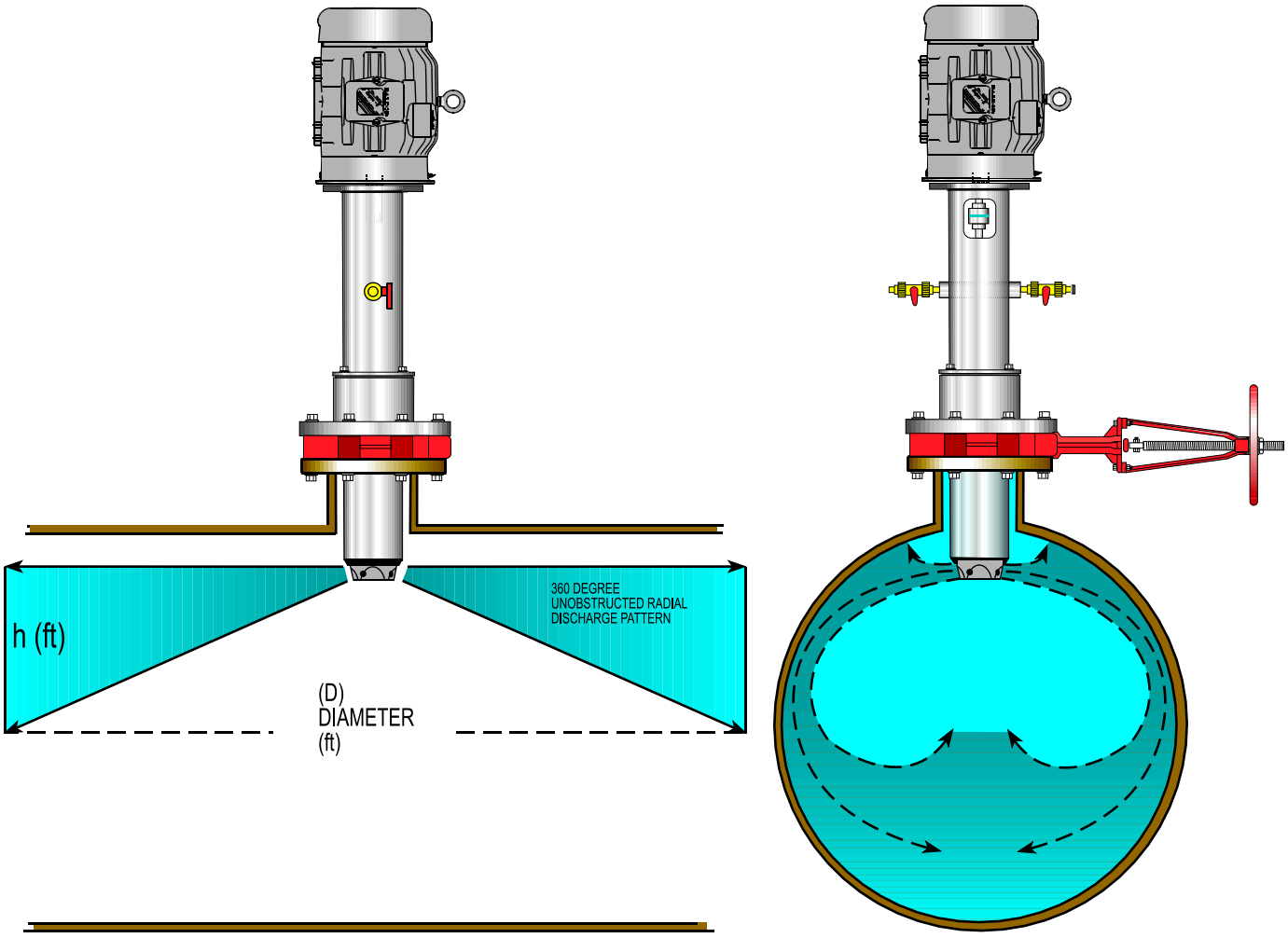
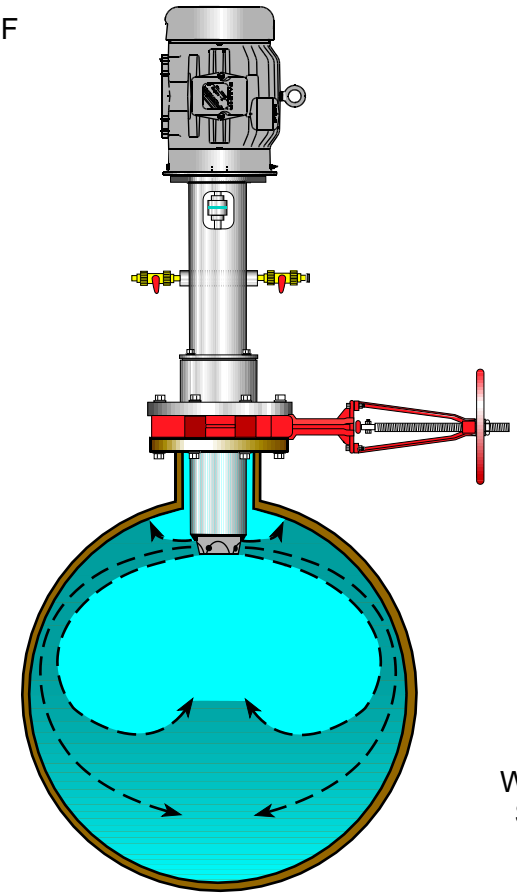
"INTRUDRRR" Series 35F & 3505F Application Guide 1

The **"INTRUDRRR"** series 35F & 3505F vacuum style radial dispersion inline chemical mixer draws the chemical product to be mixed into the process stream by inducing a strong vacuum at the periphery of the distributor rotating at 3450 RPM. By using a nonfouling, bladeless, and impact resistant *Tivar distributor, instead of a propeller; the rotation establishes a vortex flow perpendicular toward the distributor face and discharges the inducted chemical product in a 360 radial outward pattern with ideal velocity shear above 60 FPS. The vertical length of outer dispersion mix pattern is given as **"h"**. The radial discharge pattern diameter distance is given as **"D"**. See guide table page 5 for measurements.

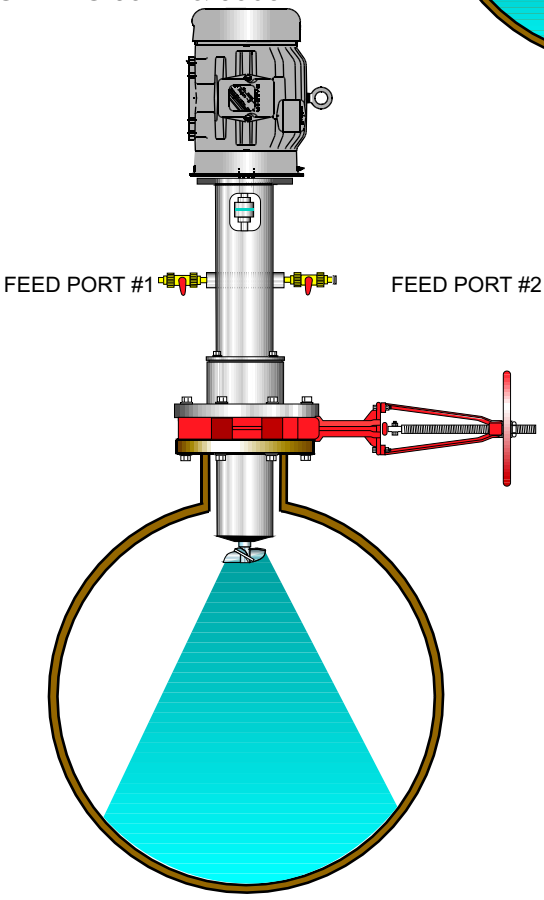


The following schematics located on page 2. will show the discharge patterns of both CIU manufactures. These manufacturers include THE MASTRRR COMPANY "INTRUDRRR" and US Filter "WaterChamp".

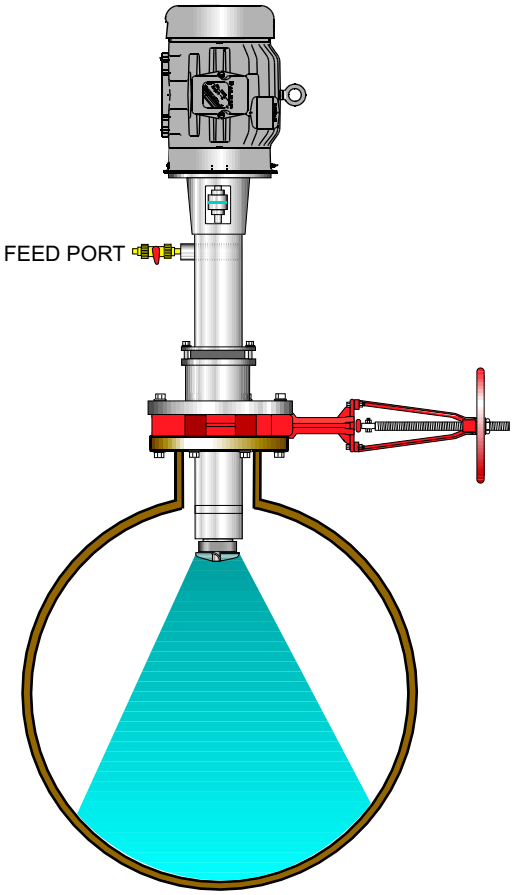
The **"INTRUDRRR"**
SERIES 35F & 3505F

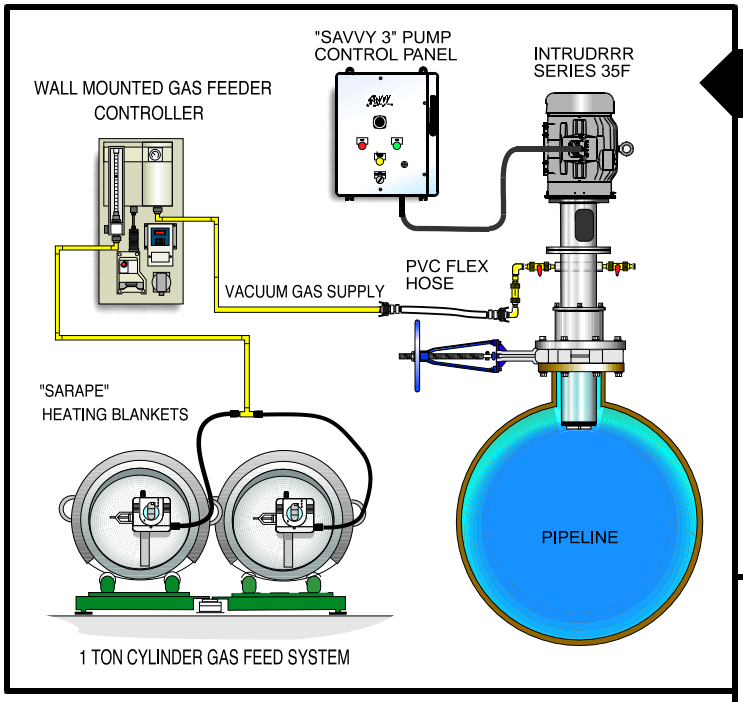


The **"INTRUDRRR"**
SERIES 35FP & 3505FP



WATERCHAMP
SERIES ILWC





Vacuum Gas Feed System

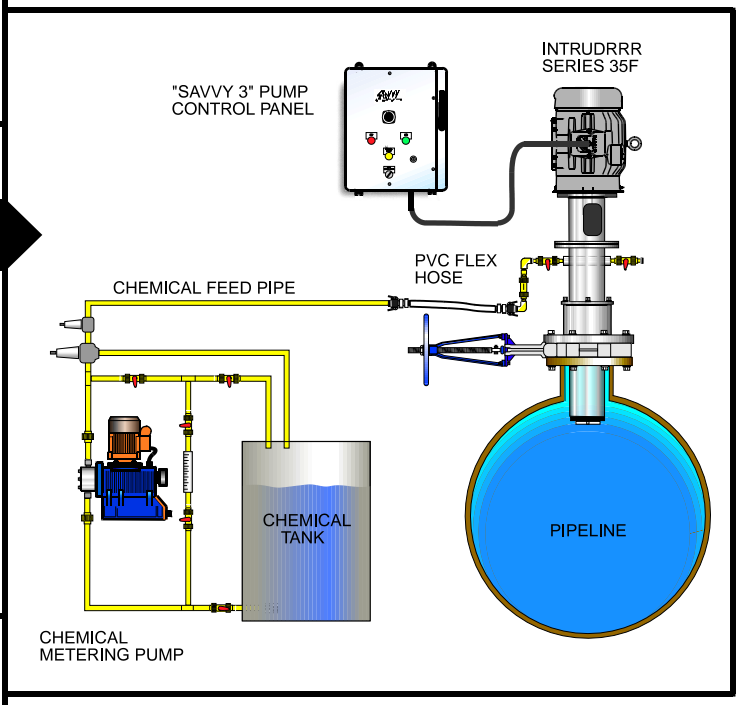
Typical vacuum gas feed system HP sizing factors may include:

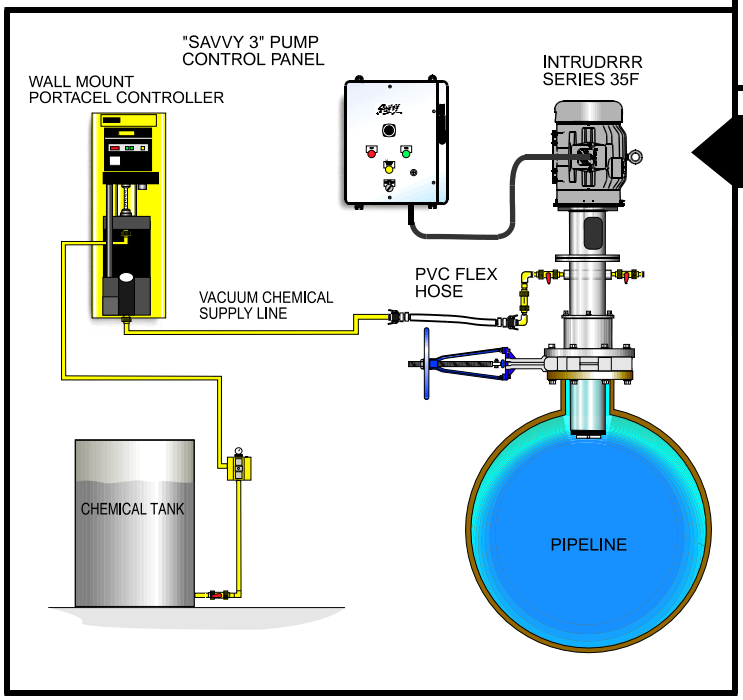
* Maximum gas feed rate
* Gas feed equipment manufacturer's inlet vacuum requirement
* Piping distance & size from feeder to CIU
* Pipline Size
* Pipline Pressure (consult factory if over 10psi)
* Required G - Value mixing intensity

Nonvacuum Liquid Feed System

Typical nonvacuumed liquid feed system HP sizing factors may include:

* Maximum liquid feed rate
* Liquid chemical viscosity
* Pipline Size
* Required G - Value mixing intensity





Vacuum Liquid Feed System

Typical vacuum liquid feed system HP sizing factors may include:

* Maximum liquid feed rate
* Gas liquid equipment manufacturer's inlet vacuum requirement
* Piping distance & size from feeder to CIU
* Pipline Size
* Pipline Pressure (consult factory if over 10psi)
* Required G - Value mixing intensity

CHEMICAL FEED RATES (GAS / LIQUID)
2 - 25 HP

HP	MAXIMUM GAS INDUCTION (PPD)	MAXIMUM VACUUM (in. Hg) GAS FEED	MAXIMUM LIQUID FEED NON-VACUUMED (GPM)	MAXIMUM LIQUID FEED VACUUMED (GPM)
2	500	21	15	10
3	1,500	22	20	15
5	*2,000	22	*25	*20
7 1/2	*3,500	23	*30	*25
10	*6,000	25	*40	*30
15	*8,000	26	*50	*40
20	*10,000	26	*60	*50
25	*10,000	26	*60	*50

25 HP USED FOR EXTREME APPLICATIONS WHERE ADDITIONAL MIXING IS REQUIRED, LARGE DIAMETER PIPELINES, OR LONG CHEMICAL SUPPLY PIPE DISTANCE BETWEEN CIU AND CHEMICAL FEED EQUIPMENT.

***Max gas feed rate & vacuum will vary dependent on chemical feed equipment manufacturers inlet vacuum requirements, supply piping size and length, and the pipeline pressure.**
Liquid chemical feed varies with viscosity and other factors, consult factory.

When selecting an INTRUDRRR series for an application, an ADS sheet should be filled out and submitted to the factory or a factory authorized representative for assistance.

Several factors should be considered when selecting a unit HP size. These factors include but are not limited to:

*** Maximum feed rate requirement**

*** Flow rate: design, average & peak/storm flow**

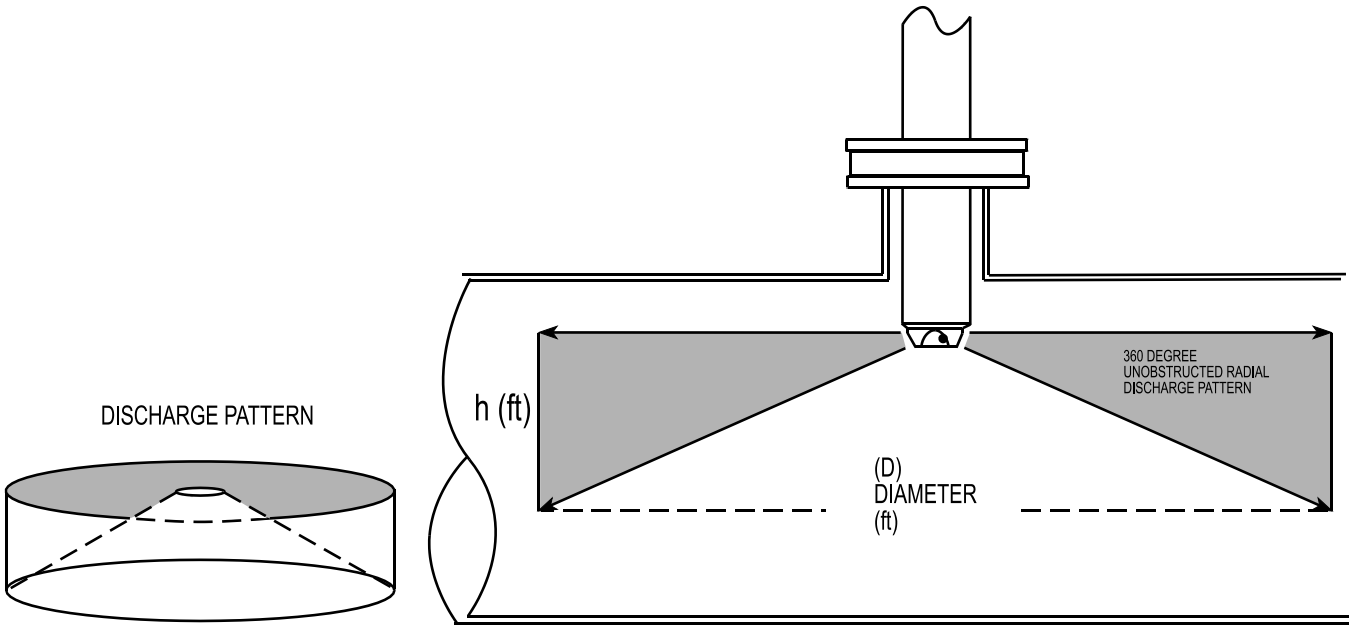
*** Mixing zone / area (pipeline size)**

*** Velocity gradient requirements "G-value"**

APPLICATION GUIDE TABLE
SERIES 35F & 3505F (2 - 25 HP)

HP	CHEMICAL FEED RATE OPTIMUM FEED RATE NOT MAXIMUM		EXIT/CHEMICAL SHEAR VELOCITY	GPM DISCHARGE RATE FROM MIXING ELEMENT	RADIAL DISCHARGE OPTIMUM DISTANCE NOT MAXIMUM	
	PPD GAS CI2	GPM LIQUID	f/s	GPM	VORTEX "h" FEET	DIAMETER (D) FEET
2	350	6	60	580	3.5	6
3	1,000	10	68	745	4	8
5	1,500	15	72	960	4	9
7-1/2	2,500	20	75	1,150	5	10
10	4,000	25	79	1,325	6	12
15	6,000	30	85	1,670	6	14
20	7,500	35	90	2,060	7	18
25	8,500	40	100	2,200	8	21

25 HP USED FOR EXTREME APPLICATIONS WHERE ADDITIONAL MIXING IS REQUIRED, LARGE DIAMETER PIPELINES, OR LONG CHEMICAL SUPPLY PIPE DISTANCE BETWEEN CIU AND CHEMICAL FEED EQUIPMENT.



Mixing regime volume and velocity gradient "GT value" calculation for pipelines

When determining a HP range for pipeline applications a "G value" velocity gradient calculation is helpful. The mean velocity gradient (G in sec $^{-1}$) or measurement of the intensity of the mix represented by:

$$G = \sqrt{\frac{P}{MV}}$$

And expressed as the Square Root of the work (**P**) in Foot Pounds Per Second (550 ft-lbs/sec) by a pump motor during mixing of the chemical into the process water regime, divided by the Viscosity (**M**) absolute of the process water at ambient (70°F), times the volume (**V)** in Ft ^{3}(Cubic Feet) of the mixing regime.

The mixing regime volume is calculated by: the cross sectional area (**A**) area x (**L**) length

(**L**) length is determined by the Peak Flow Velocity (Ft/Sec) x (*3 second) dispersion time = Ft ^{3} volume.

Example: A flow of 3 MGD peak flow in an 18" diameter (**D**) pipeline.
The flow must be converted to cubic feet per second (Ft^3/Sec).
Use the equation: MGD x 1.54723 = Ft^3/Sec 3 x 1.54723 = 4.641
Or use the equation MGD x 694.4 = GPM then GPM x .00223 = Ft^3/Sec

The cross sectional area is = 9 X 9 X 3.14 = 254.34 in X .00695 = 1.767 Ft
With a flow rate of 4.641 Ft^3/Sec the velocity is calculated as follows: $\text{Velocity} = \frac{\text{Flow Ft}^3/\text{Sec}}{\text{Area}}$

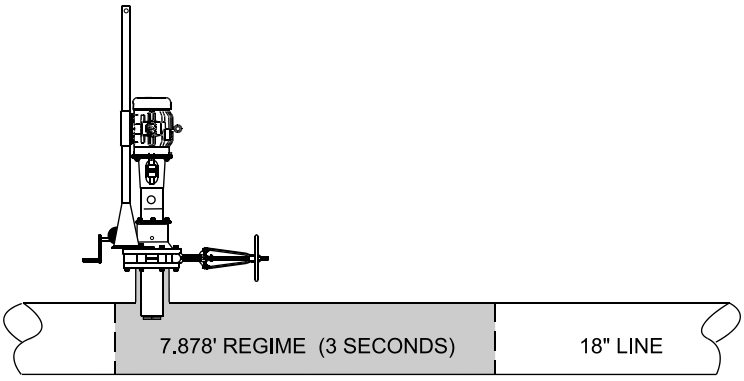
$$\text{Velocity} = \frac{4.641}{1.767} \qquad \text{Velocity} = 2.626 \text{ Ft/Sec}$$

The regime calculation is then: 1.767 x 2.626 x 3 = 13.92 Ft ^{3} volume.
A length of 7.878' allows process water to remain in the regime for 3 seconds.
The velocity gradient is then calculated as:

P = 2 HP x 550 = 1100 Ft/lbs./Sec
M = .0000235
V = Regime volume of 13.92 Ft ^{3}
G =

$$\sqrt{\frac{(2 \times 550)}{(.0000235 \times 13.92)}} = \sqrt{\frac{1100}{.0003271}} = \mathbf{1833.8}$$

A "G" value of 1000 or more is a useful indication that the mixing intensity is superior. A minimum "G" value of 500 is required in some states in the U.S.A.



APPLICATION GUIDE G-VALUE TABLE
SERIES 35F & 3505F 2-25 HP

When determining a HP range for large inflow pipe or wide channel application a "G value" velocity gradient calculation is helpful. The mean velocity gradient (G in sec^{-1}) or measurement of the intensity of the mix represented by:

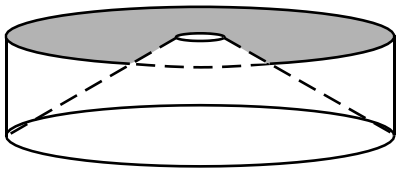
$$G = \sqrt{\frac{P}{MV}}$$

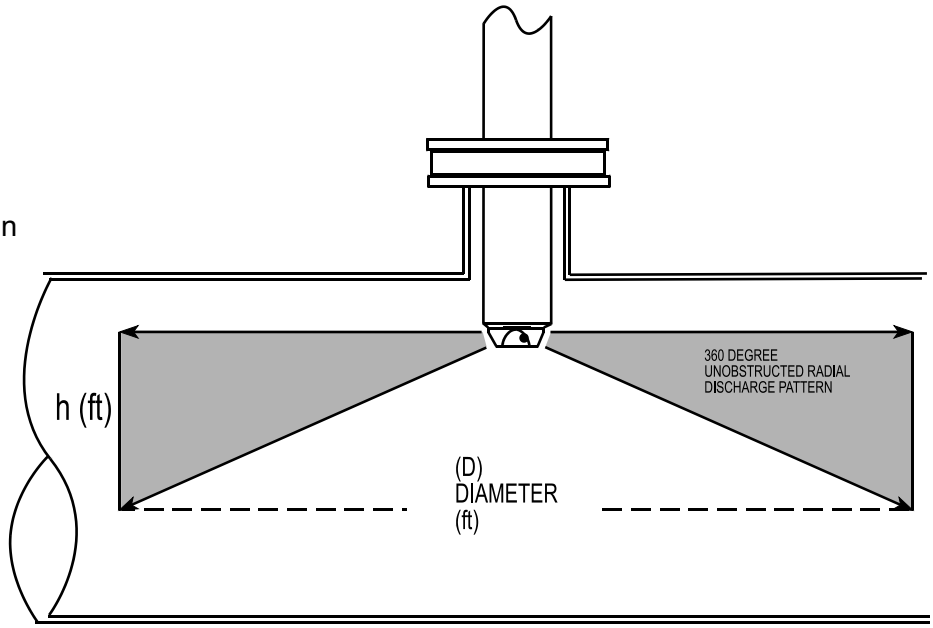
And expressed as the Square Root of the work (**P**) in Foot Pounds Per Second (550 ft-lbs/sec) by a pump motor during mixing of the chemical into the process water regime, divided by the Viscosity (**M**) absolute of the process water at ambient (70° F), times the volume (**V**) in Ft^3 (cubic feet) of the mixing regime.

P = Horsepower X 550
M = .0000235
V = Water volume in discharge mixing zone Ft^3 (cubic feet)
G = Velocity Gradient (G-Value)

D = Diameter of outer radial dispersion mix pattern (zone of influence)
h = Vertical length of outer dispersion mix pattern (feet)

DISCHARGE PATTERN





RADIAL DISCHARGE COMMON FOR 1/2 - 25 HP			VELOCITY GRADIENT (G-VALUES) PER HP									
D (ft)	h (ft)	V (ft^3)	1/2	1	2	3	5	7.5	10	15	20	25
2	.46	.48	4,955	7,008	9,910	12,138	15,669	19,191	22,160	27,140	31,339	35,038
4	.93	3.89	1,734	2,453	3,469	4,249	5,485	6,718	7,757	9,500	10,970	12,265
6	1.39	13.1	945	1,337	1,890	2,315	2,989	3,660	4,227	5,177	5,978	6,684
8	1.86	31.2	612	866	1,225	1,500	1,937	2,372	2,738	3,354	3,873	4,330
10	2.33	61.0	437	619	875	1,073	1,385	1,696	1,958	2,399	2,770	3,097
12	2.79	105.1		471	667	817	1,055	1,292	1,492	1,828	2,110	2,359
14	3.26	167.3			528	648	836	1,024	1,182	1,448	1,672	1,870
16	3.73	250				530	684	838	967	1,185	1,368	1,530
18	4.19	355.5					573	702	811	993	1,147	1,283