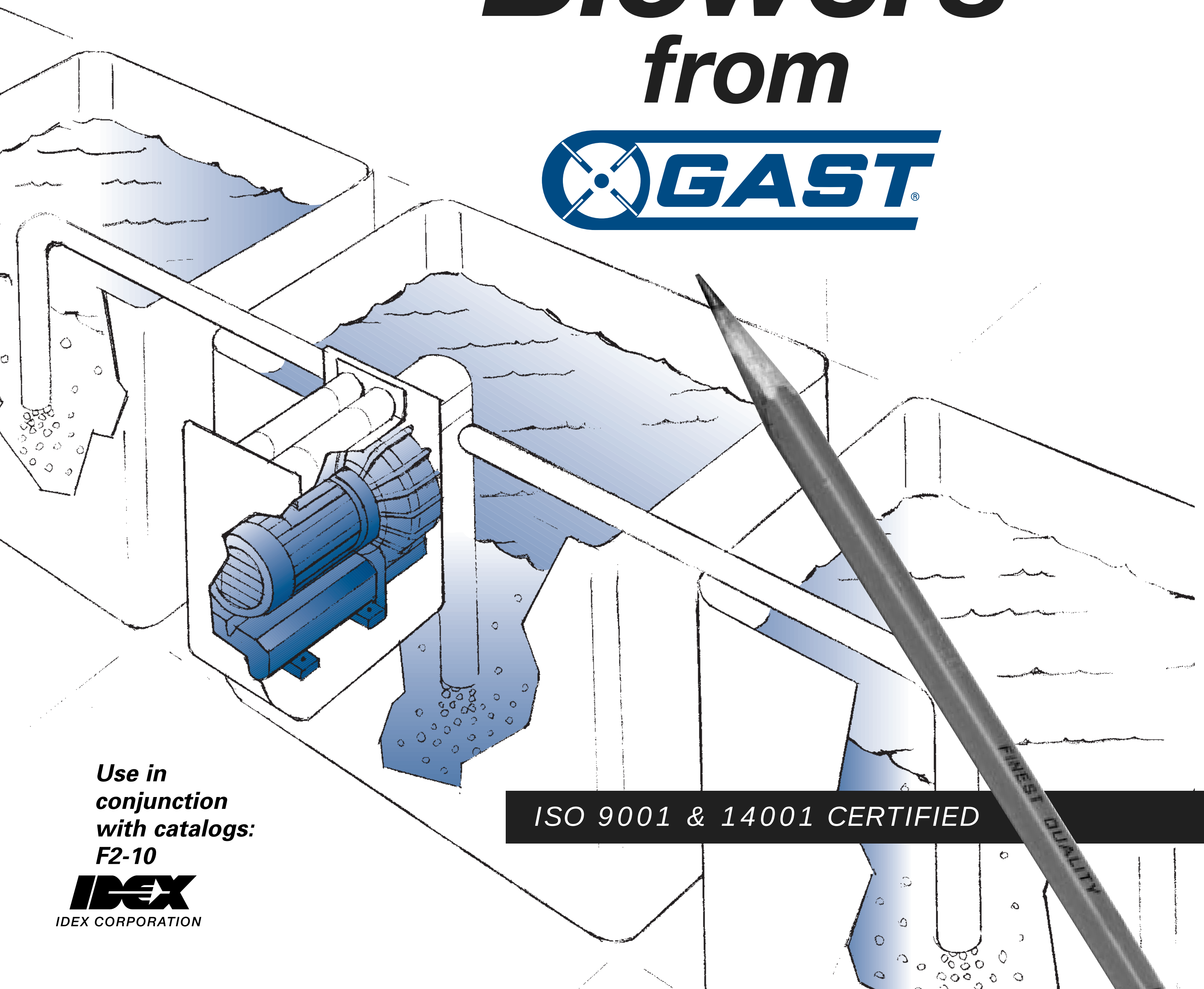
Tank Agitation using Regenair® Blowers from GAST®



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Use in conjunction with catalogs: F2-10

IDEX CORPORATION

Plating, Cleaning and Rinse Tank Agitation with a Gast REGENAIR® Blower

Why agitate with air?

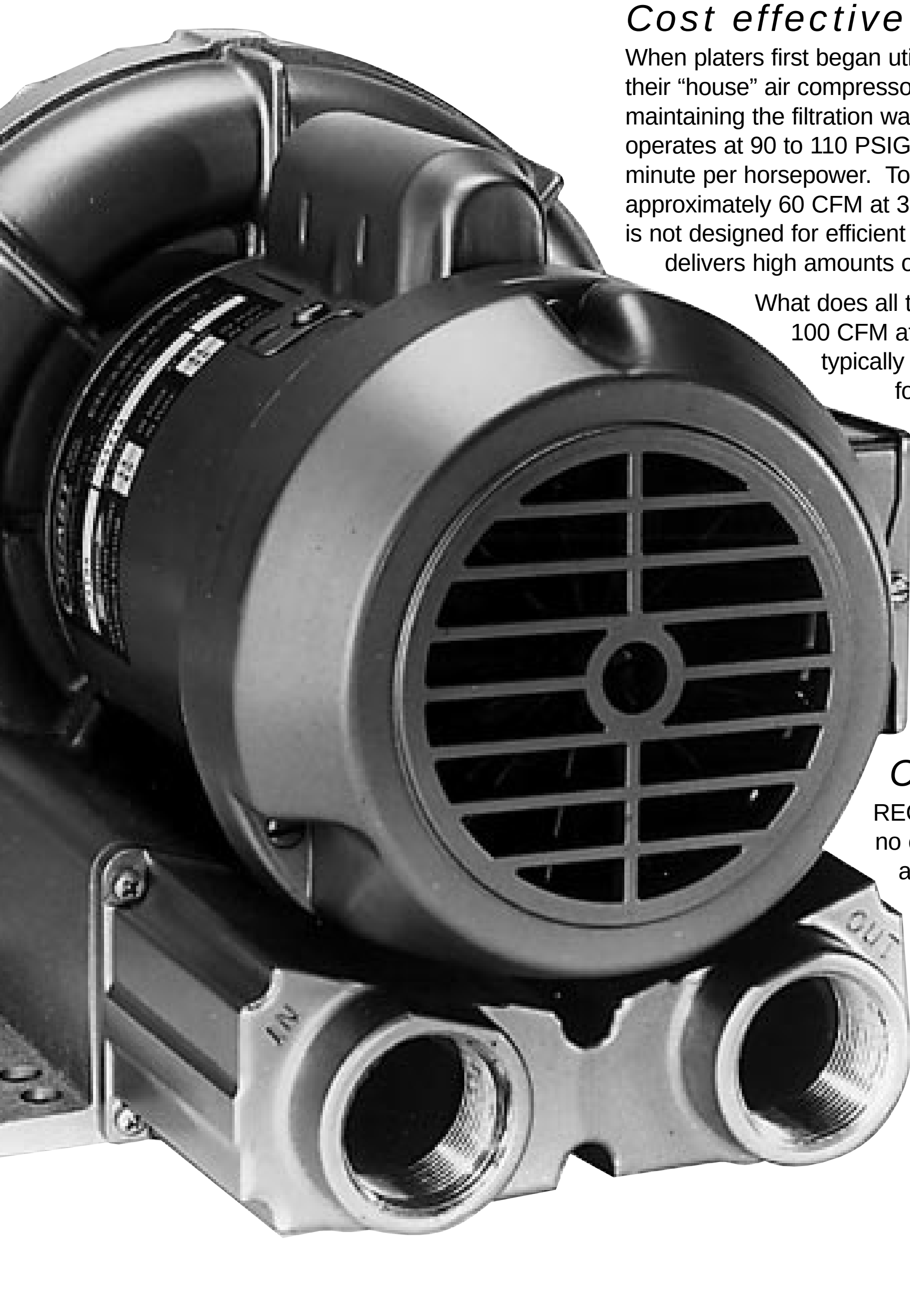
Of the four main forms of agitation (mechanical, ultrasonic, cavitation and air) air is not only the easiest to use, it also offers a form of agitation without any moving parts in the bath. For cleaning and rinsing, air agitation aids in the dislodging of dirt particles, flushes away dissolved grease and insures continuous contact with the cleaning solution. Air agitation in plating renews cathode film, decreases polarization, and allows the use of higher current densities. Results are higher plating speeds and finer grain deposits.

What are the advantages of using a Gast Regenair Blower?

Cost effective

When platers first began utilizing air as a form of agitation, they naturally used their “house” air compressor. This practice involved no initial investment and maintaining the filtration was a necessary evil. However, a plant air compressor operates at 90 to 110 PSIG and typically delivers 3.5 to 4 cubic feet of air per minute per horsepower. To agitate a tank 4 feet wide x 8 feet long x 4 feet deep, approximately 60 CFM at 3 PSIG is required. As you can see, a plant compressor is not designed for efficient bath agitation. However, a Gast blower is ideal. It delivers high amounts of air at low pressures.

What does all this mean to you? It means if your requirements are 100 CFM at a rate of 8 hours per day, a Gast blower will save you typically $ 2,400 a year. In other words, the blower could pay for itself in just 5 months of use. The reason for these savings is simple. With a blower, only 2 – 10 horsepower is needed; with plant compressors, usage is 25 horsepower and up. Plus, if you are not familiar with our guarantee, check it out, see catalog F2-10 or F2-15! Not only is it worth a pretty penny, but it offers the maintenance person or supervisor peace of mind.



Quiet

With the blower plumbed into the sparger, these blowers are well within OSHA standards.

Clean air

REGENAIR blowers require no lubrication and that means no contaminated chemical baths. With an inlet filter, the air going into the tank will be cleaner than the air you are breathing. This will further add to your bottom-line savings when you consider the cost of downtime and chemicals required to change your baths.

Mounting

Unlike competitive blowers, a Gast blower can be mounted in any position that is convenient.

How Do I Design My Sparger?

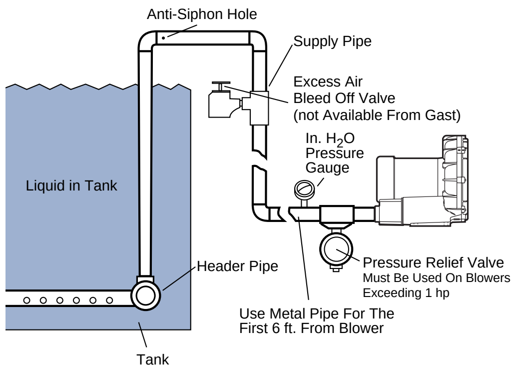


Figure A

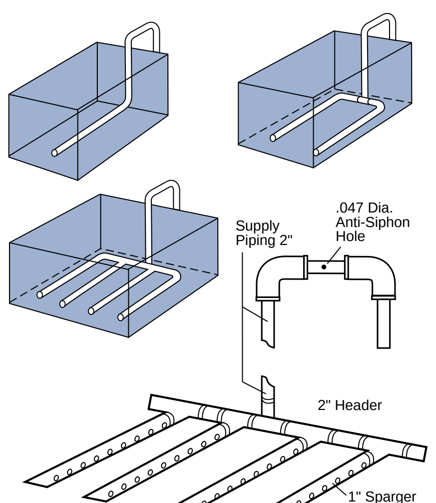


Figure B

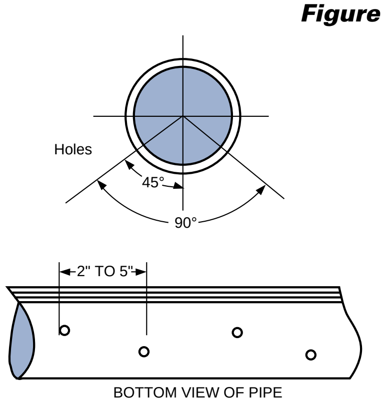


Figure C

When using a blower, the design of your plumbing and sparger are critical. When done correctly, the blower will run to its highest efficiency, Improper plumbing will create excessive back pressure which can reduce the life of the blower and consume more power, resulting in less savings.

There are three main parts in the plumbing:

1. Supply Pipe – All of the pipe, starting from the blower and stopping at the bottom of the tank.
2. Header Pipe – The pipe that is connected to the supply pipe (see Figures A & B). This pipe runs perpendicular to the supply pipe and distributes the air evenly to the sparger pipes.
3. Sparger Pipes – These are the bubbling pipes that extend across the tank from the header. The holes are drilled on the bottom, as shown in Figure C.

Figures A, B and C illustrate how to set up your plumbing and sparger system physically. With this in mind, here are some key tips to make your sparger system as efficient as possible:

Supply Pipe

- The first six feet of pipe should be metal because of exhaust air temperature.
- The pressure gauge and relief valve (on 1½ HP and up units) should be centered between the blower and the first elbow for the most accurate reading.
- A valve should be installed to bleed off excess air.
- An anti-siphon hole (3⁄64" diameter) should be drilled at the highest point of your plumbing.
- Most important (to relieve the blower of back pressure), your supply pipe must be one standard size larger than the exhaust port of the blower. Have the least number of elbow connections possible.

Header Pipe

- This pipe should be the same size as your supply pipe (one standard size larger than the exhaust port of the blower).
- The supply pipe should be centered into the header pipe.

Sparger Pipe

- Divide the number of pipes by the CFM the blower you've selected produces at the estimated pressure. This will give you the CFM per sparger pipe. Refer to Table 1 with this figure to determine what size pipe is best suited for your sparger system.

TABLE 1
SPARGER PIPE SIZE SELECTION CHART

CFM LIMIT	Sch. 40 PIPE SIZE
11	¾"
22	1"
44	1¼"
56	1½"
115	2"

- Using Figure C, drill your holes in this pattern every 2 – 5".
- The diameter of the holes can range from 3⁄32" (standard) to 3⁄16". The larger sizes are used for tanks with residue that can cause sparger hole blockage. Clean these holes of drilling chips.
- Make sure drilled holes point downward in the tank and your sparger pipes are suspended above the bottom.
- Clean the insides of all pipes of debris before assembly.

NOTE: Check pressure gauge to see if blower is working under max-rated pressure.

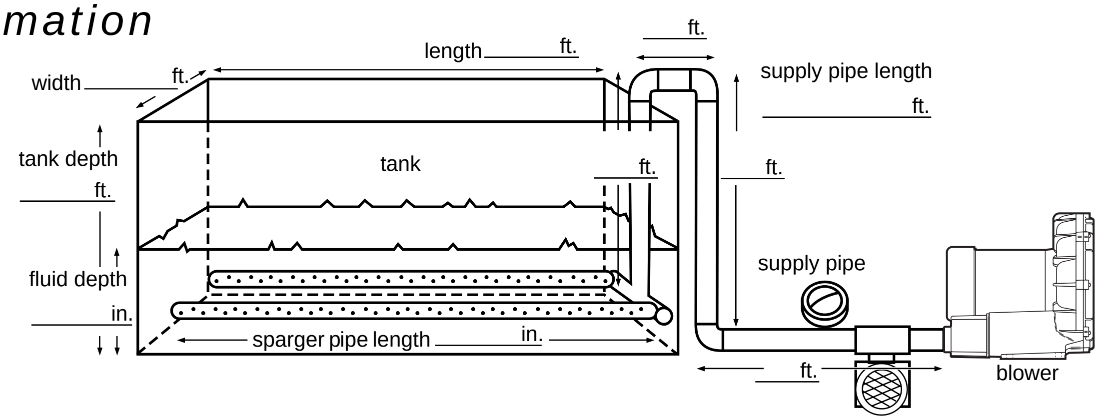
To make sure your system is as efficient as possible, refer to the REGENAIR blower agitation work sheet.

WORKSHEET

GAST® REGENAIR® Blowers for Agitation Systems

Company:____________________ **Tank Number:** _______________________ **Location:** ________________________

Basic Information



A. Bath Type — Specific Gravity — Agitation Factor

	Bath Type	Specific Gravity	Agitation Factor
_____	cleaning	1.1	1.0 – 1.5
_____	Al plating	1.2	1.2 – 1.8
_____	Cu plating	1.2	1.1 – 1.5
_____	Ni plating	1.2	1.5 – 2.0
_____	rinsing	1.0	0.8 – 1.3

B. Fluid depth:_______________in.

C. Length of tank_______________ft. __________________Width of tank ft.

D. Number of spargers:_________________ (New systems use one per rack.)

Length of spargers: _____________________________ins.

Existing systems: Size of sparger pipe: ______________________________

Size of holes: ____________________________________

Distance between holes:_________________________ins.

E. Blower location:

Distance from tank to blower: _____________________________________ft.

Number of elbows ____

Tees and valves ____

Determining the Proper Blower

Air flow and pressure requirement

1. Determine estimated operating pressure (PE).

_______________ in. x _________________ + 15 = _______________ in. H_2O

Fluid Depth — Specific Gravity — Operating Pressure (PE)

2. Determine the highest air flow in CFM (QE).

______________ x ______________ x ______________ = ______________ CFM

Tank length — Tank width — Air agitation factor — Est. air needed (QE)

Trial blower model

3. Review REGENAIR blower performance curves.
Select model to meet both the required air flow (QE) and the estimated operating pressure figures from Steps 1 & 2.

__________________ __________________ __________________

Model # — Max. Pressure — CFM at Max. Pressure

__________________ __________________

Est. Pressure (PE) — CFM at Est. Pressure (QB)

Model No.:	R1 R2	R3	R4, R4P, R5	R4H, R4M R6, R6P	R7 R7S	R6PP R9, R9S	R7P	R9P
Outlet Size:	1"	1¼"	1½"	2"	2½"	3"	4"	5"

Pipe size

4. Blower outlet size: _______________ in.
Supply pipe/header size: _______________ " NPT
Supply pipe and header must be one size larger than blower outlet to lessen back pressure and lengthen blower life.

5. Determine air flow per sparger pipe.

_______________ ÷ _______________ = _______________

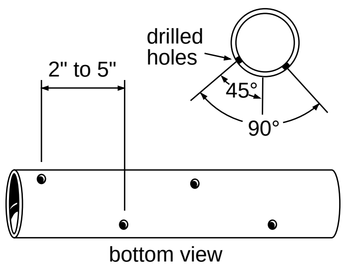
CFM at Est. Pressure (QB) | # of Sparger Pipes | CFM per Sparger Pipe

6. Determine size of sparger pipe.
   Circle the range that includes the CFM/sparger pipe figure from Step 5 and the sparger pipe size directly below.

Range per pipe	0-11 CFM	12-22 CFM	23-44 CFM	45-56 CFM	57-115 CFM	100-160 CFM	150-300 CFM	250-550 CFM
Sparger pipe size	¾"	1"	1¼"	1½"	2"	2½"	3"	4"

   Check existing sparger pipe size to see if it fits the range.
   If not, the sparger size will need to change to achieve good air distribution.

Sparger Holes



Sparger Pipe

7. Determine minimum/maximum number of holes per sparger pipe.
   Holes should be no closer than 2" or farther than 5" apart. Holes are drilled on alternate sides of the pipe.

_________ x _________ ins. = _________ ÷ 2" = _________

# of sparger pipes | Length of each pipe | Total Inches | # holes 2" apart

÷ 5" = _________ # holes 5" apart

÷ " = _________ # existing holes

8. Determine the air flow per hole.
   The pressure drop in the sparger pipes **must** range from 2 – 10 inches of water for uniform air distribution.

_________ ÷ _________ = _________
CFM at Estimated Pressure | # Holes 2" Apart | Air Flow per Hole 2" Apart

_________ ÷ _________ = _________
CFM at Estimated Pressure | # Holes 5" Apart | Air Flow per Hole 5" Apart

_________ ÷ _________ = _________
CFM at Estimated Pressure | # Existing Holes | Air Flow per Existing Hole

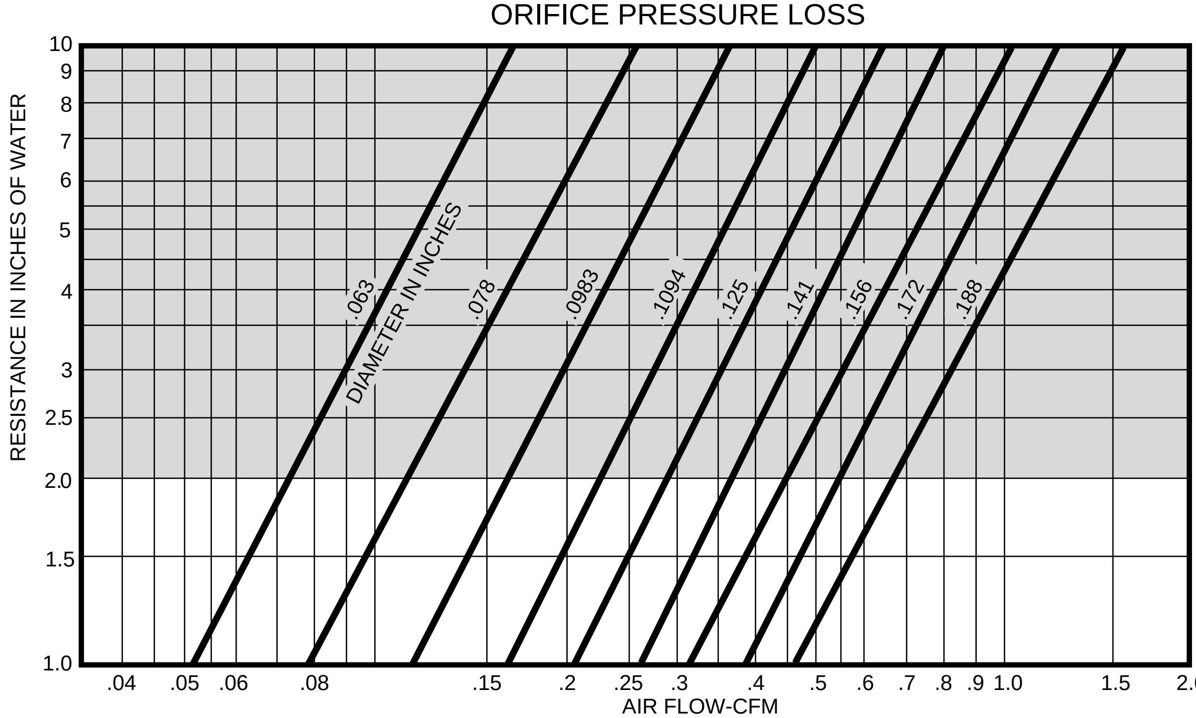
9. Determine sparger hole diameter.
   A pressure drop of 2" to 10" is acceptable 3" to 6" is best. On the bottom line of the graph, Air Flow CFM, mark the 2" and 5" results from Step 8. Using a ruler, run vertical lines from each CFM point where a diagonal line intersects within the shaded area (2" to 10" pressure drop).

   Select System Hole Diameter: _______________________________

   Select System Pressure Drop: _______________________________
   Existing systems: check actual hole diameter against pressure drop.

   Note: Cleaning systems need the large holes because residue settles and can block openings.

ORIFICE PRESSURE LOSS



System friction loss

Friction causes pressure loss in all systems. Plumbing design and length affect this loss in air flow.

10. Determine total straight pipe equivalent.
    List number of each fitting in system. Circle the column under the supply pipe size. Multiply the number of each item by the pipe size conversion factor to find the equivalent amount of straight pipe.
    Add equivalent figures to actually straight pipe figures.

Supply Pipe Size Conversion Factor

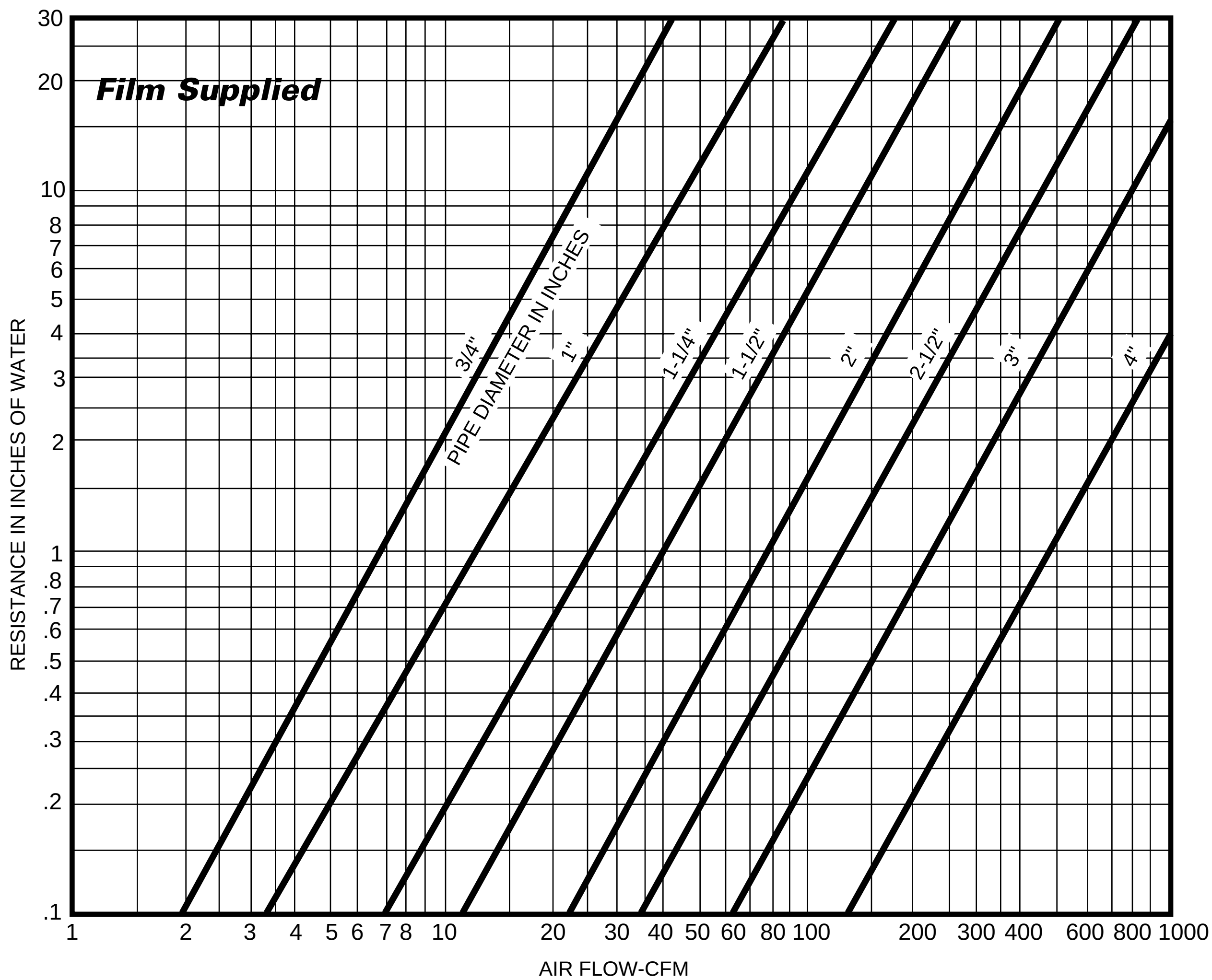
Fitting	#	¾"	1"	1¼"	1½"	2"	2½"	3"	4"	Equivalent Feet
90° Elbows	_____ x	2.0	3.0	3.5	4.0	5.0	6.0	8.0	10.0	= _____
Std.Through Tees	_____ x	1.5	2.0	2.5	3.0	3.5	4.0	5.0	7.0	= _____
Std. Branch Tees	_____ x	4.0	5.0	7.0	8.0	10.5	12.5	15.5	20.0	= _____
Check Valves	_____ x	7.0	9.0	11.5	13.5	17.0	20.5	25.5	34.0	= _____
Gate Valves	_____ x	.55	.70	.90	1.0	1.5	2.0	2.0	3.0	= _____

Total length of straight pipe = ____ ft.

Total straight pipe equivalent = ____ ft.

11. Determine total friction loss in supply pipe.
    On bottom line of the pipe friction loss chart, mark the air flow needed as figured in Step 2. Using a ruler, scan vertically from the CFM figure to the diagonal line for the proper pipe size from Step 4. Mark the intersection and then scan to the left (vertical) axis to find the friction loss figure.

PIPE FRICTION LOSS/10' of pipe



Divide the total straight pipe equivalent from Step 10 by 10; multiply by friction loss figure just determined to get the total friction loss in the supply pipe.

_______________	÷ 10 x	_______________	=	_______________
Total Feet of Supply Pipe		Friction Loss Factor		Total Friction Loss in Supply Pipe H_2O"

12. Determine total friction loss in sparger pipes.

    On the bottom line of the pipe friction loss chart, mark the air flow needed as figured in Step 5. Using a ruler, scan vertically from the CFM figure to the diagonal line for the sparger pipe size from Step 6. Mark the intersection and then scan to the left (vertical) axis to find the friction loss figure. Divide the sparger pipe length from Step 7 by 30 and multiply by the friction loss figure.

    ___________________ ÷ 30 x _____________________ = _____________________

Total Inches of Sparger Pipe		Friction Loss Factor		Total Friction Loss in Sparger Pipe

13. Determine the actual system pressure.

    Add total friction loss in the supply pipe; total friction loss in the sparger pipes; the pressure drop; and the fluid depth multiplied by the specific gravity. The final sum equals the actual pressure of the system.

    __________ + __________ + __________ + (__________ x ______) = ____________

Total Friction Loss: Supply Pipe	Total Friction Loss: Sparger Pipe	Pressure Drop	Fluid Depth	Specific Gravity	Actual System Pressure

    Check estimated operating pressure from Step 1. If actual system pressure is **below** estimated operating pressure, then you will have an efficient blower system from agitation systems. If this figure is higher, use a higher horsepower Gast blower and rework figures.

Recap

A. Steps 2 and 3 give you required CFM and blower CFM. The difference is the amount of air that needs to be vented to the atmosphere.
B. Steps 4, 5 and 6 give you required system pipe size.
C. Steps 7, 8 and 9 determine number and size of sparger holes.
D. Steps 10, 11 and 12 give you system friction loss.
E. Step 13 compares actual system pressure against operating pressure estimated in Step 1 to make sure you have the correct size blower for the system.
F. If you need help with the worksheet, call your local sales representative or the factory.

Please note:
Pressure relief valve and flow regulating valve are always recommended to be installed.

Systems sized using this procedure have operated successfully in a variety of applications. However, Gast cannot guarantee that results will always be satisfactory due to additional considerations not covered by these calculations.

Remember, if you cannot find a blower that meets your needs, Gast makes a large line of positive displacement compressors.

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