TK-101

Industrial Finishing

A Hitchcock Publication

...Air Agitate in Plating, Cleaning and Rinsing

Reprinted from June 1981 issue of INDUSTRIAL FINISHING

...Air Agitate in Plating, Cleaning and Rinsing

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The use of low-pressure air to agitate metal finishing plating, rinse and wash tank solutions has greatly enhanced finishing quality and allowed for increased production. Air agitation offers: (1) efficient removal of cathode films with higher speed plating, (2) effective cleaning action and (3) continuous surface exposure to fresh plating solution. Air agitation increases rinse efficiency, thus reducing the amount of rinse water required and the size of the waste treatment system.

These and other advantages, such as increased operating limits for solution ingredients and a reduction in the required amount of additive agents, have more than justified the rapidly expanding use of air agitation.

The oil-free, nonpulsating-flow design of regenerative air blowers has proven them to be the most suitable means of supplying clean, steady air flow at volumes and pressures needed for plating and ancillary air agitation applications. Unlike compressed air, regenerative blower "air out" is as clean as "air in" (cleaner if an inlet filter is used).

In selecting the proper regenerative blower for air agitation, the blower must be capable of a sufficient air-flow rate and output pressure to meet the requirements; over-sizing of the blower brings waste. The required air-flow rate and output pressure for your application can be determined with the formulas and tables in Fig. 1, along with a "how to use" example. Blower selection can then be made using a manufacturer's selection chart, as shown in Fig. 2.

The method shown for determining required pressure includes allowances for typical air line and sparger losses as well as the head represented by depth and specific gravity of the liquid.

In multiple plating systems involving more than one plating tank and perhaps one or more wash and rinse tanks, determination must be made whether to use one blower (or the smallest number possible) for the total air volume required or to use individual blowers for each tank or multiples of tanks. Trade-offs depend on the likelihood of certain tanks occasionally being bypassed while remaining tanks operate, making "air bleeds" or flow regulation necessary to relieve blowers sized for higher flow systems and to prevent excessive air agitation. Relative proximity of tanks, lengths of connecting air lines, possibility of widely disparate liquid depths and system geometry must be considered.

When excessive air agitation is experienced in a regenerative blower system, excess blower air

FIGURE 1

Blower Selection for Tank Agitation

(1) Determine the required pressure
P (in psig) = 0.43TD + 0.75 where
T = solution depth in feet
D = specific gravity of the solution (see table)

(2) Determine the required flow rate
Q (in scfm) = AF where
A = total surface area of tank(s) in ft^2
F = agitation factor in $scfm/ft^2$ (see table)

Agitation Factors (F) and Specific Gravities (D)

Solution Type	Agitation Factor *F ($scfm/ft^2$)	Specific Gravity D
Cleaning	1.0-1.5	1.1
Cu Plating	1.0-1.5	1.2
Al Plating	1.0-1.8	1.2
Ni Plating	1.2-2.0	1.2
Rinse	0.5-1.5	1.0

Example: Shop wishes to agitate three nickel plating tanks. Each tank is 3-ft wide by 8-ft long by 5-ft high (solution depth is 4.5 ft). Pressure required (P) = (0.43 x T x D) + 0.75. T = 4.5 ft, D (from chart) = 1.2, so P = 3.07 psig. Flow required (Q) = AF. A = total surface area = 8 by 3 by 3 ft tanks = 72 sq ft. and F = 1.6 (from chart-median agitation selected) so Q = 72 x 1.6 = 115.2 scfm. From the selection chart, the DR6D89 delivers 119 scfm at 3.0 psig. So the DR6D89 is recommended.

**Since the efficiency of agitation depends greatly on sparger design, contact your plating equipment distributor for specific agitation factor selection.*

Excess Air
Excess airflow should never be throttled but rather dumped back into the room or out of the building. Install a pipe "T" or "Y" at the blower outlet with a dumping valve on the free line from the "T" or "Y". Open this valve to reduce the amount of air supplied to the system. This method allows the blower to draw less power, run cooler and last longer—and thus be more economical to operate.

FIGURE 2

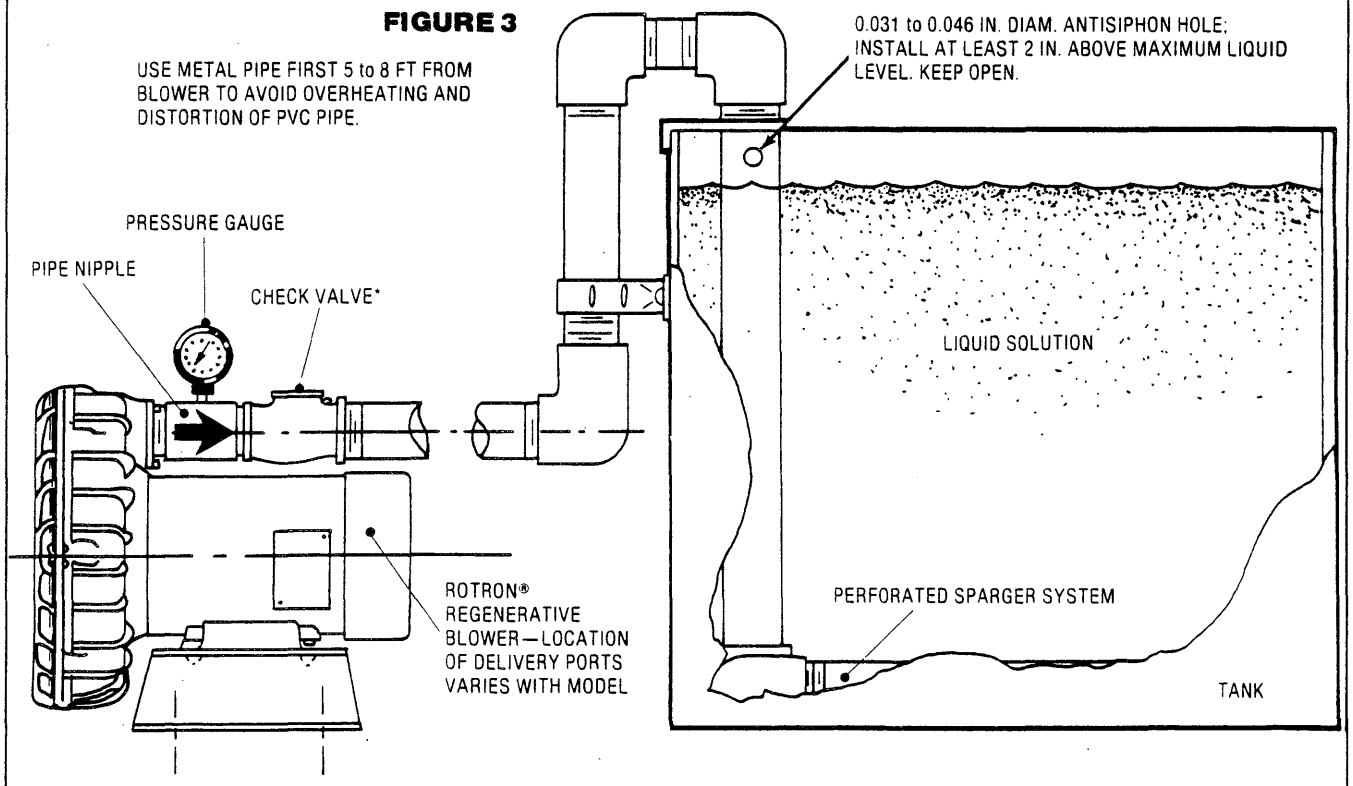
REGENERATIVE BLOWER SELECTION CHART
PLATING, RINSE, CLEANING TANK AGITATION AND PUSH-PULL VENTILATION
FLOWS IN SCFM AT VARIOUS PRESSURES PSIG

Blower Model	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0	5.5	6.0	6.5	7.0	7.5
DR202Y9	20	—	—	—	—	—	—	—	—	—	—	—	—	—
DR303BR9	35	24	—	—	—	—	—	—	—	—	—	—	—	—
DR404AL72	80	64	—	—	—	—	—	—	—	—	—	—	—	—
DR4R72E	60	45	30	9	—	—	—	—	—	—	—	—	—	—
DR505AS72	124	108	91	72	—	—	—	—	—	—	—	—	—	—
DR606CK72	160	144	130	112	93	66	—	—	—	—	—	—	—	—
DRS5K72E	77	65	53	42	33	25	11	—	—	—	—	—	—	—
DR6D89	190	179	160	139	119	99	80	—	—	—	—	—	—	—
DRP7X72C	358	324	290	248	204	144	—	—	—	—	—	—	—	—
DRS7X72	198	193	186	178	169	161	154	145	135	—	—	—	—	—
DR8BB72	360	340	325	303	275	250	215	160	—	—	—	—	—	—
DRP9BM72	660	630	585	550	505	460	400	290	—	—	—	—	—	—
DRS9BM72	360	350	345	330	325	315	305	290	280	265	250	235	200	180

should be bled off or dumped, never throttled. A pressure gauge with a typical range of 0 to 6 psig could be installed at the blower outlet to prevent exceeding the blower's continuous duty pressure limits.

Spargers (perforated aeration pipes) and header pipes may be fabricated of any material not susceptible to corrosion from the solution. These materials include iron, hard rubber and plastic. In cases where a slight reduction in blower outlet air temperature is desired, a section of metal piping may be installed between the blower outlet and nonmetallic piping or hose. Fig. 3 shows a typical regenerative

FIGURE 3



*CHECK VALVE NOT NECESSARY WITH ANTISIPHON HOLE IN VERTICAL HEADER.

FIGURE 4

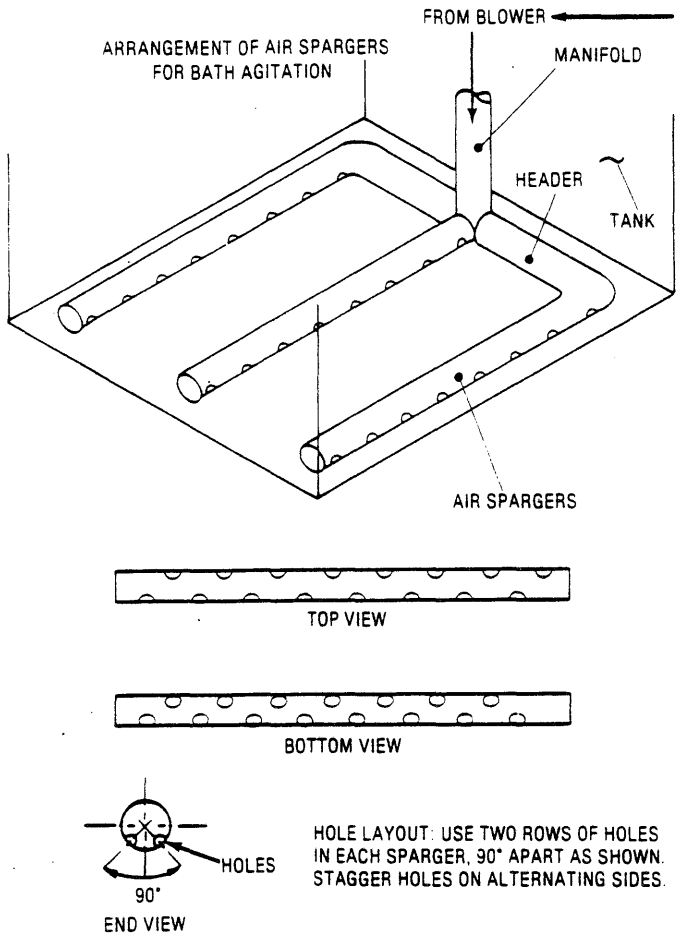
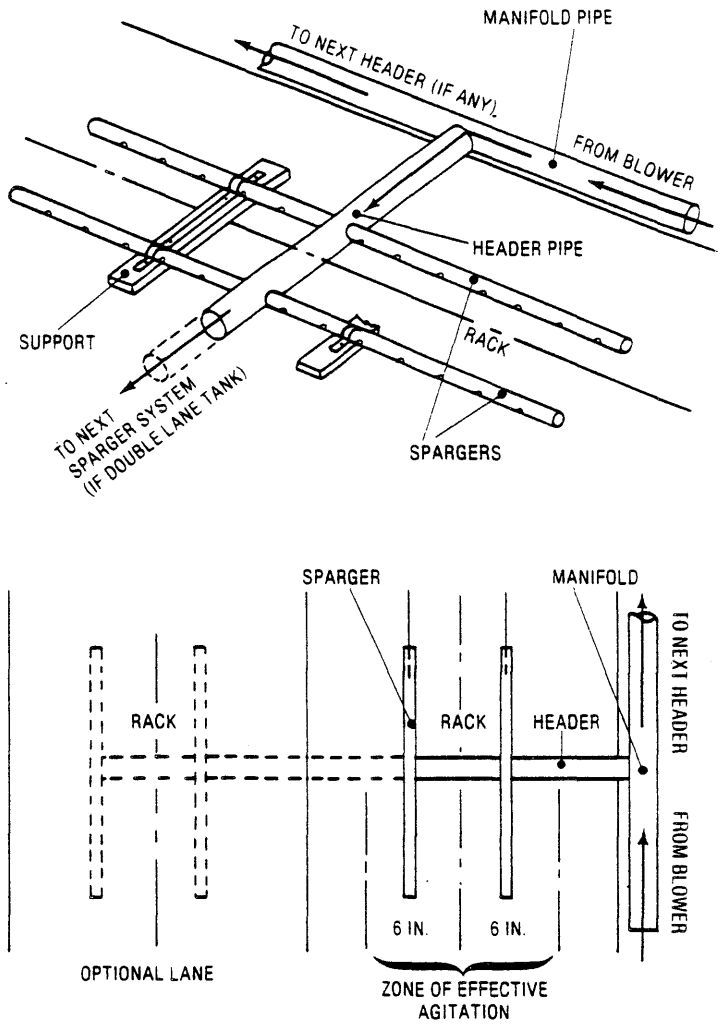


FIGURE 5



blower system layout. Note the elbow or loop arrangement of the air delivery piping, including an anti-siphon hole above the liquid level of the tank to avoid ingestion of solution by the blower at the moment the air system is turned off. A check valve may also be used if desired.

Pipe diameter sizing depends on the number and diameter of orifices or air holes used in the air spargers. Sparger diameters of ¾ or 1 in. should be used, with the latter preferable. Drilled holes in the sparger are usually 3/32 in. in diameter but may vary from 3/64 to ¼ in. spaced 1 to 5 in. apart, with most applications at 3½ or 4 in. The holes should be 1½ to 2 times the total cross-sectional area of all the drilled holes in the sparger.

Header diameters are selected with cross-sectional areas two times the sparger cross-sectional areas. Manifold diameters should represent cross-sectional areas about two times the header cross-sectional areas.

Figures 4 and 5 show suggested optional layouts for sparger systems. Note the recommended 6-in. sparger spacing "zone of effective agitation" in Fig. 5. When more than two plating lanes are required, it is advisable to manifold the air from both sides of the tank, avoiding excessive air pressure drop and ensuring balanced sparger air supply.

If more than four header pipes are used, center the regenerative blower air supply so that airflow is equally balanced to all header and sparger systems. In the event of any question, the blower manufacturer should be consulted for installation recommendations.