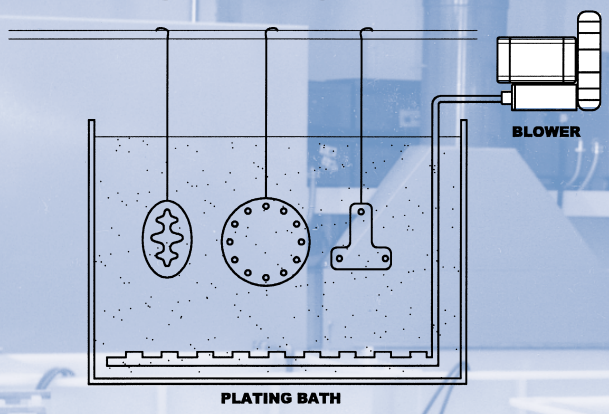
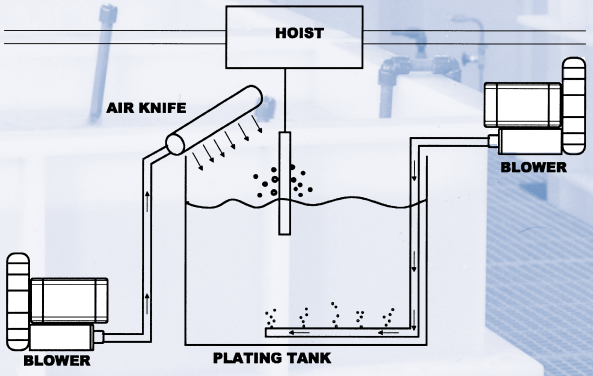
AMETEK®
ROTRON®
INDUSTRIAL PRODUCTS

ELECTROPLATING BLOWERS

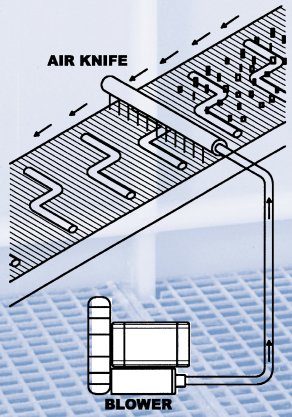
Improve Electroplating Quality and Productivity Using Regenerative Blowers



Electroplating Tank Agitation



Solution Blow-Back and Fume Guiding



General Parts Blow-Off and Drying

Photograph courtesy of Goad Company

Your Choice. Our Commitment.™

50 Years of Commitment
AMETEK® ROTRON®
ISO 9001 Certified

Financial Benefits of Low-Pressure Air Blowers

Rotron regenerative blowers result in a cost savings in a number of ways: you'll experience lower capital expense, a six-month payback on electrical use, enhanced plating quality through aeration, increased production utilizing a consistent continuous plating process, oil-free regeneratives not needing oil filters, and a more reliable, no/low maintenance design.

Lower Capital Expense. When you compare the cost of a compressor in a small plating shop against a 5-hp regenerative blower, a compressor can initially cost 4 to 6 times more than the Rotron unit.

Six-Month Payback on Electrical Use. Operating costs of a regenerative blower will vary depending on tank size, but the standard payback varies from 4 to 6 months. See Tool 1 for cost-savings examples.

Enhanced Plating Quality. Minimizing plate fall-out requiring replating is an advantage for tank agitation. Through air agitation, cathodes remain fresh, thus decreasing a polarization occurrence. Less need for replating results in a cost savings.

Increased Production. Air agitation reduces stratification, dislodges surface particles ensuring a greater solution contact, and speeds up production. Higher speed production reduces rinse bath water consumption and minimizes costly waste treatment usage.

Oil-Free Air. PD lobes and compressors require oil filters to minimize plating bath contamination; regenerative blowers provide oil-free air cost and component savings.

Reliable, No-Maintenance Design. Regenerative blowers are simple devices with one wearing part – the permanently sealed ball bearing inside the electric motor. Unlike PD lobes and other technologies, Rotron does not require wear-prone belts, pulleys, carbon vanes, rotary lobes, gears, pistons, or oil reserve level maintenance. No/low maintenance saves operating costs over all other maintenance-ridden technologies.

Tool 1. Operating Costs Saved by Using Low-Pressure Air Agitation.

Operating costs savings are formulated on a duty-cycle consisting of a 10-hour day, 6-day week, 50-week year. Average utility power costs are estimated at $.07 per kilowatt hour. Variations in this schedule can be adjusted accordingly.

For a 100 PSIG compressor:

- 100 SCFM = 25 BHP needed
- 764 watts = 1 BHP theoretically

$$\frac{25 \text{ BHP} \times 746 \text{ W}}{0.9 \text{ efficiency}} =$$

20,722 input W (20.7 kW)

For a Rotron blower at:

- 4-ft depth, a DR606CK72 at 2.7 PSIG = 2.9 kW
- 5-ft depth, a DR6D89 at 3.5 PSIG = 4.5 kW
- 6-ft depth, a DR707D89X at 3.9 PSIG = 6.0 kW

Operating Cost Savings/Year=

(Power KW compressor – KW blower) x

$$\frac{10 \text{ hour}}{\text{day}} \times \frac{6 \text{ day}}{\text{week}} \times \frac{50 \text{ week}}{\text{year}} \times \frac{.07 \text{ cents}}{\text{KWH}}$$

- Rotron DR606 vs. compressor = $3,738.00 savings
- Rotron DR6 vs. compressor = $3,402.00 savings
- Rotron DR707 vs. compressor = $3,087.00 savings

Guidelines for Maximum Agitation Efficiency

Once you select the proper regenerative blower, a system design should be planned in order to achieve the most efficient and cost-effective use of the blower.

Single Vs. Multiple Blowers. In multiple-tank plating systems, you must determine whether to use one blower per tank, one blower for the entire system, or various blowers on groups of tanks. In-tank air distribution and plating quality is equal in either option, as long as the system layout is correct. Use of multiple blowers will help to control the plating process and the blower efficiency.

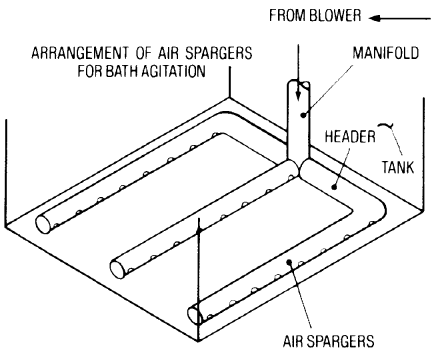
Advantages.	Disadvantages.
Single Blower.	Single Blower.
• Capital cost of one unit normally is less than multiple units.	• If tanks are taken off-line or added in the future, an air bleed is required to prevent excess air agitation and overpressuring the blower.
• Efficient use of space.	
Multiple Blowers.	Multiple Blowers.
• Best control and efficient use of blowers when not at 100% production.	• Separate accessories are required per blower (i.e., fillers, starters).
	• More space is used for blower layout.

Sparger Selection. Pipe diameter sizing depends on the standard cubic feet per minute (SCFM) of air flow needed to pass in each part of the system. Too small of a pipe diameter will create excessive friction drop and minimize the blower effectiveness. The following chart is a useful guideline. Whenever possible, oversize rather than undersize.

Dia.	SCFM*	Dia.	SCFM*
1/2"	2-5	2-1/2"	130-260
3/4"	6-13	3"	200-400
1"	12-25	4"	400-800
1-1/4"	21-45	5"	800-1300
1-1/2"	35-70	6"	1100-2200
2"	70-140	8"	2100-4200

*Use middle point SCFM when designing the system.

Figure 1.
Sparger System Layout



HOLE LAYOUT: USE TWO ROWS OF HOLES IN EACH SPARGER, 90° APART AS SHOWN. STAGGER HOLES ON ALTERNATING SIDES.

Sparger Layout. A typical sparger will produce a 6 to 9 inch "zone of effective agitation" for usable plating in the tank. Figures 1 and 3 illustrate suggested sparger systems. When more than two plating lanes are required, it is advisable to manifold the air from both sides of the tank, thus avoiding excessive air pressure drop and ensuring balanced sparger air supply.

Sparger Hole Selection

Rule 1. Use 1.0 square inch total open hole area for each 62.5 SCFM in the system.

Rule 2. Use 3/32" diameter holes (Single hole = 0.007 sq. in.) for best agitation, thus needing 144 holes for each 1.0 square inch open hole area required.

Rule 3. If using other hole sizes, use $\frac{\pi d^2}{4}$ for new single hole open area, and its reciprocal to determine number of holes for each 1.0 square inch total hole area required.

Guidelines for Maximum Process Protection

Figure 2.
Preventing Water Backrush

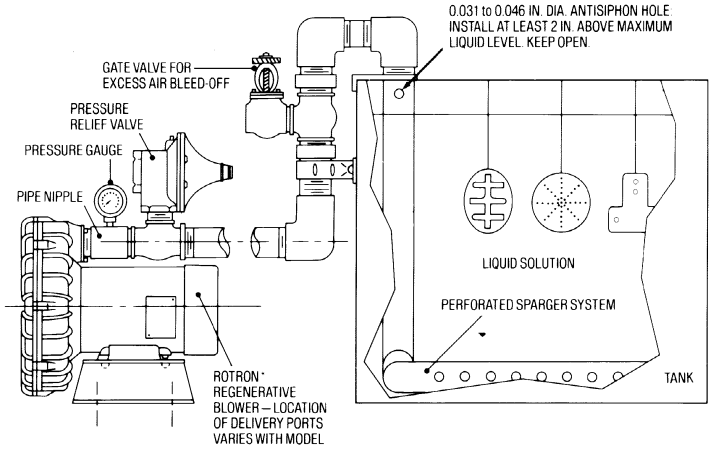
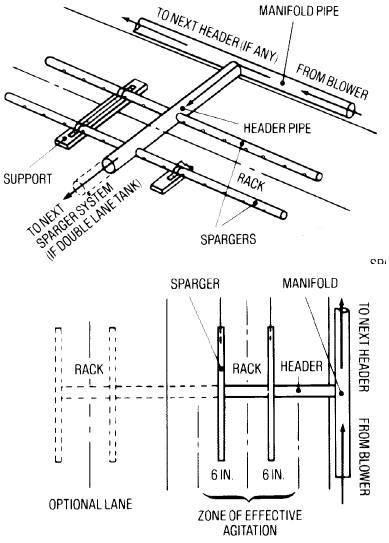


Figure 3.
Alternative Sparger System Layout



Avoid Excess Air. Never throttle unwanted blower air. Dumping and bleeding air are recommended so that the blower air is not overpressured and does not overheat. Overheating can drastically cut the normally long life of the blower. A pressure gauge should be installed at the blower outlet to monitor pressure. A relief valve is an excellent safety device to prevent overpressure.

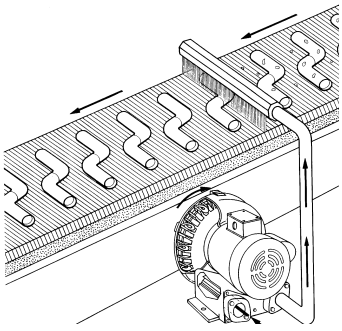
Preventing Water Backrush. A low-pressure (0-5 IWG) actuated check valve will prevent water from filling the air path or getting into the regenerative blower. A Hartford loop can also be used which is a high loop in the air pipe measuring at least 18 inches above the tank solution level – solution typically won't climb that high. A third measure would be an antisiphon hole. (See Figure 2.)

Piping. Sparger and header pipes may be fabricated of any material not susceptible to corrosion from the solution being aerated. These materials include iron, hard rubber, and PVC/CPVC. Any pipe coming directly from the air blower should be hard metal pipe to dissipate any blower heat. The typical length of hard metal pipe is 7 to 12 feet depending on the blower size and outlet temperature.

Blower Placement. The air blower should be as close as possible with maximum distance of 20 feet. Further distances will require friction loss calculations to determine extra pressure drop. For multiple tank set-ups, center the blower in the floor plans to minimize long length runs.

Guidelines for Maximum Parts Blow-Off

Figure 4.
Slot Angle



Slot Adjustment. Each Rotron Air Knife has been preset for a 0.090" (a 3/32") slot. The slot can be adjusted wider or narrower to maximize the flow-velocity combination. Narrowing the slot too much can cause a collection of airborne particles to clog the slot. Widening the slot too much will diminish the high velocity air curtain's ability to direct water/dust to its collection point.

Slot Angle. The recommended angle of 45° into the moving part achieves maximum control. (See Figure 4.)

Air Knife Placement. For maximum velocity, place the air knife from 1/2" - 3" away from part path. Closer always has higher velocity. Use the next higher velocity range for 3" - 6", and even higher for greater distance.

Rotron Capabilities

Technical superiority. Innovative thinking. A proven commitment to quality. Since it's inception, in 1949, the name Rotron has been synonymous with reliability, quality, innovation and technical leadership in the field of electro-mechanical devices designed for the specialized movement of air and gas media. Over the years, Rotron products have become significant contributors within the industrial manufacturing, instrumentation, environmental, processing, air and water pollution control, material handling and medical markets. Rotron's commitment to supply customized and standard products to fit customer needs has positioned Rotron as the true regenerative blower leader within the markets we serve.

How Air Agitation Improves the Quality of Electroplating

Rotron regenerative blowers have replaced compressed air and other high-pressure air-moving devices in thousands of metal-finishing lines and furnish clean, oil-free, stable air for reliable energy-efficient air agitation of tanks. Each installation of a regenerative blower has decreased a plant's operating expenses and improved plating quality.

The use of low-pressure air to agitate metal finishing plating, anodizing, rinse-and-wash tank solutions represents a milestone in the advancement of electro-plating technique. While decreasing your operating costs, you can expect low-pressure air agitation to: (1) enhance plating quality, (2) increase production, (3) permit a more continuous plating process.

Enhances Plating Quality. Low-pressure air from a Rotron regenerative blower provides efficient removal of cathode films with higher speed plating, thus decreasing polarization. Polarization is the increase in resistance of the electrodes that results from the chemical reactions of metal finishing, and causes a drastic slowdown of the electrolytic reaction needed to produce the process.

Increases Production. Low-pressure air helps dislodge dirt particles, flushes away dissolved grease, and ensures contact with the plating solution. The air also increases rinsing efficiency, which reduces the amount of rinse water required, thus minimizing demands on a plant's waste treatment system.

Permits Continuous Plating Process. Air agitation also prevents excess collection concentration, thus lowering drag out. Concentration circulation will keep the solution fresh and minimize the required solution change. In addition, agitation will maintain an even solution concentration and prevent stratification in the separation and division of chemicals in solution.

The Rotron Advantage

Less Cost. Developing pressures higher than required by the application wastes energy. Rotron regenerative blowers develop just the right pressure and flow needed for properly sized pneumatics. (See Tool 1).

Flexibility. You have a wide choice of Rotron regenerative blowers to use modularly in a machine or operation.This gives the user added versatility.

Cleaner. Because Rotron blowers supply clean air, free of oil, excess moisture, and other compressor-induced contaminants, the need for expensive, high-maintenance filters and dryers is eliminated.

Safer. High-pressure air is potentially dangerous to workers, equipment, and parts in a process. Rotron Regenerative blowers eliminate those risks and meet OSHA standards.

More Reliable. Less moving parts mean less wear and tear: no sliding vanes, no valves, no pistons to worry about. The only contacting moving parts are two precision-made, long-life ball bearing assemblies made of the highest quality materials. Reliability is also enhanced by the fact that Rotron blowers do not require intricate air cleaners, driers, or pressure reducers.

Sizing Tools

Tool 2. Blower Sizing for Tank Aeration.

Design Criteria.

Solution Type	Agitation Factor *F	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
Cr Plating	1.2-2.0	1.3
Rinse	0.5-1.5	1.0

(1) Determine the required pressure
P (in PSIG) = .43TD + 0.75 where
T = solution depth in feet
D = solution specific gravity

(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)

Example.

Shop wishes to agitate three (3) nickel plating tanks. Each tank is 3'W x 8'L x 5'H (solution depth is 4.5').

(1) Pressure required (P) = (.43 x T x D) + 0.75. T = 4.5'D = 1.2 so P = 3.07 PSIG.

(2) Flow required Q = AF. A = 8' x 3' x 3 tanks = 72 sq. ft. and F = 1.6 (from chart – median agitation selected) so Q = 72 x 1.6 = 115.2 SCFM.

The DR6D89 delivers 119 SCFM at 3.0 PSIG, and is recommended.

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

Tool 3. Blower Selection for Push Air Ventilation.

Chemical baths in process contribute fumes to the air which need to be collected and disposed of. A side collection system is typically added. Since the low-vacuum, high-volume blowers collecting the fumes cannot pull across the entire bath, a Rotron regenerative blower is normally added to push and direct the fumes toward the hood.

Design Criteria.

- **Pressure.** 1 PSIG. (Based on tanks up to 6 feet wide). Add 0.5 PSIG for wider tanks.
- **Air Flow.** 6 SCFM per linear foot of tank length.
- **Pipe Diameter.** Use outlet connection size from Rotron blower.
- **Slot Open Area.** A slot, series of slots, or holes can be used for air delivery from push bars. A 1.0 square inch open space is recommended per 100 SCFM.

Example.

Three tanks each 8'L x 4'W need push air ventilation. Total linear footage for push bars would be 8'L x 3 tanks = 24 linear feet. Push system requirement will be 24 linear feet x 6 SCFM per tank = 144 SCFM and working pressure is 1 PSIG.

A DR606 with a 2" pipe diameter and 1.44 square inches open slot/hole area is recommended.

Consult your plating distributor if recommended sizing or configuration is required.

Tool 4. Blower Sizing for Parts Blow-off and Drying.

(1) Determine length of knife or knives. If multiple knives are needed, but one blower is desired, simply add the total knife lengths together and size it as if it were one knife.

(2) Use chart to the right to choose an appropriate blower for the chosen air knife and air velocity.

Recommended Velocities:

- light dust - 5-10,000 ft./min.
- water - 10-15,000 ft./min.
- oily solution - 15-20,000 ft./min.

Air Knife Model	Slot Length	Velocity Range (fpm)					
		5-10,000	10-15,000	15-20,000	20-25,000	25-30,000	30-35,000
AK06S090	6	DR101	DR303	DR353	DR454	DR505CD	DR606CK
AK12S090	12	DR303	DR404	DR505AS	DR606K	DR707D	DR808AY
AK18S090	18	DR353	DR505AS	DR606K	DR707K	DR808AY	DR858BB
AK24S090	24	DR404	DR606K	DR707K	DR808AY	DR909BE	DR909BE
AK30S090	30	DR454	DR707K	DR808D	DR858AY	DR909BB	DRP9BM
AK36S090	36	DR505AS	DR707K	DR858AY	DR909BB	DRP9BL	DR14DW
AK42S090	42	DR606K	DR808D	DR909BB	DR909BB	DRP9BL	DR14DW
AK48S090	48	DR707K	DR808D	DR909BB	DRP9BL	DR14BH	DRP13BP
AK54S090	54	DR707K	DR858AY	DR909BB	DR14BH	DR14BK	DRP15EE
AK60S090	60	DR808D	DR858AY	DRP9BL	DR14BH	DRP13BM	DRP15EE

For further application assistance, or to request AMETEK Rotron's Product Sourcebook or Complete Product Catalog, please contact the factory for the sales representative in your area.

75 North St., Saugerties, NY 12477 • e mail: rotronindustrial@ametek.com • internet: www.rotronindustrial.com • Phone: (845) 246-3401 • FAX: (845) 246-3802