How to Select and Size an Air Cannon

Global Manufacturing Inc.®
1801 East 22nd Street
Little Rock, Arkansas 72206
501.374.7416 TEL
800.551.3569 TOLL FREE USA & CANADA
501.376.7147 FAX

www.GlobalManufacturing.com **www.Viber-Vibrators.com**

How to Select and Size an Air Cannon

Rotary Vibrators or Linear Force Vibrators are widely used to initiate or restore the flow of bulk materials, and have proven to be effective in most situations. Occasionally using vibrators may not be practical, but an Air Cannon will solve the problem. See "How Industrial Vibrators or Air Cannons Solve Material Flow Problems".

What are Air Cannons?

Global Manufacturing's patented Air Cannons are blast aerators, which release stored air in a sudden, high-energy blast. Compressed air is stored in a Certified Pressure Vessel and released through a quick-opening valve. Air Cannons are capable of discharging the entire contents of the pressure vessel in as little as 0.09 seconds, can produce air velocities in excess of 680 mph, and will produce nearly 4,000 pounds of force.

When are Air Cannons Used?

- When bulk materials are too cohesive, or too difficult to dislodge with vibration.
    - Some materials like Wood Chips and Pulp are very difficult to vibrate effectively.
    - Materials with higher-than-normal moisture content may not respond to vibration.
- When the storage facility is not conducive to placing vibrators where they can be effective.
    - When space restrictions are present or access to optimum locations is not available.
    - Concrete Silos cannot be effectively vibrated, but Air Cannons can be used.
- When the volume of stored material would require more vibrators than is practical. Air Cannons have a larger area of influence than industrial vibrators.
- When noise is an issue, some locations prefer using Air Cannons because they are 'relatively quiet'. The bulk material inside the silo/hopper absorbs much of the sound of the blast.
- When materials are stored on the ground or in a hopper with a flat bottom, Air Cannons can be used to 'sweep' the material towards the discharge opening.
- When stored material needs to be aerated to restore flow.
- As special effects equipment in the entertainment business.

Types of Air Cannons

Standard Duty - GW and GWE Series Air Cannons are designed for use in applications where ambient temperatures remain below 130°F / 54.4°C.

High Temperature - Global G400 Series High Temperature Air Cannons are designed for the extreme temperatures often found in cement kilns, steel mills and other extreme temperature environments. G400 Series Air Cannons can tolerate ambient temperatures of 400°F / 204°C. When properly mounted, G400 Cannons are often used in applications where temperatures exceed 2,000°F / 1000°C.

Sub-Zero - These unique G400 Cannons feature specially designed components that can withstand temperatures as low as -40° F / C.

Nitrogen - Every Global Air Cannon model is available as a Nitrogen Cannon. Nitrogen Cannons have special decals and the pressure tanks are painted green for easy identification. Nitrogen Cannons are used whenever an inert gas is preferred or the introduction of oxygen might be problematic.

Selecting an Air Cannon for Your Application

A Four-Step Approach to selecting the proper size, quantity and placement of Air Cannons:

1. Determine the characteristics of the stored bulk material
2. Ensure the storage structure is adequate for installing Air Cannons
3. Locate and understand the existing flow problems
4. Define the scope of the objective

1. Bulk Material Types

Bulk Materials may be categorized as:

Type I - more difficult
Type II - free-flowing

Type I Materials:

Stored in structure with low sloping walls
Stored in structure with small discharge outlet
Density in excess of 55 lb/ft^3 (880 kg/m^3)
Clings, regardless of weight
Compacts easily
Greasy or pasty consistency
"Sets up" or hardens during holding
Large chunks or mixed size
Heavily oil– or water-laden

Type II Materials:

Stored in structure with high sloping walls
Stored in structure with large discharge outlet
Density less than 55 lb/ft^3 (880 kg/m^3)
Does not cling
Spongy and does not compact
Dry or powdery
Flows easily under most conditions

Note: If your bulk material has two or more of the properties listed for Type I, consider it a Type I (more difficult) Material. If the material has one property for Type I, but has several Type II properties, you may consider it a Type II (free-flowing) Material.

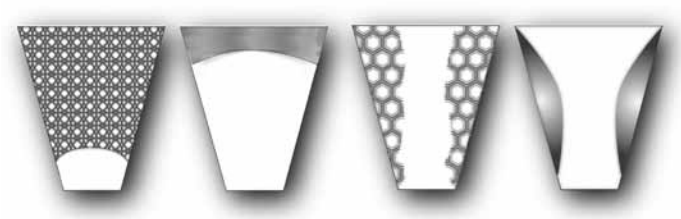
2. Storage Structure

The storage structure wall must be rigid enough to support the weight of the Air Cannon and withstand the forces that occur during discharge. Reinforce structure walls less than 3/16" (5 mm) thick. Please see minimum thickness requirements in next column. Tank Mount Hardware is available from Global Manufacturing to help support the weight of the Air Cannon and withstand the firing forces. Contact Global Manufacturing or your distributor for mount hardware.

Wall Thickness Recommendations

Air Cannon Model	Weight		Minimum Wall Thickness	
	lb	kg	inches	millimeters
GW2.5-8-24	56	25	3/16	4.7625
GW4-12-28	94	43	3/16	4.7625
GW4-16-34	115	52	3/16	4.7625
GW4-20-30	128	58	1/4	6.350
GW6-24-48	260	118	1/4	6.350
GW6-30-60	554	251	1/4	6.350

3. Common Material Flow Problems:



Bridging Arching Ratholing Clinging

4. Objective:

If the objective is simply to **restore material flow**, Air Cannons can be located in proximity to known blockages. The Cannon discharge will dislodge the blockage and allow gravity and the design of the storage facility to restore material flow. If the goal is to **clean or sweep the interior walls** of the storage facility, a greater number of Air Cannons will be required.

If Restoring Material Flow

If the bulk material is Bridging or Arching and the objective is to restore material flow, locate the Air Cannon discharge within the estimated Area-of-Influence dimension of the blockage based on Air Cannon size and Bulk Material Type. (See the Area-of-Influence data in the Air Cannon chart on next page.)

Global Manufacturing, Inc ®
1801 East 22nd Street
Little Rock, AR 72206 USA

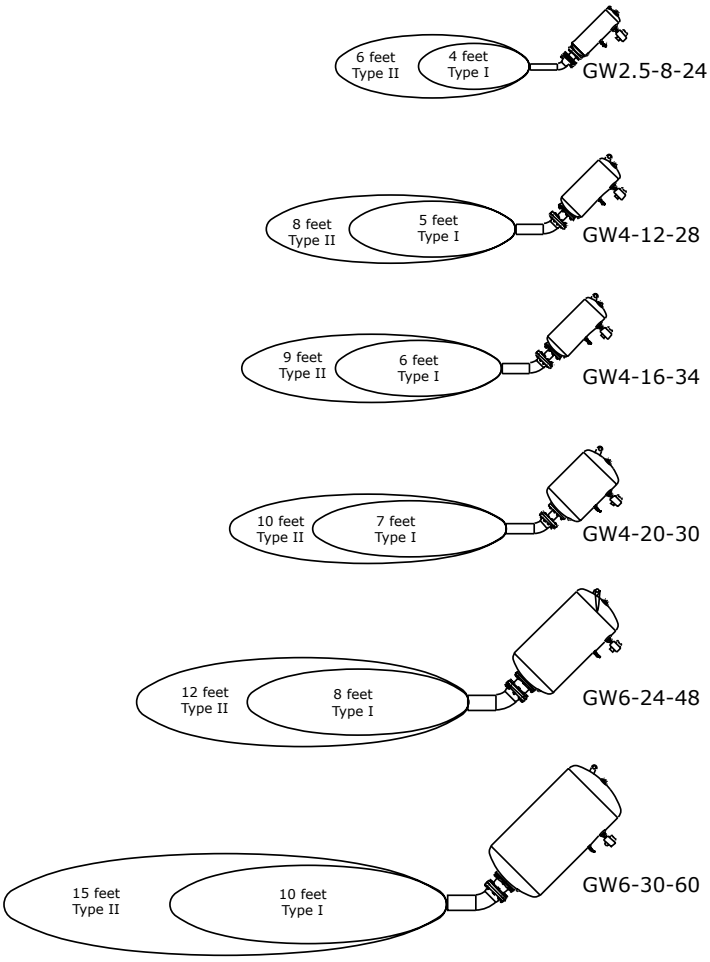
800.551.3569 TOLL FREE USA & CANADA
501.374.7416 TEL 501.376.7147 FAX
www.GlobalManufacturing.com

Air Cannon Model	Material Type	Area-of-Influence
		feet
		meters
2.5-Inch Discharge		
GW2.5-8-24	Type I	4
		1.22
	Type II	7
		2.13
4-Inch Discharge		
GW4-12-28 GWE4-12-28 G400-40-50	Type I	5
		1.52
	Type II	8
		2.44
GW4-16-34 GWE4-16-34 G400-40-100	Type I	6
		1.83
	Type II	9
		2.74
GW4-20-30 GWE4-20-30 G400-40-150	Type I	7
		2.13
	Type II	10
		3.05
6-Inch Discharge		
GW6-24-48 GWE6-24-48 G400-60-300	Type I	8
		2.44
	Type II	12
		3.66
GW6-30-60 GWE6-30-60 G400-60-650	Type I	10
		3.05
	Type II	16
		4.88

Select the smallest Cannon whose area of influence is large enough to access the blockage and direct the discharge above the base of the area where blockages typically occur. Ensure that the Area of Influence extends through the blockage area, but avoid locating the Cannon so that the hopper discharge is within the Area of Influence of the Cannon.

Use Global's Tangential Discharge Assemblis to simplify the mounting process and for the most effective results.

Area-of-Influence for Blast of Air



While it is possible that the installation of a single well-placed Air Cannon will break the built-up bridge and collapse the material, often times additional Cannons are required to achieve the desired flow. Type I materials often require more Cannons to restore flow because the self-adhering bridges are more difficult to collapse.

Square or rectangular hoppers may also require more Cannons than comparable size round structures because bulk materials often accumulate first in the corners of square hoppers and the resulting bridges may be more difficult to access. Depending on the dimensions of the hopper at the level where the bridging occurs, it may be necessary locate enough Air Cannons to access both the corners and the central area of the hopper.

If Cleaning or Sweeping the Storage Walls

If the bulk material is Ratholing or Clinging (or more complete cleaning of the storage structure is desired) additional Air Cannons will be required.

(See the Number of Air Cannons Recommended data in the Air Cannon chart below. Note - square or rectangular hoppers may require more Cannons than comparable size round structures because bulk materials often accumulate first in the corners of square hoppers.)

To determine the total distance, of the perimeter of a square or rectangular hopper, add the length of all the sides together. For a round bin/hopper use the **"Global Calculators"**.

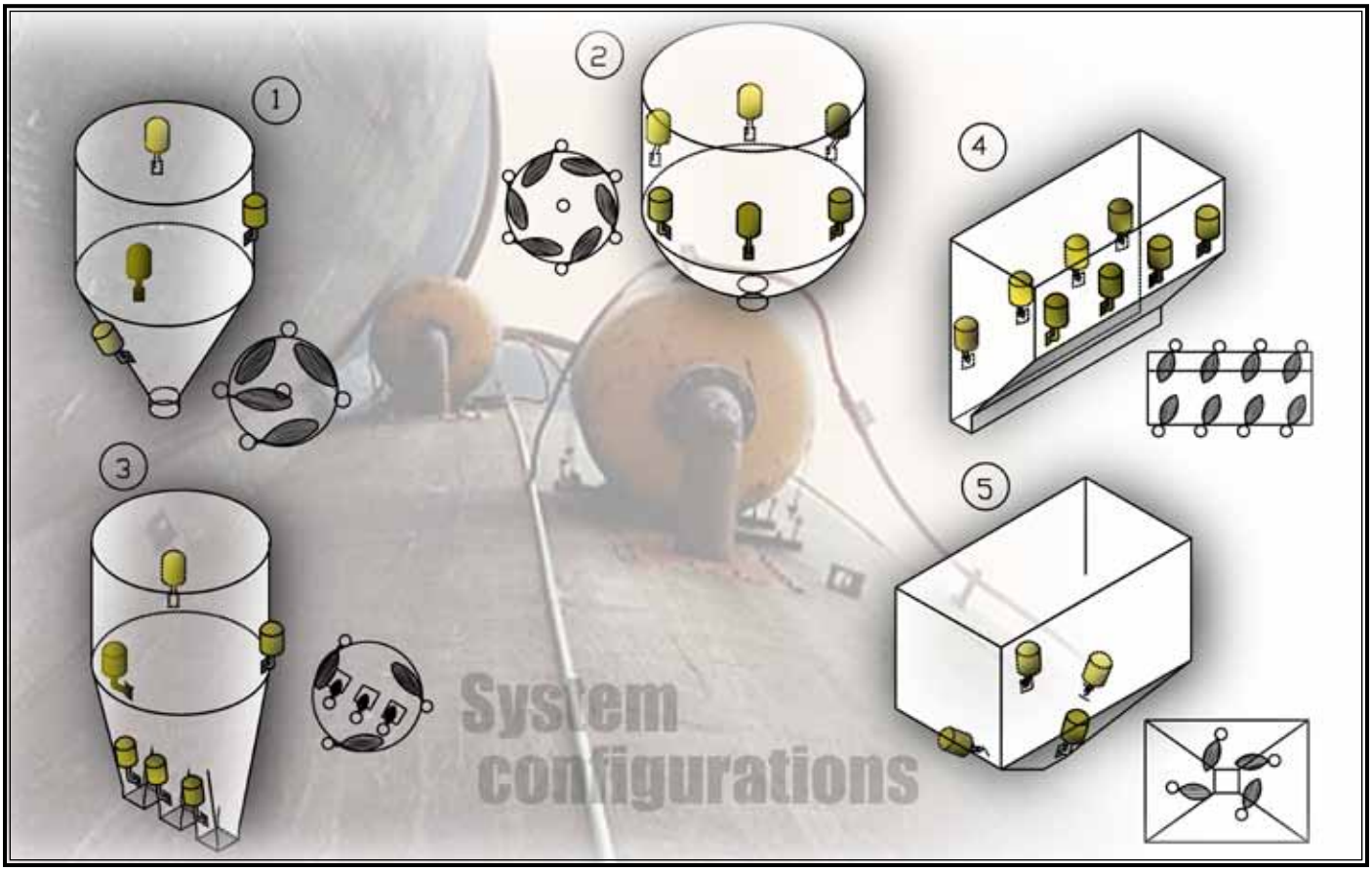
Air Cannon Model	Material Type	Number of Air Cannons Recommended per Bin/Hopper												Area of Influence	
		Diameter of Structure													
		ft	3	5	10	15	20	25	30	35	40	45	50	ft	m
		m	1	2	3	5	6	8	9	11	12	14	15		
2.5" Discharge															
GW2.5-8-24	I		1	3	6	9	12	15	18	21	24	27	30	4	1.2
	II		1	2	3	5	6	7	8	10	12	13	15	7	2.1
4" Discharge															
GW4-12-28	I		*	3	4	6	10	12	14	16	18	20	25	6	1.8
	II		*	2	3	4	5	6	7	8	10	11	12	9	2.7
GW4-16-34	I		*	2	3	6	9	11	13	14	17	18	22	7	2.1
	II		*	1	2	3	4	5	6	7	8	9	11	10	3.0
GW4-20-30	I		*	2	4	6	8	10	11	12	15	16	18	7	2.1
	II		*	1	2	3	4	5	6	7	8	9	10	10	3.0
6" Discharge															
GW6-24-48	I		*	2	3	5	6	8	9	10	12	14	16	8	2.4
	II		*	1	2	3	4	5	6	7	8	9	10	12	3.7
GW6-30-60	I		*	1	2	3	4	5	7	10	10	11	12	10	3.0
	II		*	1	1	2	2	2	2	3	4	5	5	16	4.9

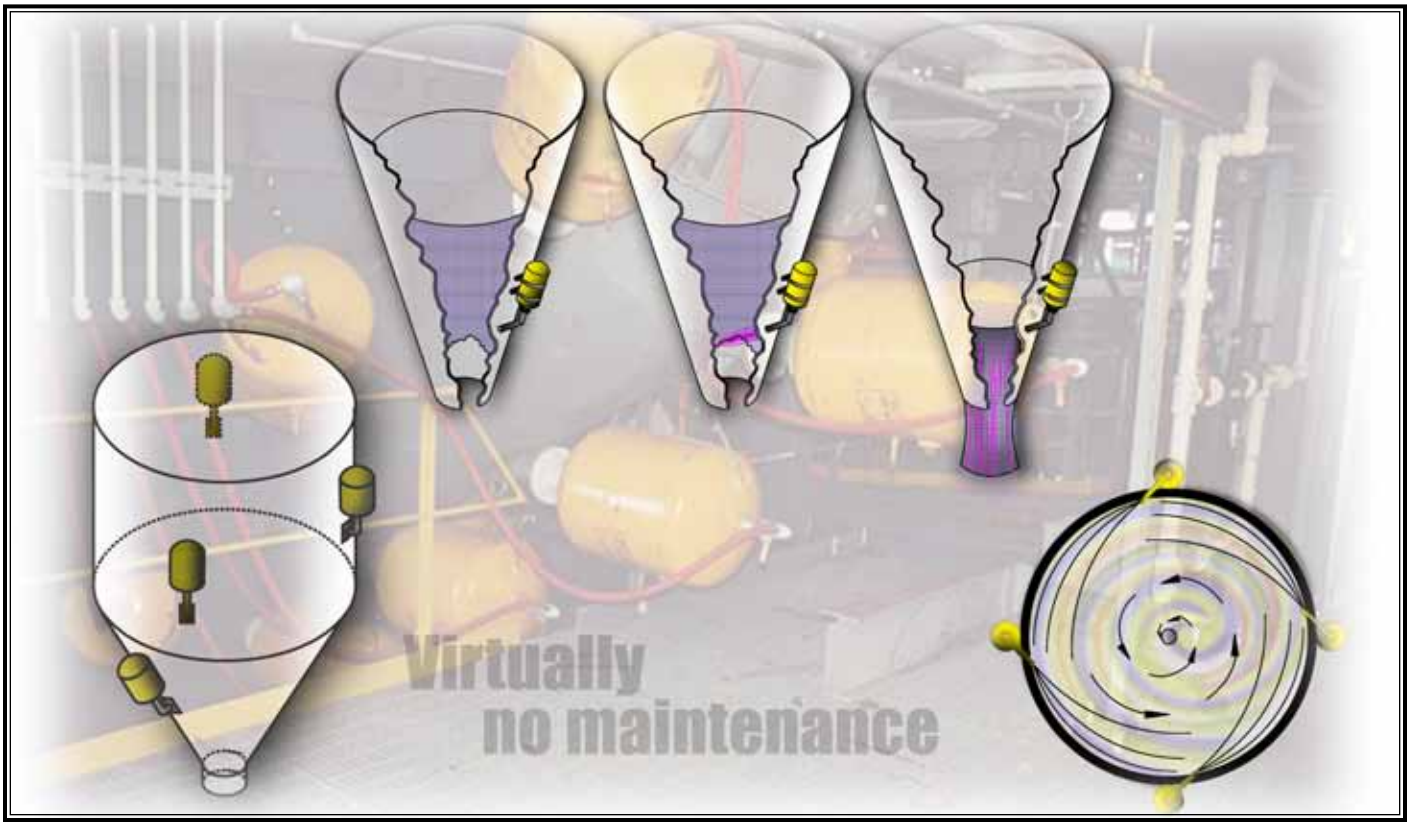
*This application is too small for this model Air Blaster.

Global Manufacturing, Inc ®
1801 East 22nd Street
Little Rock, AR 72206 USA

800.551.3569 TOLL FREE USA & CANADA
501.374.7416 TEL 501.376.7147 FAX
www.GlobalManufacturing.com

The best method to ensure effective coverage is to overlap a series of Tangential Discharges in a "cyclone" pattern so that all the materials are moved in the same direction.





The lateral tangential blast will shear the bulk material away from the wall to restore material flow, while the downward orientation will move the material toward the hopper discharge preventing material from entering the Air Cannon discharge pipe.

The Cannons should be arranged in a full 360° orientation. For example, if using six Air Cannons, they should be positioned every 60°. If using four Air Cannons, position them at 90° intervals, etc. For better results when the material blockage covers a large vertical are of the bin or hopper, it may be effective to arrange the Air Cannons in an ascending spiral (whether the hopper is round or rectangular). Using manual controls, or a programmable timer, 'fire' the Cannons in succession beginning with the Cannon located closest to the hopper discharge and working upwards. This will prevent the collapsing material from falling onto previously compacted material and worsening the situation. In some cases when the material is especially cohesive and the resulting clinging is very tall, it may be necessary to repeat the spiral pattern to address blockages in the upper reaches of the hopper.

Tips and Hints for Using Air Cannons

Firing the Cannon

Properly-installed Air Cannons may be operated manually (simply by closing a manual valve) or may be controlled electronically (by sending an electronic signal to a solenoid valve). Remote firing of the Cannon can be managed by a manual push-button switch, by using the facility's PLC system or with Global's programmable HMI Timer.

Discharge Pipe

To ensure maximum transfer of the blast force to the bulk material, the discharge pipe should be as straight and as short as possible. If not using a discharge assembly provided by Global Manufacturing, please use the following guidelines:

- Use Schedule 40 steel pipe for most applications
- If bends are necessary, use a long radius elbow. Avoid sharp bends in the discharge pipe.
- If the discharge pipe length exceeds six feet (1.8m), use the next larger size Air Cannon.

Air Supply

Operate the Air Cannon on filtered (40 micron), regulated, compressed air (45-125 psi / 3-8.6 bar). The air pressure may be adjusted to obtain the desired amount of blast force (typically 80-100 psi). Global Air Cannons require no lubrication.