

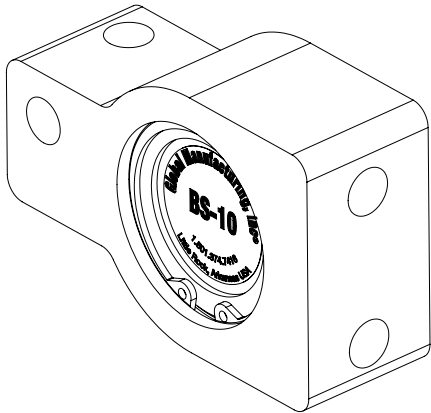
# Ball Vibrators

## Operating Instructions

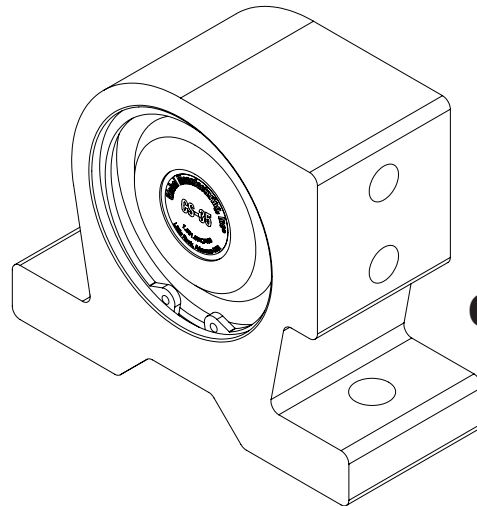
### Pneumatic Ball Vibrators

### Models

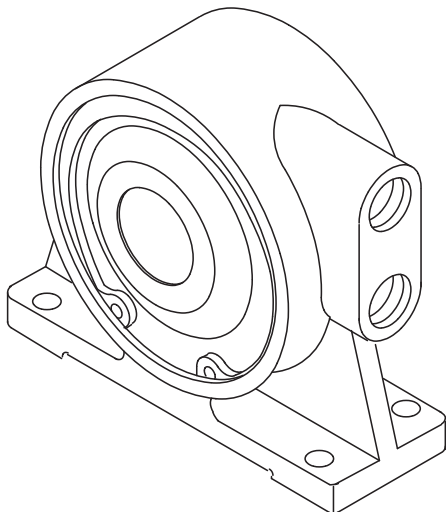
<b>BS-10</b>	<b>CS-19</b>	<b>US-13</b>
<b>BS-13</b>	<b>CS-25</b>	<b>US-19</b>
<b>BS-16</b>	<b>CS-35</b>	<b>US-25</b>
<b>BS-19</b>	<b>DS-41</b>	<b>US-38</b>
<b>BS-25</b>	<b>DS-51</b>	



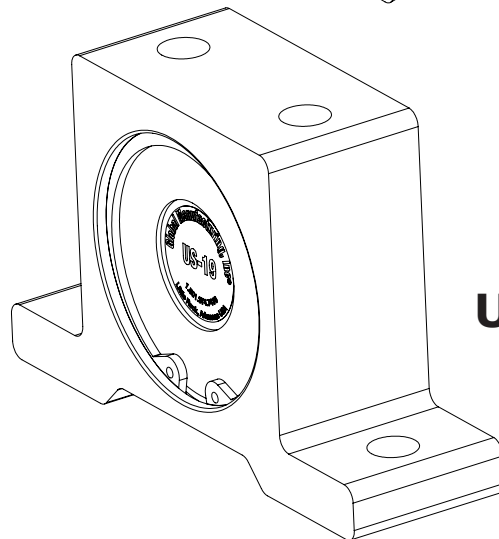
**BS**



**CS**



**DS**



**US**



VIBRATORS



VIBRATORS



AIR BLASTERS

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## I. Introduction

For optimum performance, cycle the vibrator on and off. The vibrator acts as a friction reducer and once the bulk solid is set into motion, gravity should do the rest. Do not operate the vibrator on an empty hopper as this may cause structural damage to the hopper.

Vibrators should be operated only when discharge gates are open. Operating the vibrator with the discharge gate closed will cause the material inside the structure to compact.

Vibration has two important elements – Frequency and Amplitude. Frequency is the speed (RPM) or the number of vibrations per minute. It is controlled by the oil flow to a hydraulic vibrator or the air flow to a pneumatic vibrator. Amplitude is the unbalance or amount of force produced by the eccentric weight. The faster the eccentric weights turn the more force output generated. Force and frequency work together. It is not necessary to use a lot of force when you adequate frequency.

## II. Operation - Air Requirements

Operate on filtered, regulated air between 20 and 80 PSI (1.36 to 5.44 Bar). An air regulator may be used to control the vibrator speed. Adjust airflow until material flow occurs. More air is not always better. Operating the vibrator at higher pressures will reduce vibrator life.

Cycle the vibrator on and off. Ball vibrators can run continuously, but it is usually not necessary. Once the material is set into motion, gravity should do the rest. Do not operate the vibrator on an empty hopper.

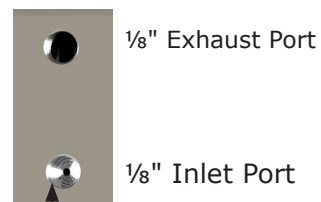
The vibrator should appear motionless. Vibrators should NOT shake the hopper wall or make an abundance of noise. Vibrations pass through the structure and into the material.

Do NOT lubricate the ball vibrator. Lubrication is NOT required. Lubrication will collect dirt, impairing proper vibrator operation.

## ! Safety Precautions

1. Follow all installation instructions.
2. Always use a safety cable or chain for support.
3. Do not operate vibrators when structure is empty.
4. Wear ear protection for 90+ decibel levels.
5. Do not operate vibrator if there is a restriction to the exhaust port.
6. Do not operate the pneumatic vibrators above 100 psi.
7. Always operate pneumatic vibrator with a filter - regulator.
8. Always disconnect air line before maintenance.

### Locate Inlet Port



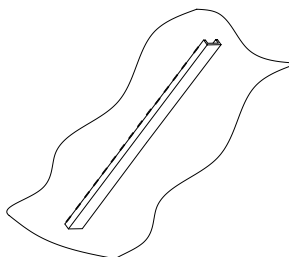
To locate the **inlet port** of the aluminum ball vibrator find the port that looks like a funnel. It has a small hole at the "bottom" of the port.

### III. Installation Procedures

#### ⚠ Caution!

Do not mount the vibrator directly to the structure wall. Use a channel iron stiffener for proper mount rigidity and as the transducer of the vibrational energy.

The key to successful vibration is a proper mount because rotary vibration resonates the material inside the structure, when the vibrator is mounted correctly. The vibrator should appear motionless. There should not be a large amount of motion or noise.



**Stitch Weld the Channel Iron**

### IV. Channel Irons - Size & Mounting

#### Important!

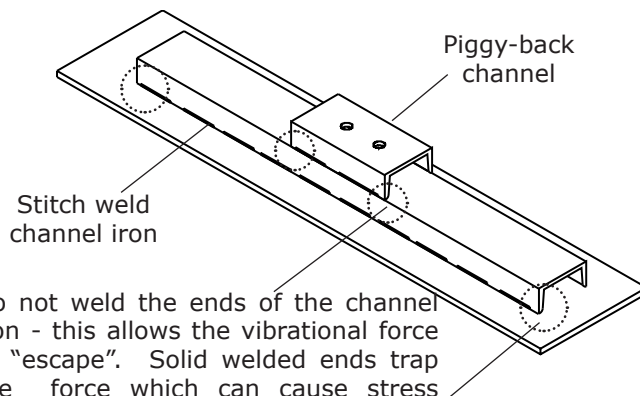
The channel iron should be at least 2/3 of the height of the sloped portion of the hopper but no greater than 6 feet (1.83 m).

The channel iron should be at least two-thirds the height of the sloped portion of the hopper, but not be greater than 6 feet (1.83 m) in length. The channel iron width should not be less than the base width of the vibrator. See chart below for recommended channel sizes. DO NOT install more than one vibrator on the same channel iron or use a channel iron shorter than the recommended length. A short channel may flex the bin wall.

#### Channel Iron Size Recommendation

Vibrator		Channel Iron Size
BS-10	CS-19	2" x 1" x 3/16" x 2.5 lb/ft
BS-13		
BS-16		
BS-19		
BS-25		
CS-25	US-25	3" x 1.41" x .170" x 4.1 lb/ft
CS-35		
DS-41		
US-38		
DS-51		

**Attach the vibrator to the channel iron.** Stitch weld nuts to the back of the channel iron or the channel iron may be drilled and tapped to accept the mounting bolts. An alternate method is to cut a second channel iron slightly longer than the footprint of the vibrator. Stitch weld the second channel iron to the first. Do not weld the ends. Mount the vibrator to the second channel iron.



Do not weld the ends of the channel iron - this allows the vibrational force to "escape". Solid welded ends trap the force which can cause stress cracks.

**Stitch weld the channel iron vertically to the sloped portion of the bin wall.** Weld 3 inches (7.5 cm), skip 1 inch (2.5 cm), weld 3 inches (7.5 cm), etc. Leave 1 inch (2.5 cm) un-welded on the ends and corners. This allows the vibration to dissipate out the ends of channel without causing stress cracks to the hopper or bin. By doing so, should the weld fail, the entire mount will not fall off. Do not mount the channel iron horizontally.

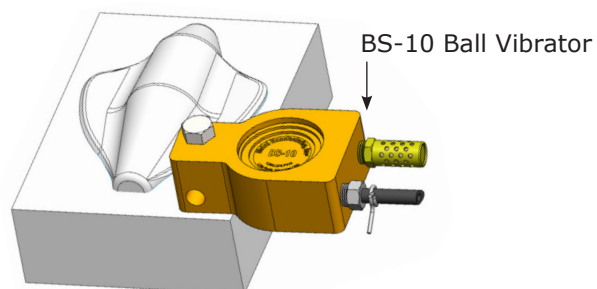
**Secure the vibrator to the channel iron with SAE coarse thread grade 8 plated bolts with lock washers or an adhesive such as Loctite<sup>®</sup> 262.** Tighten bolts in a sequential process. At least two passes are required in most situations. Give all bolts the same torque value. Grade 8 bolts can handle more torque than standard bolts. If Loctite<sup>®</sup> is not used, retorque the bolt after the vibrator has operated for a few minutes and check tightness often. If Loctite<sup>®</sup> is used do not retorque the bolts as this will break the Loctite<sup>®</sup> bond.

Attach a safety cable to a stronghold (not the channel iron mount), which is higher than the mounted vibrator and capable of holding the vibrator's weight.

Attach a safety cable to a stronghold (not the channel iron mount), which is higher than the mounted vibrator and capable of holding the vibrator's weight.

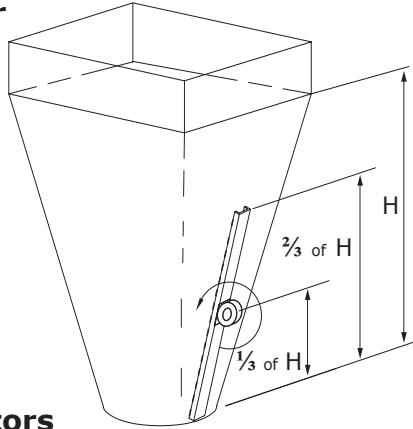
### V. Mounting Guidelines

**Installation on Foundry Molds** - The BS model vibrator may be used on foundry matchplate molds. Bolt the vibrator to the matchplate as shown.



### Single Vibrator

Install a channel iron stiffener on the outside of the sloping wall 1/3 the distance above the discharge opening.

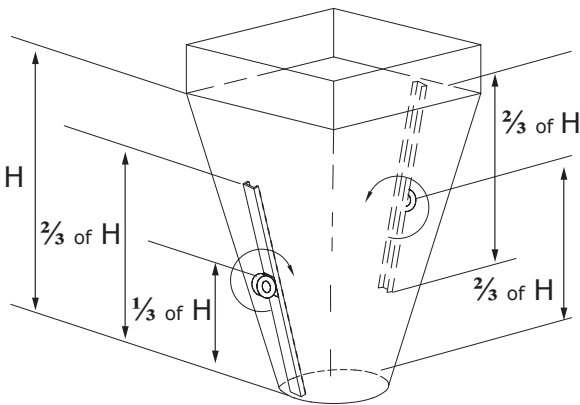


### Multiple Vibrators

Use more than one vibrator when the diameter or width of any wall is greater than 12 feet (3.66 m). Always mount the vibrators on different planes.

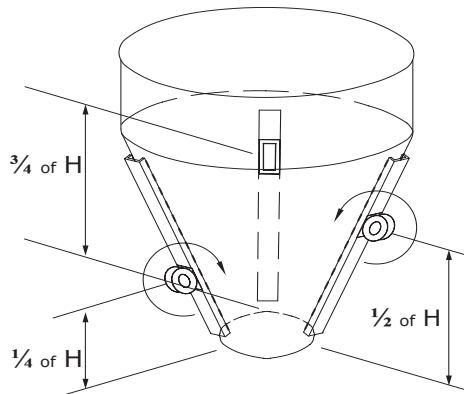
### Two Vibrators on Round or Square Hoppers

Install channel iron stiffeners 180° apart. Install one vibrator on the outside of the sloping wall 1/3 the distance above the discharge opening. Install the second vibrator on the outside of the opposite sloping wall 2/3 the distance above the discharge opening.



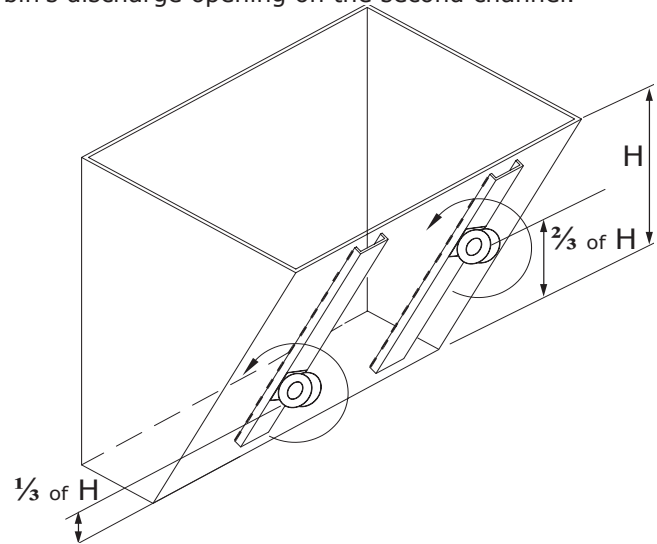
### Three Vibrators on Round or Square Hoppers

Install channel iron stiffeners mounted 120° apart. Install the first vibrator on the outside of the sloping wall 1/4 the distance above the discharge opening. Install the second vibrator on a separate channel iron at 1/2 the distance above the discharge opening. Install the third vibrator on the remaining channel iron at 3/4 the distance above the discharge opening.



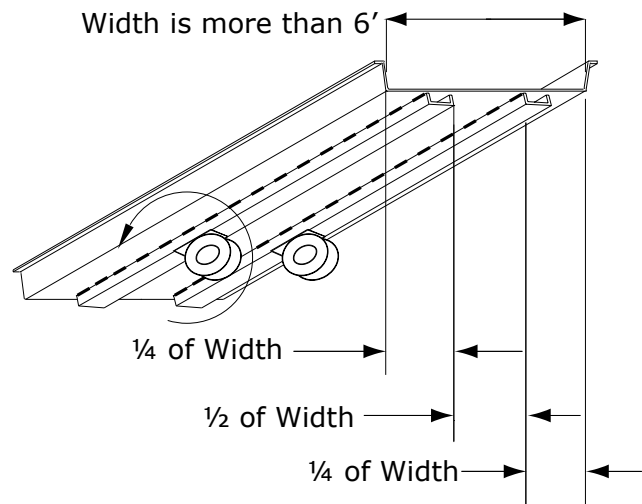
### Two Vibrators on Rectangular Hoppers

Install channel iron stiffeners on opposite sides of the long walls. Install one vibrator on the outside of the sloping wall 1/3 the distance from the discharge opening. Install the second vibrator on the outside of the opposite sloping wall 2/3 the distance above the discharge opening. When only one wall slopes, mount both stiffeners on it. Equally space the stiffeners on the wall. Place one vibrator 1/3 above the discharge opening on one channel iron and the other vibrator 2/3 above the bin's discharge opening on the second channel.



### Installation on Chutes and Flow Pipes

Mount channel iron stiffeners vertically or in the direction of material flow. Center the channel if the chute is less than 6 feet (1.83 m) in width. If the chute is greater than 6 feet in width, use two vibrators on separate channel irons. To maximize each vibrator's radius of influence; center each channel iron in each half of the chute. Each channel iron should be located 1/4 of the chute width from the edge and 1/2 of the chute width apart. (e.g. - for a chute 8' wide, the channel iron locations would be 2' from each edge and 4' apart.) When wall thickness is less than 1/8", additional reinforcement may be required.

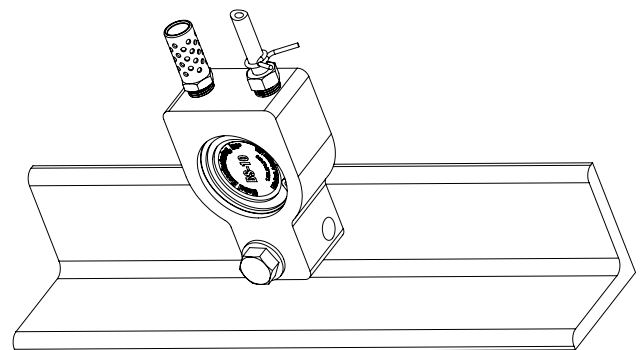
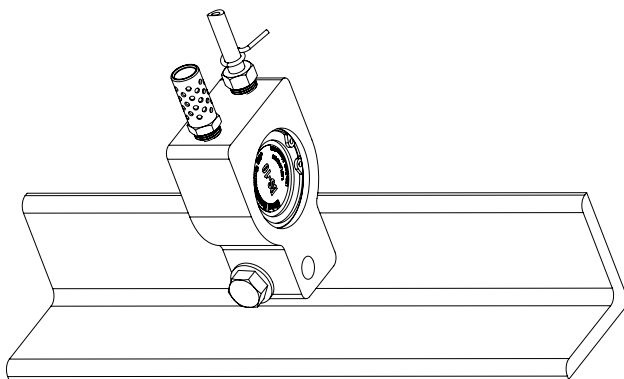


## VI. Performance Data

Ball Vibrator Performance Data															
Model	Unbalance	Air Pressure													
		Start Minimum		20 psi (1.4 bar)			40 psi (2.8 bar)			60 psi (4.1 bar)			80 psi (5.5 bar)		
		Vert	Horz	Speed	Flow	Force	Speed	Flow	Force	Speed	Flow	Force	Speed	Flow	Force
		lb-in	psi	psi	rpm	cfm	lb	rpm	cfm	lb	rpm	cfm	lb	rpm	cfm
kg-mm	bar	bar		lpm	N		lpm	N		lpm	N		lpm	N	
BS-10	0.004	5	2	16,000	4.3	25	20,000	7.0	40	22,000	9.0	48	22,800	10.8	52
	0.04	0.3	0.1		122	113		198	177		255	214		306	230
BS-13	0.01	5	2	11,400	4.3	26	19,200	7.0	73	22,800	9.0	103	24,900	10.8	123
	0.08	0.3	0.1		122	115		198	326		255	200		306	548
BS-16	0.022	15	7	9,400	4.1	50	13,000	6.4	93	14,000	8.2	110	14,800	10.0	138
	0.26	1.0	0.5		116	222		181	414		232	489		283	614
BS-19	0.043	20	10	8,600	5.5	89	11,000	8.4	150	13,000	11.0	200	14,800	13.7	269
	0.50	1.4	0.7		156	396		238	667		311	890		388	1,195
BS-25	0.123	30	15	5,700	7.5	110	6,900	12.0	160	8,200	16.0	230	9,600	19.8	322
	1.42	2.1	1.0		212	489		340	712		453	1,023		561	1,432
US-13	0.009	5	2	13,000	6.5	45	18,000	11.0	84	20,000	15.0	110	22,400	19.0	134
	0.11	0.3	0.1		184	200		311	374		425	489		538	596
US-19	0.043	20	10	8,700	5.5	92	11,000	8.4	160	13,000	12.0	210	15,000	16.0	276
	0.50	1.4	0.7		156	409		238	712		340	934		453	1,228
US-25	0.123	30	15	6,300	7.0	140	8,400	12.0	240	9,100	16.0	280	9,600	20.0	322
	1.42	2.1	1.0		198	623		340	1,068		453	1,246		566	1,432
US-38	0.524	50	25	4,300	12.0	270	5,600	19.0	470	6,000	25.0	540	6,200	31.0	572
	6.03	3.4	1.7		340	1,201		538	2,091		708	2,402		878	2,542
CS-19	0.043	20	10	9,100	5.7	100	12,000	8.4	170	14,000	12.0	220	17,000	15.7	355
	0.50	1.4	0.7		161	445		238	756		340	979		445	1,577
CS-25	0.123	30	15	6,300	7.8	130	8,100	13.0	220	9,200	18.0	290	10,000	22.3	349
	1.42	2.1	1.0		221	578		368	979		510	1,290		631	1,554
CS-35	0.240	50	25	5,300	7.8	190	6,700	13.0	310	7,600	16.0	390	8,100	19.0	447
	2.77	3.4	1.7		221	845		368	1,379		453	1,735		538	1,989
DS-41	0.815	55	25	3,200	13.0	240	4,000	21.0	370	4,400	27.0	450	4,900	33.7	555
	9.38	3.8	1.7		368	1,068		595	1,646		765	2,002		954	2,471
DS-51	1.300	60	30	3,100	13.0	350	4,000	20.0	580	4,300	27.0	680	4,600	33.7	781
	14.98	4.1	2.1		368	1,557		566	2,580		765	3,025		954	3,475

### Mounting the BS model

Mount the BS vibrator with one bolt using either mount hole. See illustrations below.



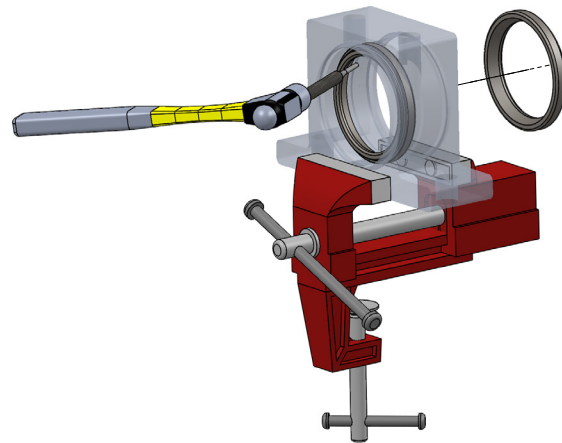
## VII. How to Rebuild Aluminum or Ductile Iron Global Ball Vibrators

Please note the special instructions in #4 and #6 for the aluminum vibrators.

### Tools

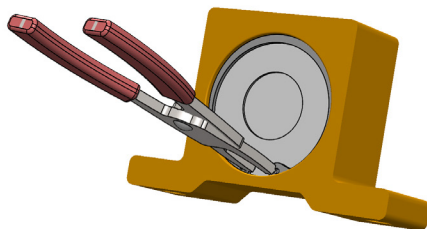
1. Bench Vice
2. Correct internal retaining ring pliers
3. Medium grit emery paper
4. Large steel punch
5. Medium hammer
6. Heat source capable of heating housing to 400° F. Minimum (aluminum housing only)
7. Pick for removing O-rings
8. Arbor or hydraulic press rated at 2000 pounds force or better
9. Correctly sized press disk slightly smaller than Raceway ring O.D.
10. Light lubricant such as WD-40
11. Clean shop towel

5. Quickly clamp the feet of the housing into the bench vice in a position that will allow the rings to clear as they are driven out of the housing.



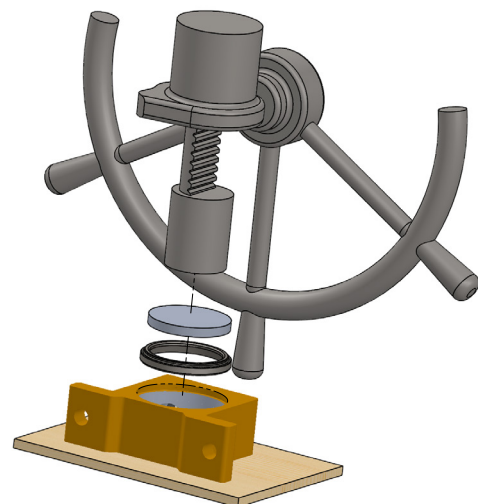
### Follow the steps below to rebuild your Global Ball Vibrator

1. Using retaining ring pliers, remove both retaining rings from housing.



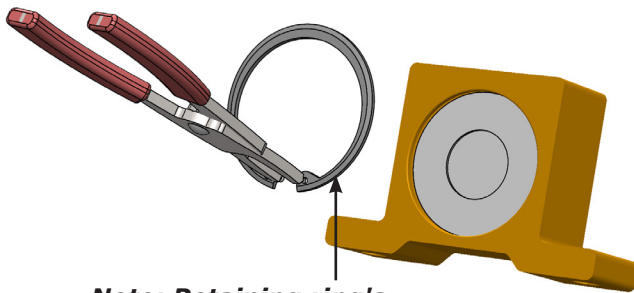
2. Remove both side covers and the ball. This will require some manipulation as the covers are a close fit to the housing
3. Using the pick, remove both O-rings from exposed raceway rim groove
4. **If the vibrator housing is aluminum, heat by some means, such as, an oven or torch to 400-500°F.** Check temperature using either a temperature sticker, temperature crayon, or laser thermometer. You can also skip checking the temperature by simply tapping on the raceway ring to see if it loosens up enough to extract it.

6. Using punch and hammer, drive a raceway out of the housing bore via the inner edge of the ring exposed above the divider rim in the housing. Strike the ring alternately at 10, 2, and 6 O'clock position to prevent cocking in the housing bore. **With the aluminum housing this must be done while the housing is hot.** Repeat for remaining ring. NOTE: Any damage to housing bore or divider ring must be dressed down with emery prior to reassembly. Small scratches are acceptable, gouges and raised dings are not.
7. Clean housing with light lubricant and shop towel.
8. Place housing flat on press and lay the new ring bevel side down on the housing bore. Using press and press disk press ring into bore without cocking until it seats solidly on the dividing shoulder in the housing.

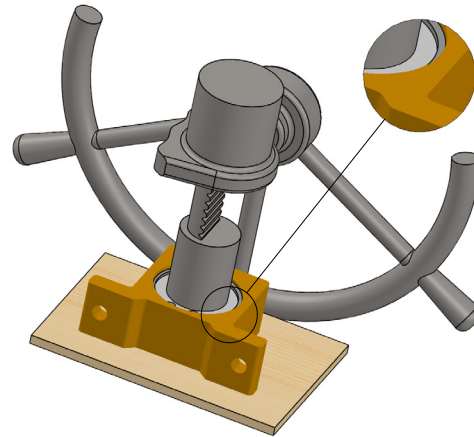




9. Turn the housing over and repeat the installation of the second ring.
10. Install an O-ring into the outer groove of the raceway ring.
11. Install the side cover into the same bore and lightly seat against the raceway ring.
12. Install the retaining ring (beveled side out) into the bore groove. Check that it is seated and the cap is against the raceway ring. Lightly press on the cover with the press to assure it is seated and the retaining ring is seated.
13. Turn the housing over.
14. Install the ball, O-ring, side cover, and retaining ring.
15. Check that ball rotates freely within the completed assembly.



**Note: Retaining ring's beveled side is out.**



## VIII. Troubleshooting Ball Vibrators

Troubleshooting Global Ball Vibrators		
Problem	Probable Cause	Solution
<b>Vibrator runs slowly or does not operate</b>	Air line is blocked, restricted, or is connected to the exhaust port and not to the inlet port.	Remove restriction in the air line. Check for kinked air line. Check hose connections.
	Pipe or hose size is inadequate for distance from compressor.	The air line should be at least equal to vibrator inlet port.
	Contamination is in the vibrator.	Disassemble vibrator and clean.
	Faulty control valve.	Clean, repair, or replace. Start valve should be within 6' of vibrator.
	Inadequate air supply to operate vibrator.	Check compressor. Provide more volume of air to vibrator.
<b>Vibrator makes excessive noise</b>	Mounting is not rigid.	Check mounting bolts, broken welds, or fatigue in structure.
	Muffler not used.	Use exhaust muffler.
	Hopper or bin is empty.	Do not run vibrator on an empty hopper or bin.
	Ball and/or raceway rings may be worn out.	Rebuild vibrator with repair kit.

## IX. Ball Vibrator Dimensions

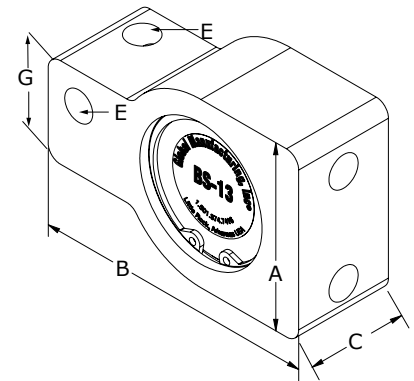
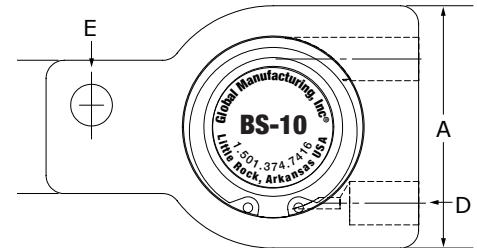
### BS & DS Ball Vibrator Dimensions

VIBRATOR MODEL	WEIGHT	A	B	C	D	E	F	G
		HEIGHT	LENGTH	WIDTH	INLET	BOLT HOLE	BOLT CENTERS	MOUNT BASE HEIGHT
	lb kg	in mm	lb mm	lb mm	in	in	in mm	in mm
BS-10	0.50	2.00	3.08	1.10	1/8	11/32	Single Bolt	1.10
	0.23	51	78	28				27.9
BS-13	0.51	2.00	3.08	1.10	1/8	11/32	Single Bolt	1.10
	0.23	51	78	28				27.9
BS-16	1.01	2.60	4.04	1.34	1/4	7/16	Single Bolt	1.38
	0.45	66	103	34				35.1
BS-19	1.51	3.10	4.38	1.50	1/4	7/16	Single Bolt	1.52
	0.68	79	111	38				36.6
BS-25	2.60	3.75	5.25	1.75	1/4	7/16	Single Bolt	1.68
	1.17	95	133	44				42.7
DS-41*	10.45	5.65	6.75	2.50	1/2	2/5	5.50 x 1.75	
	4.74	144	171	64				140 x 44
DS-51*	11.00	5.65	6.75	2.50	1/2	2/5	5.50 x 1.75	
	4.99	144	171	64				140 x 44

\* only available in ductile iron

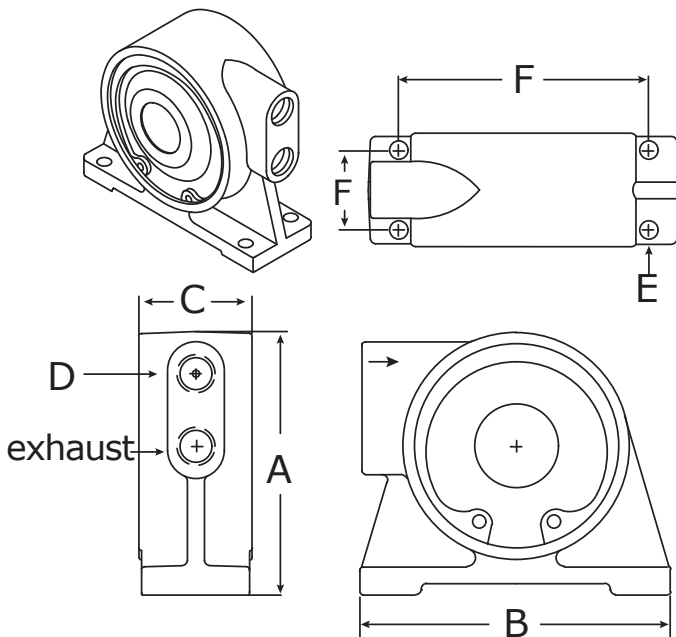
### BS Series - Aluminum

Have a single bolt hole mounting base. Mount vibrator with one bolt using either mount hole.

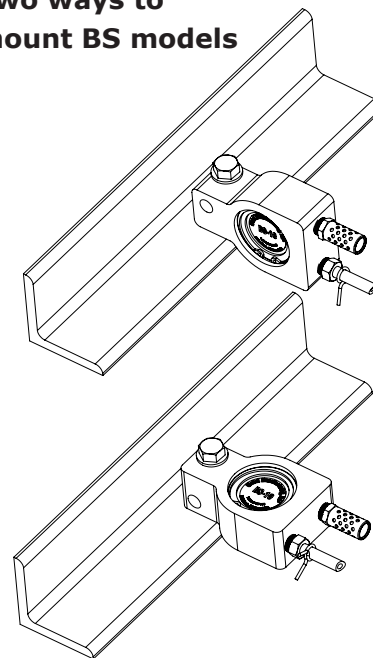


### DS Series - Ductile Iron

DS-41 & DS-51 available in ductile only



### Two ways to mount BS models

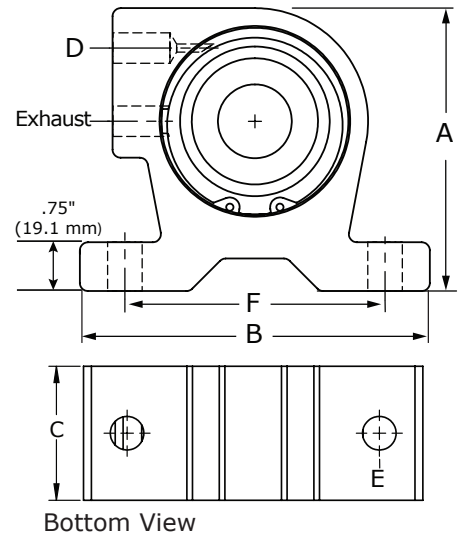




US & CS Ball Vibrator Dimensions							
VIBRATOR MODEL	WEIGHT	A	B	C	D	E	F
	lb	HEIGHT	LENGTH	WIDTH	INLET	BOLT HOLE	BOLT CENTERS
	kg	in	lb	lb	in	in	in
		mm	mm	mm			mm
US-13	0.82	2.58	5.00	1.21	1/8	11/32	4.00
	0.37	66	127	31			102
US-19	1.44	3.15	5.00	1.51	1/4	7/16	4.00
	0.65	80	127	38			102
US-25*	3.50	3.88	6.50	1.75	1/4	7/16	5.00
	1.59	99	165	44			127
US-38*	7.95	5.18	7.75	2.30	3/8	7/16	6.00
	3.61	132	197	58			152
CS-19*	2.4	3.40	5.25	1.50	1/4	7/16	4.00
	1.09	86	133	38			102
CS-25	3.28	4.35	5.38	2.13	1/4	17/32	4.00
	1.48	110	137	54			102
CS-35	3.53	4.35	5.38	2.13	1/4	17/32	4.00
	1.59	110	137	54			102

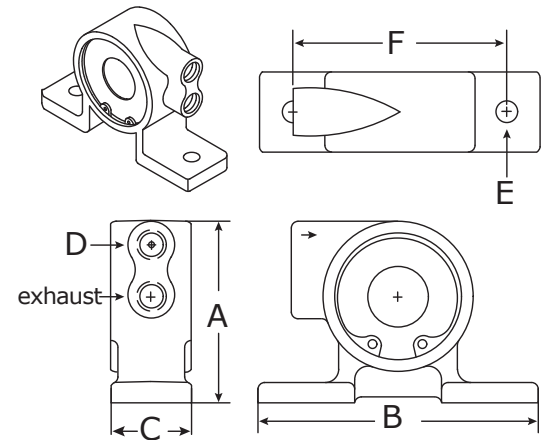
\* only available in ductile iron

### CS Series - Aluminum

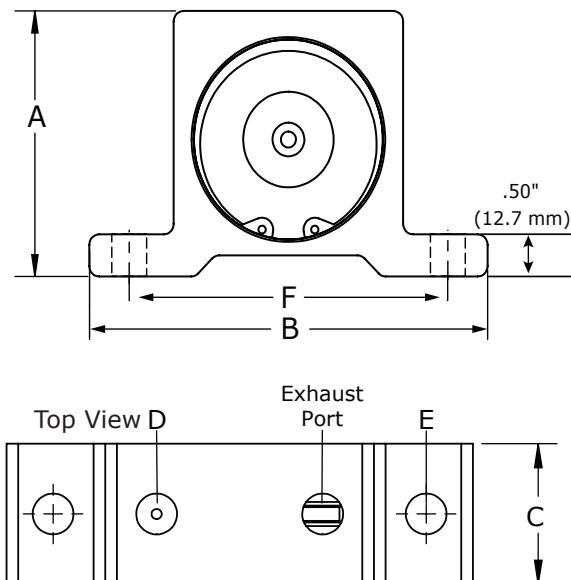


### CS Series - Ductile Iron

CS-19 available in ductile only



### US Series - Aluminum



### US Series - Ductile Iron

US-25 & US-38 available in ductile only

