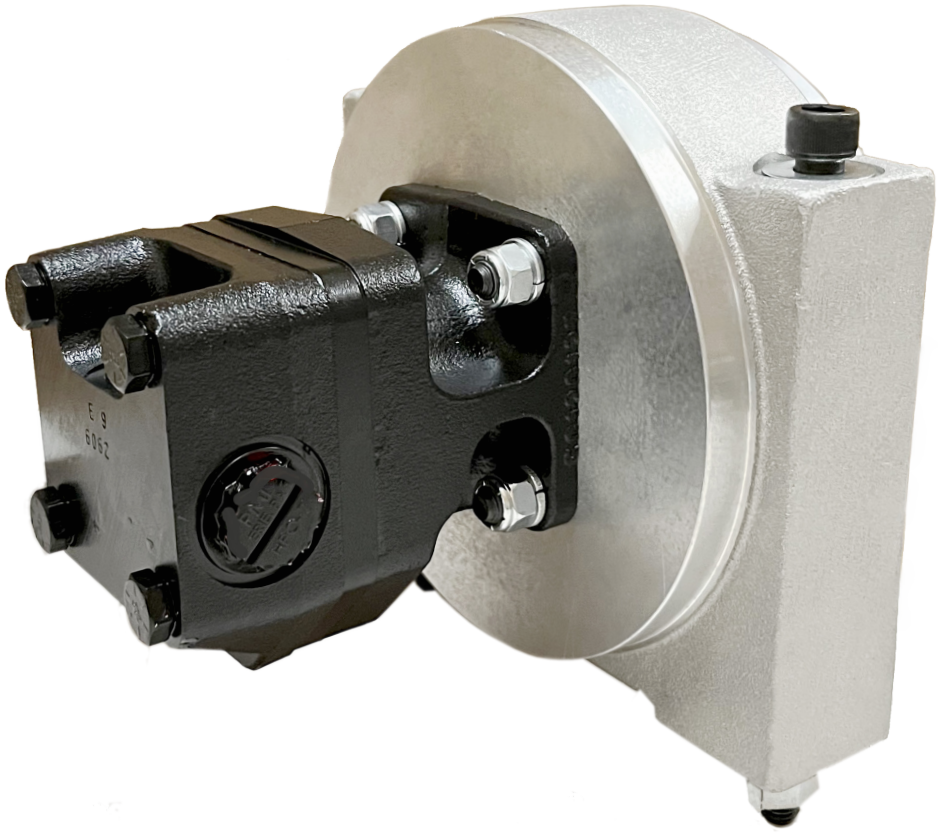
Design Series

Operating Instructions

Global® External
Hydraulic Vibrators

MODEL

C2-0.5-2HM
C2-1.0-2HM
C2-1.4-2HM



Global® VIBRATORS

Viber® VIBRATORS

Global® 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 have the frequency.

⚠ Safety Precautions

- Follow all mounting instructions.
- Always use a safety cable or chain for support.
- Do not operate vibrators when structure is empty.
- Do not operate vibrators when gate is closed or conveyor is stopped unless consolidation of material is desired.
- Wear ear protection for 90+ decibel levels.
- Do not operate vibrators without side covers.
- Do not operate the Design Series hydraulic vibrators above the maximum pressure (psi) or flow (gpm).
- Never use your hands to check for hydraulic leaks. Hydraulic fluid can be extremely hot.
- Always disconnect hydraulic line before maintenance.

II. Installation Procedures

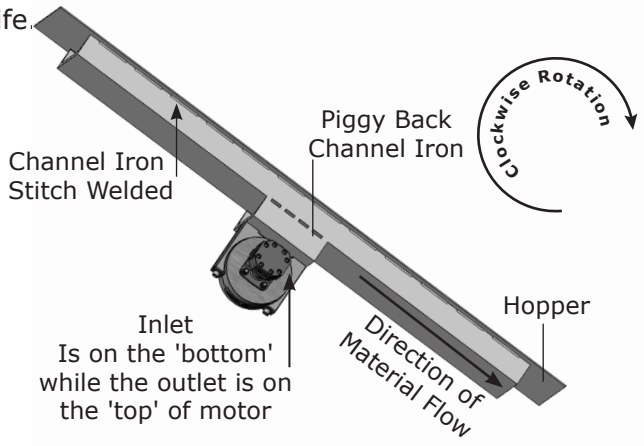
Caution!

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.

Placement on Channel Iron

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 motion-less. There should not be a large amount of motion or noise.

The axis of rotation of the eccentric weights for all rotary vibrators should be oriented in the direction of material flow. The shaft of the vibrator should ideally be in a horizontal position to prolong bearing life.



Channel Irons - Size & Mounting

Important!

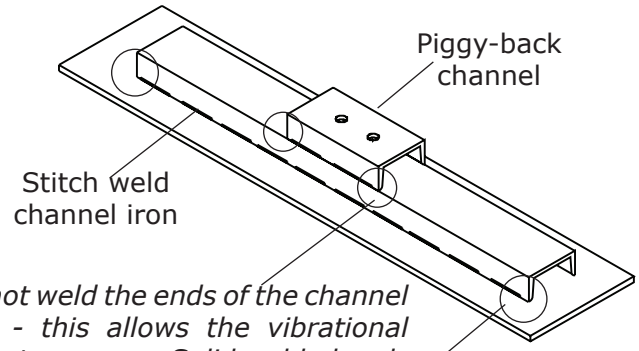
The channel iron should be at least two-thirds of the height of the sloped portion of the hopper but no greater than 10 feet (3 m).

The channel iron should be at least two-thirds the height of the sloped portion of the hopper, but not less than 4 feet (1219 mm) 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:

Model	Channel Iron Size	Minimum length
All C2 Models	C3" x 4.1 lb/ft	48"
	C75 x 6 kg/m	1219 mm

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 slope 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.

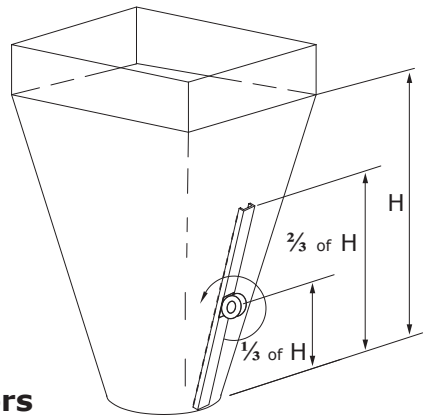
Secure the vibrator to the channel iron with SAE coarse thread grade 8 plated bolts with lock washers or an adhesive such as Loctite® 262. Tighten bolts in a sequential process. At least two passes are required in most situations. Give all bolts the same torque value. Grade 8 bolts can handle more torque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

III. Mounting Locations

Single Vibrator

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

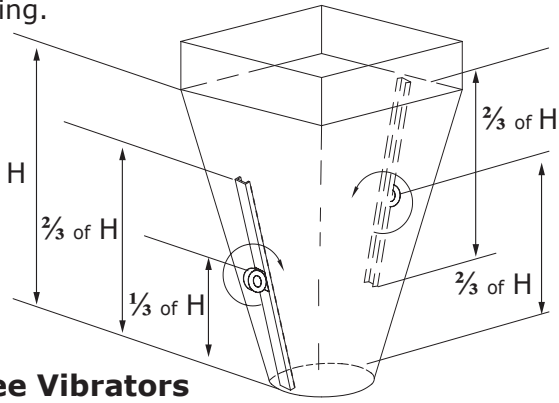


Multiple Vibrators

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.

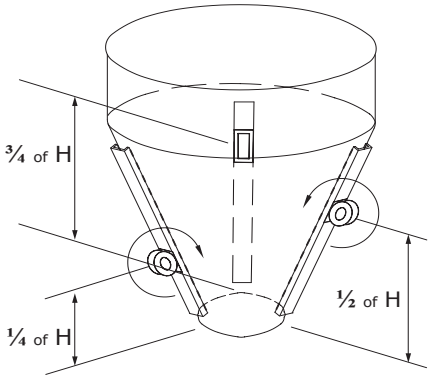
Two Vibrators on Round or Square Hoppers

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 ⅔ the distance above the discharge opening.



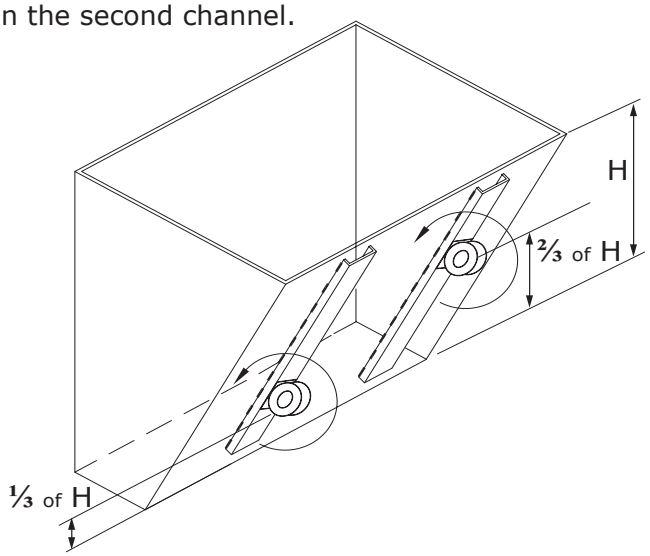
Three Vibrators

Install channel iron stiffeners mounted 120° apart. Install the first vibrator on the outside of the sloping wall ¼ the distance above the discharge opening. Install the second vibrator on a separate channel iron at ½ the distance above the discharge opening. Install the third vibrator on the remaining channel iron at ¾ the distance above the discharge opening.



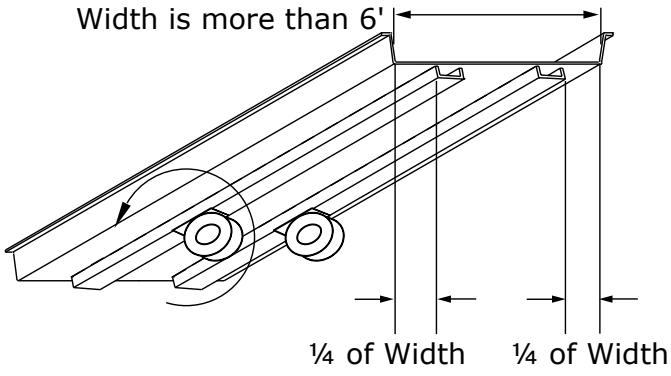
Two Vibrators on Rectangular Hoppers

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 ⅔ 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 ⅓ above the discharge opening on one channel iron and the other vibrator ⅔ above the bin's discharge opening n 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 ft (1.83 m) in width. If the chute is greater than 6' 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 ¼ of the chute width from the edge and ½ of the chute width apart. (e.g. – a chute 8' wide, the channel iron locations would be 2' from each edge and 4' apart.) When wall thickness is less than ⅛", additional reinforcement may be required.



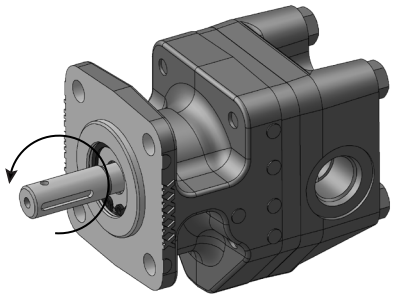
IV. Operation

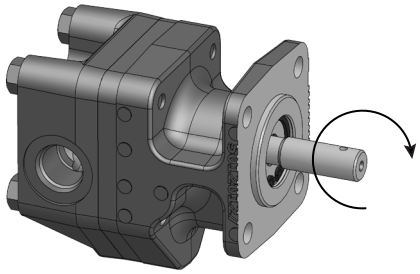
Pipes & Hose Sizes

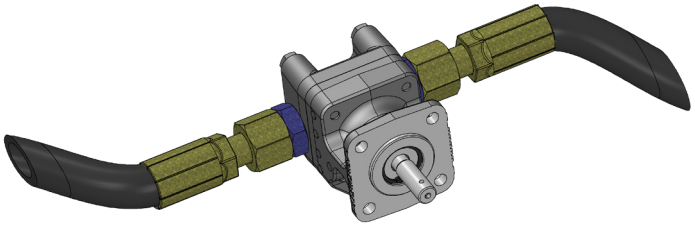
Use an inlet hose that is the same size or larger in diameter than the inlet port of the vibrator. Use a short, flexible hose between the vibrator and the main hydraulic line if the main line is metal to avoid strain on the vibrator motor ports. Allow a loose bend of 9" to 16" (23 cm to 41 cm) to be formed by the hose to prevent cracking from vibration. Use a return hose at least one size larger than the inlet hose. Using a larger hose will minimize back pressure which can blow the shaft seal. In applications where the vibrator hoses are frequently disconnected, use in-line filters to keep contaminants out of the vibrators.

Bidirectional Motors

The motors of the Design Series vibrators are bidirectional; therefore the eccentric weight rotation can be reversed by changing the hose connections. (Change the inlet to the outlet and the outlet to the inlet.)





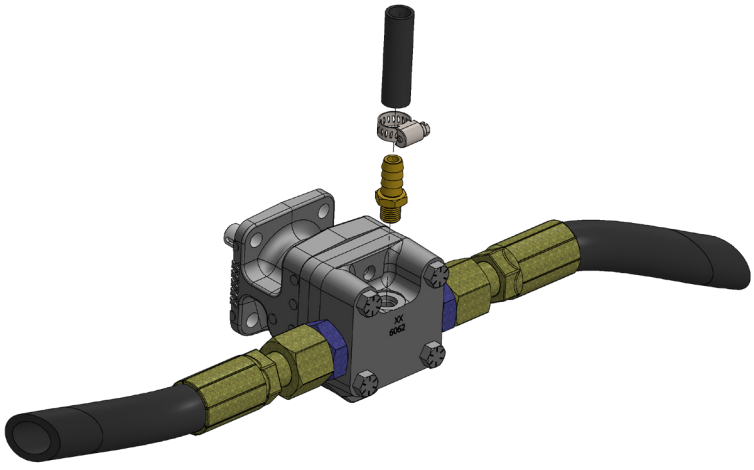


Case Drain

In most applications a case drain is unnecessary. The shaft seal will tolerate up to 200 psi maximum back pressure; however, the VITON shaft seal will fail if case pressure is excessive. If properly plumbed, the case pressure should stay low, unless running 2 or more vibrators plumbed in series. If the back pressure, including spikes, exceeds 200 psi then a case drain is required.

Excessive vibrator speed is often due to excessive oil flow or excessive pressure, which will compromise the shaft seal. After installation check the inlet and outlet pressures, as well as the rpm of the vibrator. Immediately address any parameters out of tolerance limits. Unresolved high outlet pressure requires a case drain. **Running 2 or more vibrators plumbed in series** will most definitely create high outlet pressure and will require a case drain.

To install the case drain, remove the case drain plug and install a hose stem that has $^{7}/_{16}$"-20 SAE fitting with an o-ring. Route the case drain directly back to the reservoir.



V. Disassembly and Assembly

Tools Required:

⅛" hex key
5/32" hex key
5/16" hex key
¼" hex key
½" open end wrench
Propane torch
Small mallet
Arbor press
Press in ring or rod 1 15/16" in diameter
Solvent to dissolve grease

How to Change the Weights:

Follow steps 1 - 11.

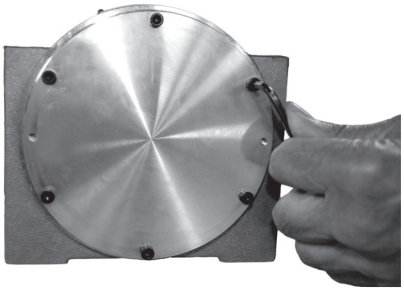
Disassembly:

Follow steps 1 - 21 to disassemble vibrator for maintenance.

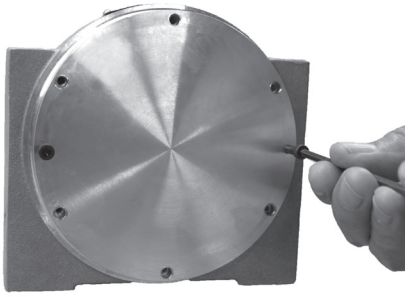
1. Disconnect the hydraulic hose from the hydraulic motor and dismount vibrator from application.

2. If necessary, using the 5/16" hex key, remove the vibrator from its mount to gain access to the vibrator housing cover.

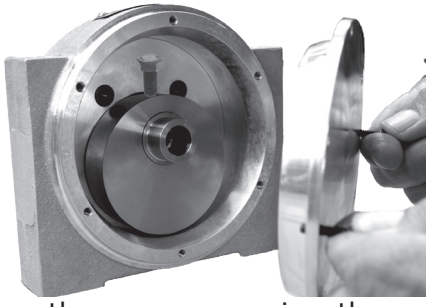
3. Remove the housing cover after using the 5/32" hex key to remove the 6 each of the 10-24 socket head screws.



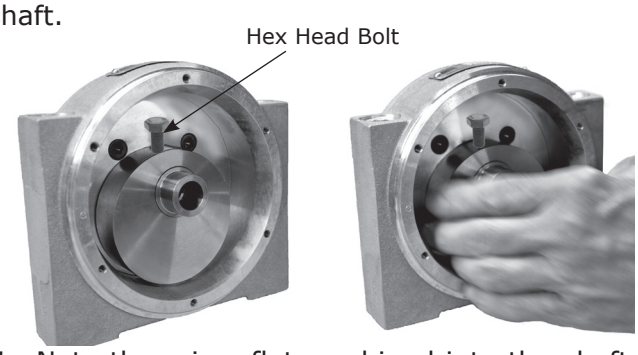
4. Insert two of the 10-24 flathead cover screws into the threaded holes in the cover.



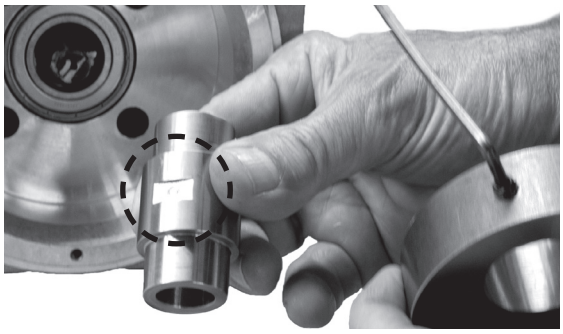
5. Working alternately, gradually screw these screws into the housing until the cover comes free. Remove the two screws from the cover.



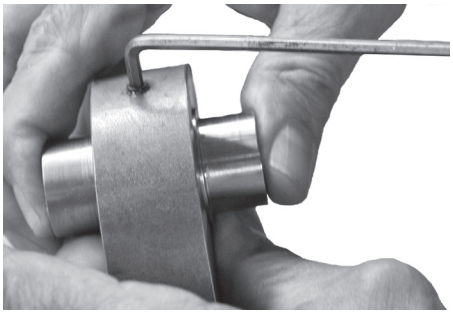
6. Remove the cover, exposing the weight and shaft. The weight is not adjustable and must be replaced with a heavier or a lighter weight to change the force output. Loosen the hex head bolt to remove the weight. Slide the weight from the shaft.



7. Note there is a flat machined into the shaft to allow it to be secured on the shaft with the bolt.



8. When replacing the weight, assure that the bolt in the weight engages the flat on the shaft. Apply Loctite® 271 to the bolt threads and tighten the bolt securely. Replace weight/shaft assembly into housing making sure the motor shaft cross pin engages the slots inside the shaft and seats completely.



9. Rotate the weight and shaft by hand to make sure they rotate freely. If it binds, remove shaft and rotate 180° and replace it on the motor shaft.

If you are finished replacing the weight and no further maintenance is required do the next two steps:

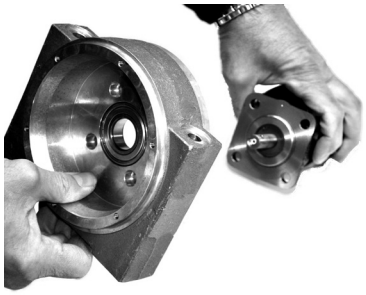
10. Install cover on housing, tamping it down evenly all around until it seats against the housing. Move threaded cover removal holes to horizontal position between tapped holes on vibrator housing. Tighten all 6 cover screws to snug, then using a cross pattern tighten securely.

11. Replace the hose connections and verify proper operation. Listen carefully to make sure there is no audible rubbing of the weights within the housing.

To continue with full disassembly, continue from step #7, on page 6, and follow the instructions below starting with #12.

12. Assume weight/shaft assembly is pulled off as noted in #6 on page 6. Using the ½" wrench and ¼" hex key, loosen and remove motor mount bolts.

13. Pull motor from vibrator housing.



14. Clean weight/shaft assembly inside and outside in solvent.

15. Inspect weight shaft ends for wear and discoloration. Check bearings for smooth operation.

16. Inspect coupling engagement grooves in weight shaft for wear. Replace shaft if wear of any kind is noticeable.

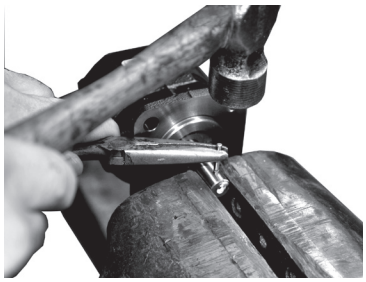
17. Check coupler cross pin in motor shaft for breakage or wear. Replace if worn or broken. (NOTE: Pin can be press fit or slip fit.) Check bearings for wear and smooth rotation.

18. Worn bearing in the vibrator cover can be removed by heating the back of the cover with a propane torch to expand the aluminum around the bearing until the press fit is loosened.

19. The bearing in the main housing can be pressed out.

20. Using the $1^{15}/_{16}$" press rod, press new bearings into the vibrator housing and cover.

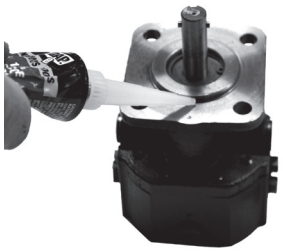
21. If the coupler pin is to be replaced in the motor shaft, support the motor shaft in a bench vise and use the new pin as a drift to drive out the old pin with a small hammer. Make sure the new pin is exactly centered in the motor shaft.



If the hydraulic motor is to be repaired, contact the factory.

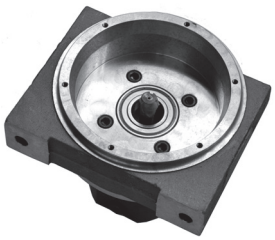
1. Place the motor on the work bench with the shaft facing up.

2. Run a small bead of sealant around the boss on mounting face of hydraulic motor.

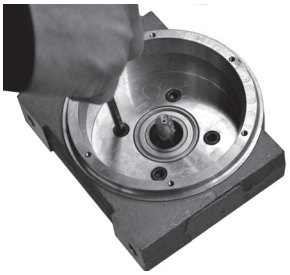


3. Grease the shaft and cross pin with a small amount of high temperature grease. Grease suitable for brake systems works well.

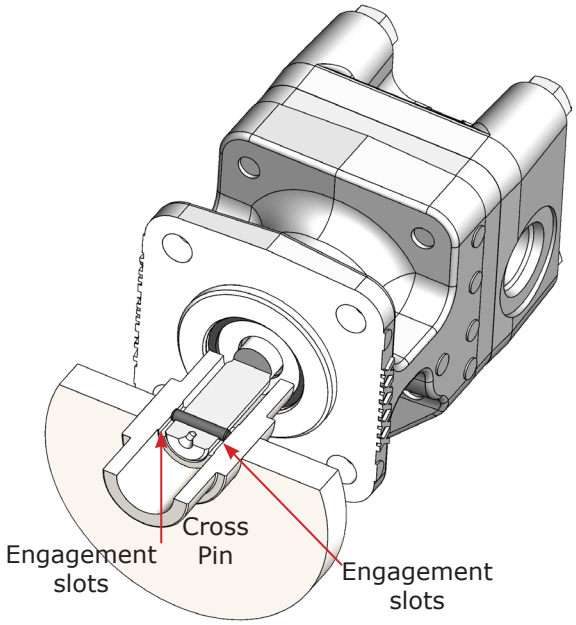
4. Place vibrator housing on the mounting flange of motor and align mounting holes in housing with mounting holes in motor flange.

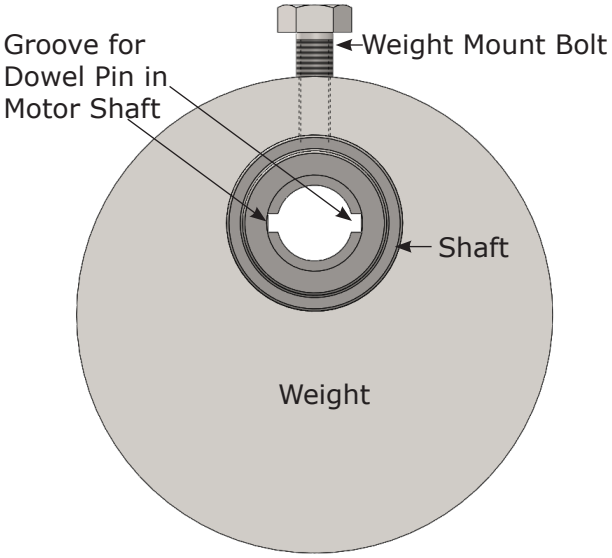


5. Install mounting bolts through housing and motor mount flange **but do not tighten**.

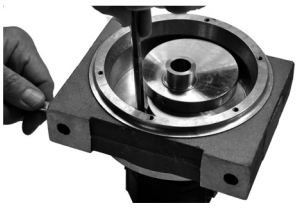


6. Align the engagement slots in the weight/shaft assembly with the cross pin in motor shaft and slide shaft into housing bearing until it is fully seated against the bearing. Rotate shaft to assure free rotation without binding.



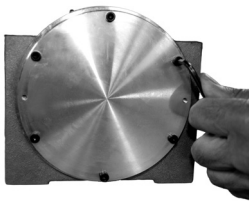


7. With the shaft in place, tighten the motor mounting bolts securely. This aligns motor and shaft. Make sure shaft rotates freely after the bolts are tightened.



8. Install cover on housing, tamping it down evenly all around until it seats against the housing. Move threaded cover removal holes to horizontal position between tapped holes on vibrator housing.

9. Tighten all 6 socket head cover screws to snug, then using a cross pattern tighten securely.

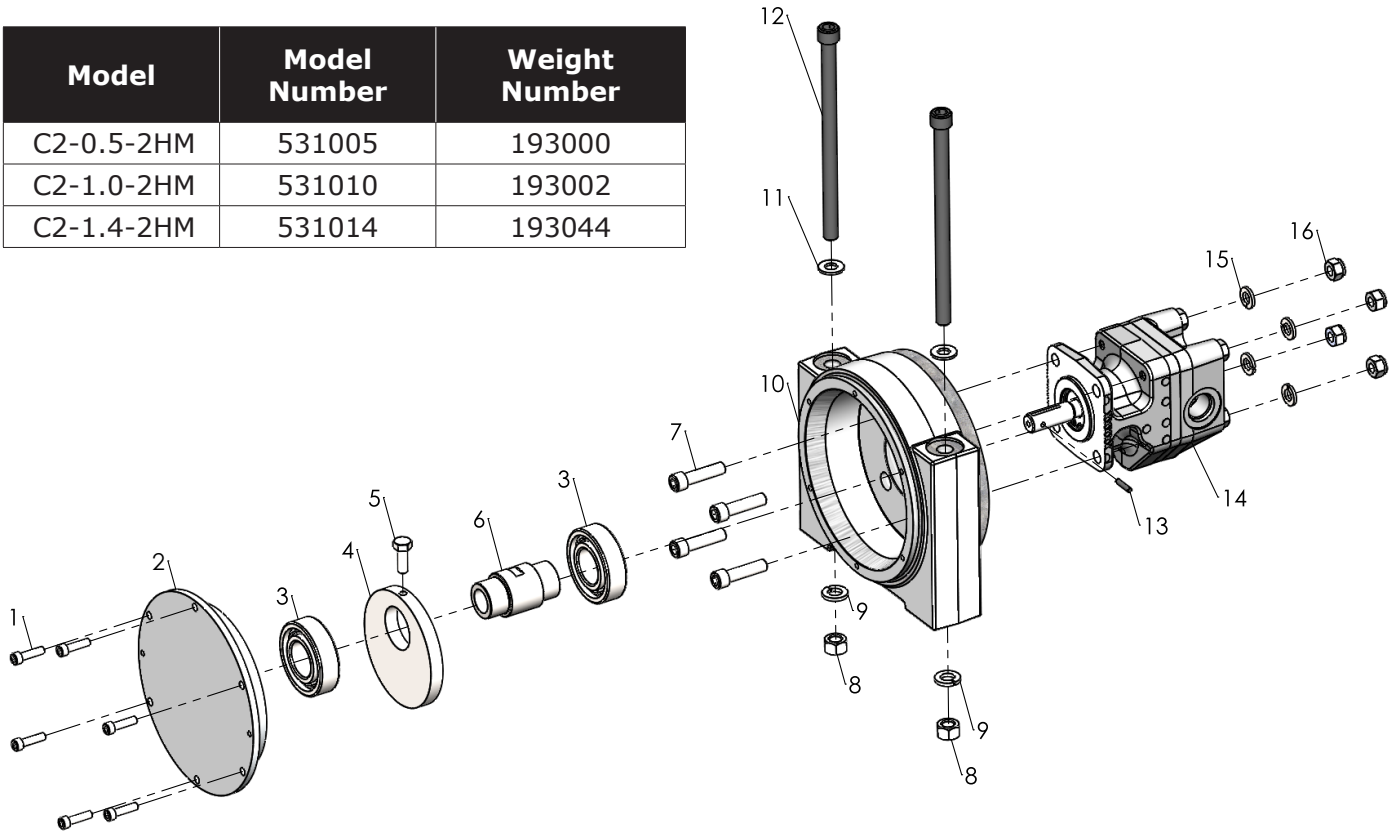


VI. Parts List & Parts Explosion: C2-0.5-2HM, C2-1.0-2HM, C2-1.4-2HM

C2 Hydraulic Vibrator Parts List

Item Number	Part Number	Description	Qty.
1	336707	Screw SCS 10 - 24 x ¾"	6
2	110220	Cover	1
3	382245	Bearing	2
4	see chart below	Weight	1
5	330007	Hex Head Bolt ¼" - 20 x ¾"	1
6	200301	Shaft	1
7	337012	Screw SSS 5/16" - 18 x 1 ¼"	4
8	333706	Hex Nut ⅜" - 16 GR5 Plated	1
9	338106	Lock Washer ⅜" Plated	2
10	142029	Housing	2
11	338205	Flat Washer 5/16" Plated	2
12	337196	Screw HSCS ⅜" - 16 x 6"	2
13	344614	Dowel Pin ⅛" x ⅝"	1
14	251030	Hydraulic Motor	1
15	338105	Lock Washer 5/16"	4
16	334205	Locknut 5/16" - 18	4

Model	Model Number	Weight Number
C2-0.5-2HM	531005	193000
C2-1.0-2HM	531010	193002
C2-1.4-2HM	531014	193044



VII. Hydraulic Motor Performance Data

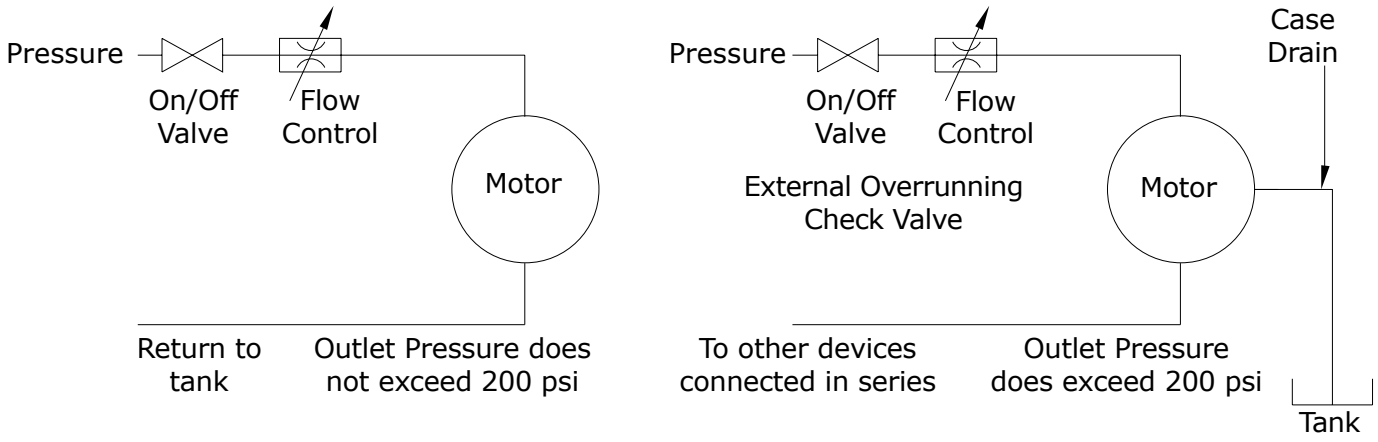
Standard Hydraulic Motor Performance Data - 2HM Motors								
Motor	**Port Size SAE**	**Minimum Hose Size I.D.**	**Displacement per Revolution**	**Max Speed RPM**	**Flow Rate at Maximum Speed**	**Maximum Continuous Pressure**	**Maximum Intermittent Pressure**	**Maximum Back Pressure**
2HM	¾" -16	½"	0.1506 cu in	4500	3.9 GPM	3000 psi	4000 psi	200 psi
			2.47 cc		11.1 LPM	207 bar	276 bar	13.8 bar

VIII. Vibrator Performance Data

Performance Data for C2 - 2HM Hydraulic Design Series Vibrators											
VIBRATOR MODEL	Unbalance	Start-Up	Speed	Flow	Force	Speed	Flow	Force	Speed	Flow	Force
	lb-in	psi	rpm	gpm	lbf	rpm	gpm	lbf	rpm	gpm	lbf
	kg-mm	bar		lpm	kN		lpm	kN		lpm	kN
C2-0.5-2HM	0.6	50	3,000	1.96	141	4,000	2.6	250	4,500	2.9	391
	63	3.4		7.4	0.6		9.8	1.1		11.0	1.7
C2-1.0-2HM	1.0	60	3,000	1.96	261	4,000	2.6	463	4,500	2.9	724
	118	4.1		7.4	1.2		9.8	2.1		11.0	3.2
C2-1.4-2HM	1.4	80	3,000	1.96	368	4,000	2.6	654	4,500	2.9	1,022
	166	5.5		7.4	1.6		9.8	2.9		11.0	4.5

Hydraulic Motor Specifications: Port size - ¾" - 16 SAE, Minimum hose size - ½", Maximum speed - 4500 rpm, Flow at maximum speed - 2.8 gpm, Maximum continuous pressure - 3000 psi, Maximum intermittent pressure - 4,000 psi, Maximum back pressure - 200 psi.

IX. Plumbing Diagram



X. Hydraulic Motor Performance Factor

There are no black & white answers to the question of what the 'exact' gpm and psi is for different speeds of the hydraulic motors. Besides gpm & psi, there are several variables that affect the vibrator speed, such as the motor shaft seal, internal leakage always inherent in gear motors, and back pressure. The following chart is a snapshot of the hydraulic motor.

Motor Property	Unit	2HM
Port Size	Side Ports	¾" - 16 SAE
Minimum Hose Size I.D.	inches	½"
Displacement (Dr)	Cubic Inches / Rev.	0.1506
Slippage Rate (fs)	gpm/ 100 psi	.023
Shaft Diameter (D)	Inches	0.5
Maximum Speed (Vrpm)	RPM	4500
Maximum Continous Inlet Pressure (Pi)	psi	3000
Maximum Intermittent Inlet Pressure (Pi)	psi	4000
Maximum Back Pressure by Mfg (P)	psi	200
Maximum Back Pressure @ 5,000 rpm	psi	200
Inlet Flow in gpm (Fi) to maintain 5,000 rpm at specified Inlet Pressures	psi	gpm
	100	2.9
	500	3.0
	1000	3.1
	1500	3.2
	2000	3.3
	2500	3.5
	3000	3.6
	3500	3.7
	4000	3.8
Note: These are motor performance statistics only. Vibrator performance may vary due to the size of the unbalanced weights used. All calculations based on oil viscosity of 200 ssu.		

Hydraulic vibrator speed can fluctuate significantly with inlet pressure (psi) and inlet flow (gpm). For instance, a vibrator with a 2HM motor given exactly 2.00 gpm at 750 psi runs about 3,000 rpm. If the inlet flow drops to even 1.80 gpm (10%), the speed will drop to 2,730 rpm (11%). Therefore, when assessing vibrator speed on a particular application it is critical to have accurate inlet flow and pressure measurements. Also, be aware that vibrator speed will vary with the size of the unbalanced weights used. One other important factor is oil viscosity, which can vary considerably with oil temperature. All published data assumes an oil viscosity of 200 ssu.

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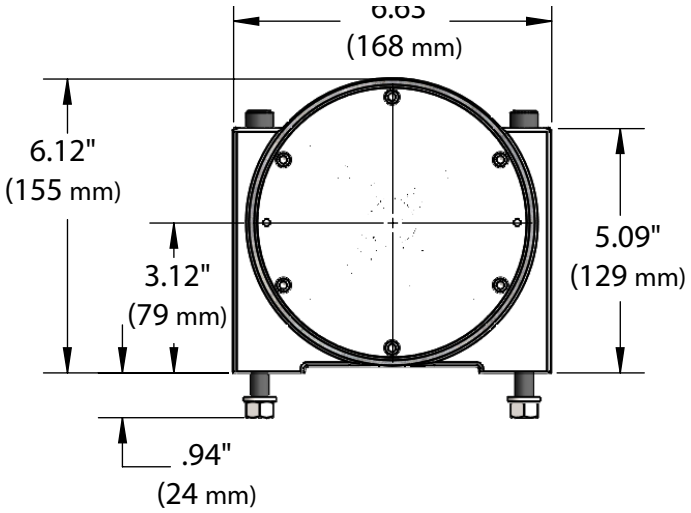
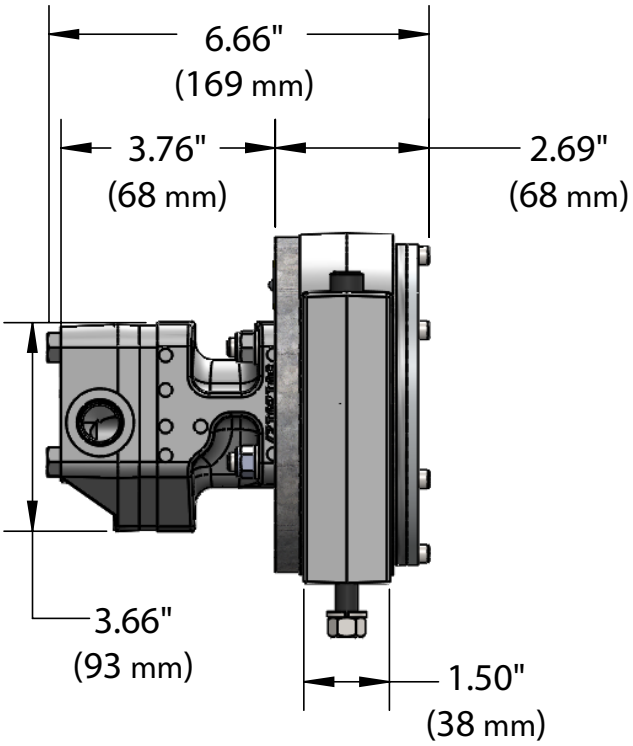
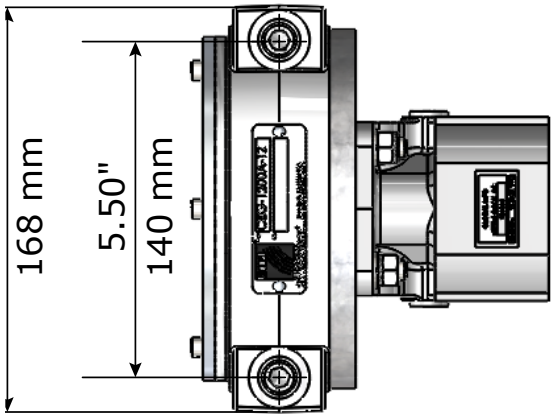
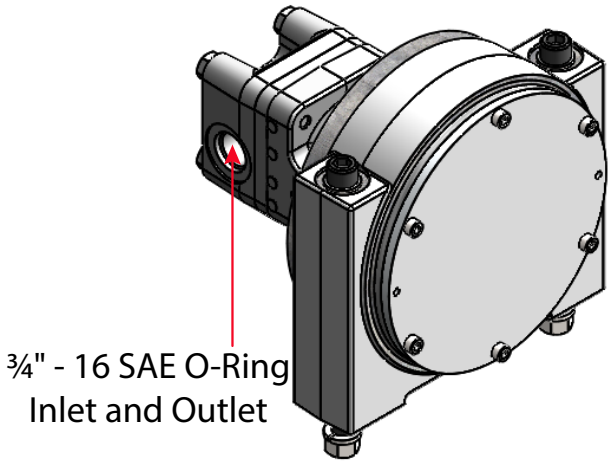
XI. Vibrator Dimensions

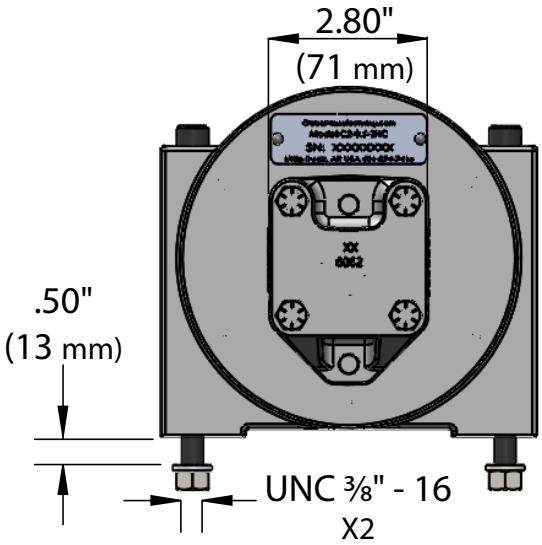
Dimensions in inches and millimeters

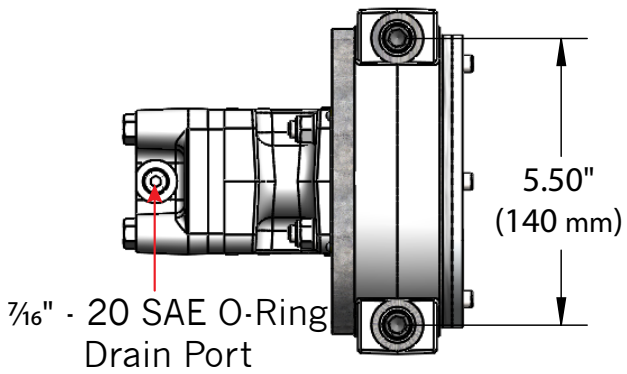












XII. Troubleshooting Guide

Problem	Probable Cause	Solution
Vibrator will not run	Not enough starting pressure	Increase pressure.
Hydraulic shaft seal blows	Excessive back pressure or pressure spikes	Reduce back pressure below 200 psi Use a transducer to detect pressure spikes. If they are present, eliminate them. If back pressure cannot be reduced or pressure spikes eliminated, install a case drain to prevent damage to the shaft seal.
	Too much oil flow	Reduce oil flow. Check flow control valve.
	Oil temperature over 400°F	Reduce oil temperature.
Excessive noise	Bearing failure (squealing sound)	Replace the bearings.
	Insufficient mount	Replace with stronger - more rigid mounting apparatus - a channel iron is highly recommended.
	Damaged housing or covers	Replace damaged parts.
Premature bearing failure	Operating the vibrator too fast	Reduce speed by reducing psi and gpm. The hydraulic motors can take a high psi load. It is often too much flow that causes the vibrator to run too fast.