

The background of the image is a photograph of a construction site. On the left, a tall, vertical rebar cage is visible. On the right, there is a large wall of concrete formwork made of wooden panels and beams. A red fire alarm pull station is mounted on the formwork. A yellow excavator arm is partially visible in the background. A large red 'X' is drawn over the entire image.

HANDBOOK & EQUIPMENT GUIDE EXTERNAL VIBRATION OF WALLS & COLUMNS

VIBCO

<http://www.VIBCO.com>

EXTERNAL VIBRATION

VIBCO has supplied the concrete industry with vibrators since 1962, almost 40 years. All Vibco vibrators are made in the United States and are manufactured following one or more of the over 20 Vibco patents. Well trained engineers and technicians insure top quality as well as the latest innovations in vibration techniques.

WHY USE EXTERNAL VIBRATION:

ECONOMICAL:

- Equipment cost (over the life of the equipment) and labor cost in operating the equipment are much less than that of internal vibrators.
- The new requirements for stronger concrete and the use of more rebars makes it difficult to use internal vibrators.

SAFE:

- The height of columns and walls makes it difficult to use internal vibrators. They do not reach the bottom, get tangled in with the rebars, damage the form sides and do not move the concrete between the rebars causing honeycombing, voids and weak concrete.

LOW MAINTENANCE:

- The maintenance cost for internal vibrators is well known to be high. External vibrators outlast the internals 1:10. They will give years of trouble free service with a minimum of maintenance.

SAVES LABOR COST:

- The cost for expensive patching crews are virtually eliminated.
- The rebars help to regenerate the vibration throughout the mix insuring no voids and a strong homogenous concrete.

The following pages will show Vibco equipment being used successfully on a variety of walls and columns. Vibco's application engineers are also available to help you select, size and place vibrators on your form.

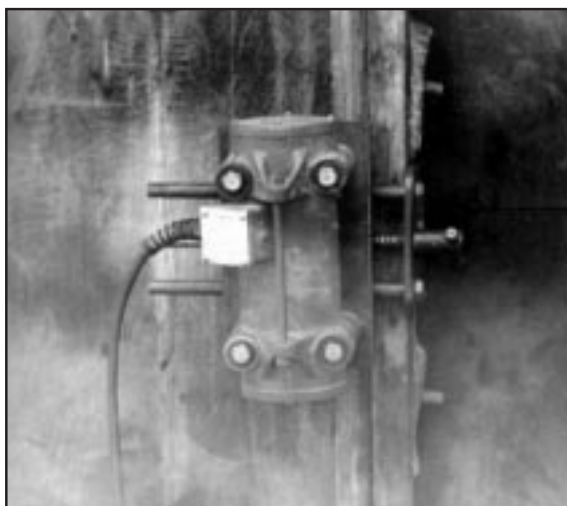
NOTE: Page numbers under "Equipment Used" refer to pages in Vibco's "Handbook & Equipment Guide to External Concrete Vibration" catalog. Ask for your FREE copy of Catalog 8401.

CAST-IN-PLACE WALL SECTIONS

- PROBLEM:** Wall sections were being cast between precast columns. It was impossible to reach the mix so internal vibrator could not be used.
- SOLUTION:** Model US-1600 electric vibrators were used with wood form brackets (page 10 of Concrete Handbook), 2 x 4 wood planks were placed on the Symons form at 4' intervals and the vibrator was clamped to the wood.
- RESULT:** The concrete consolidated properly and an excellent almost architectural surface finish was obtained by using the high frequency vibrators.



Symons form using Model US-1600 with clamp-on bracket (page 11) made to clamp on to 2 x 4.



Wood form bracket (page 10) on 2 x 4. Straddled between two 2 x 4's.

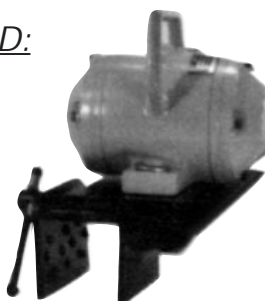


EQUIPMENT USED:

MODEL US-1600
115 Volt - 1 Phase
5 amps - 9000VPM

MODEL UC-2
Clamp-On Bracket

(Page 11 & 16 Concrete
Handbook)



ALTERNATIVE PNEUMATIC EQUIPMENT:

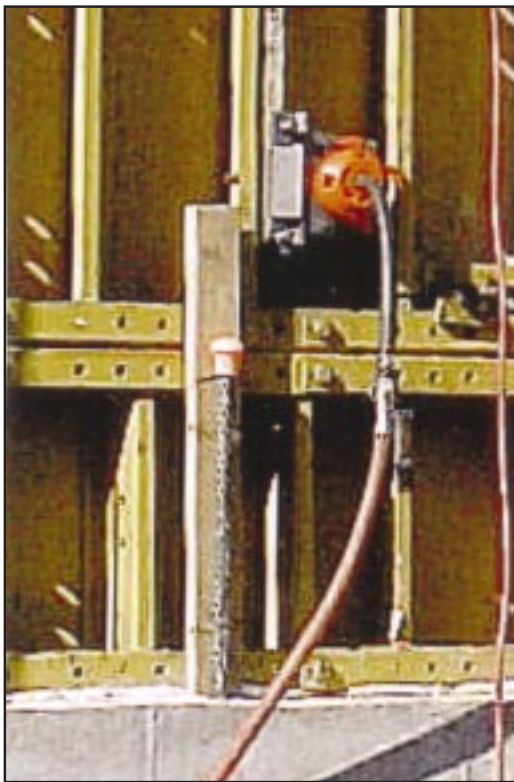
MODEL CCF-2000
or SVRFS-4000

BRACKET CCFC-3

(Page 10 & 14 Concrete Handbook)

WASTE WATER TANKS – LAWRENCE, MA

EFCO-Ready radius forms were used to cast 32' high wastewater tanks. The very close steel reinforcement rods made it impossible to use internal vibrators. 12 Model SVRFS-4000 Vibco pneumatic vibrators were used and staggered on form starting 2' from bottom to insure that concrete flowed around reinforcement bars – next vibrator 4' higher on next form panel. Required density was achieved and contractor saved several days using external vibrators.



Special vibrator bracket was designed to clamp on to form stiffener.



Wall section to be cast – notice the tight reinforcing rods.



Close up of Vibrator Spacing



EQUIPMENT USED

PNEUMATIC:

MODEL SVRFS-4000

12000 VPM

40 CFM & 85 dB

Special Bracket designed by VIBCO

(Page 14 Concrete Handbook)

Bracket specially
made by

VIBCO!

EFCO – 16' HIGH BY 12' WIDE WALL FORM



EFCO'S 16' high and two of 6' wide wall forms were equipped with 8 Model SVRWS-4000 Vibco Pneumatic Wedge Type Vibrators. A high capacity concrete pump filled the form in 5 minutes. Due to the fast pour and smooth finish required the vibrators were placed on each vertical stiffener giving additional vibration force to the stiffer form joints. The lower row of vibrators were started when the concrete reached them and continued to vibrate until concrete reached the 8' higher row of vibrators. These were then started and run until form was filled and a glistening slick surface appeared. Maximum density was achieved with a glossy almost architectural finish.



EQUIPMENT USED:

PNEUMATIC SVRWS-4000
12000 VPM
40 CFM & 80 dB

UWF-1 FEMALE BRACKET

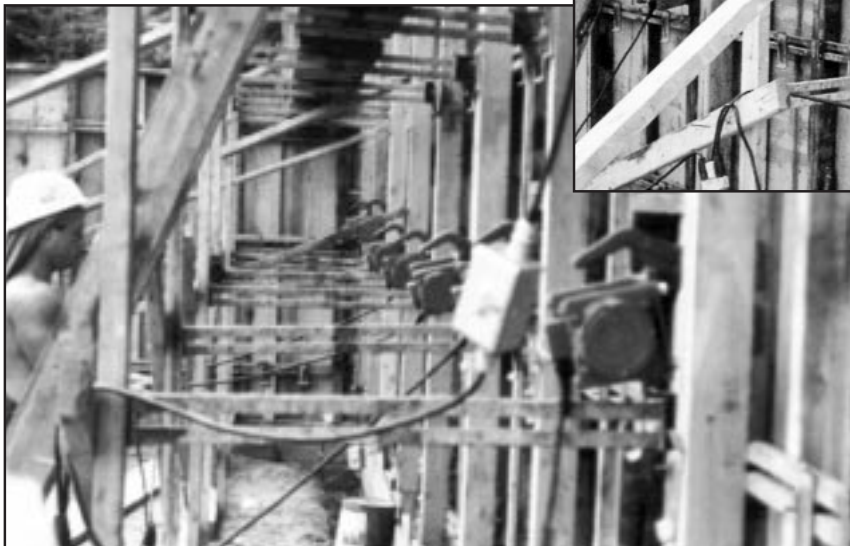
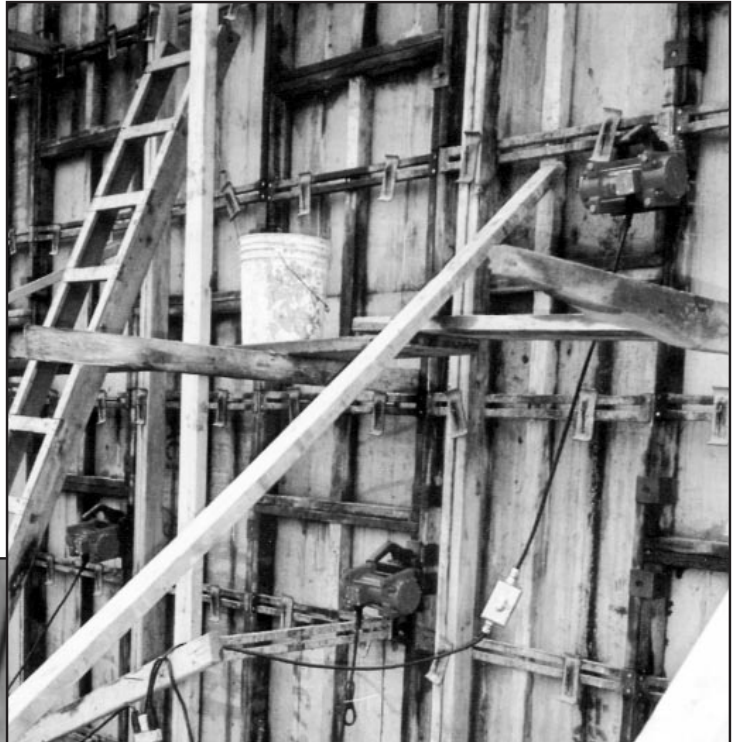
(Page 3 Concrete Handbook)

UWF-Bracket was welded onto a flat plate with drilled holes matching the existing holes on the form stiffeners making them easy to remove and reposition.

IO MODEL US-1600 ELECTRIC VIBRATORS ON 20' HIGH WOODEN FORM SYSTEM

PROBLEM: Workers handling 20' long internal vibrators when standing on ladders, became a safety concern, and contractor decided to use external vibrators.

SOLUTION: Working with VIBCO's engineers a special bracket was designed that could easily be attached and removed from the form when using Model US-1600 vibrators (page 4 of Concrete Handbook). Vibrators were placed 8' apart and staggered on 4' levels. Vibrators were started when concrete reached them and they ran until pour reached next level of vibrators. Then turned off and moved 4' above top row of vibrators.



COMMENTS: Finish came out perfect. Contractor was very pleased and now committed to use external vibrators on his wall forms because of safety, ease of handling and product finish.

EQUIPMENT USED:

UWF-1 Bracket
MODEL US-1600
115 Volt - 1 Phase
5 Amps - 9000 VPM

(Page 5 & 16
Concrete Handbook)



ALTERNATIVE PNEUMATIC EQUIPMENT:

MODEL CCW-2000
or SVRWS-4000

(Page 2 Concrete
Handbook)



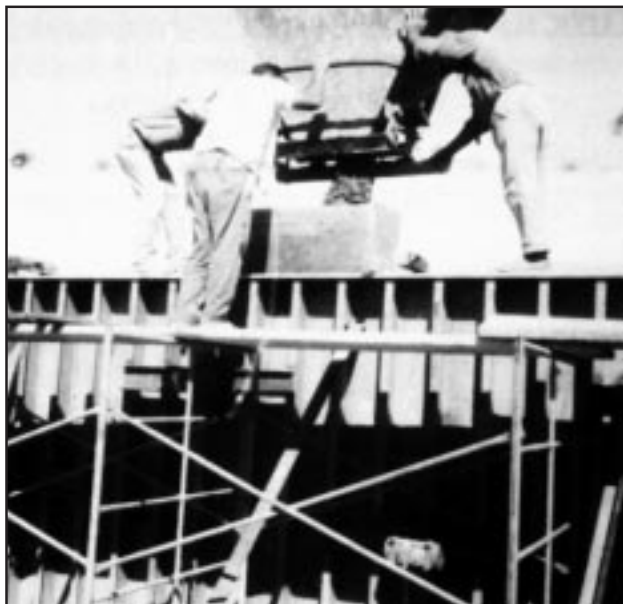
"HOW TO SERIES" – CASTING CONCRETE WALLS

PROBLEM: Contractor casting in place dividing walls between apartments of Hi-Rise building overlooking Hudson River, New York, getting voids and bubbles with internal vibrators. This required costly hand finishing.



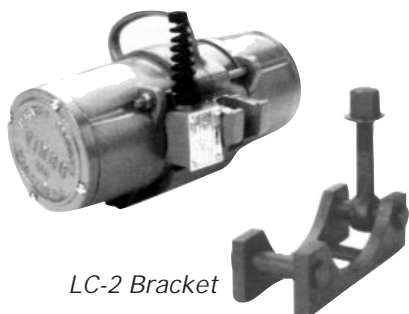
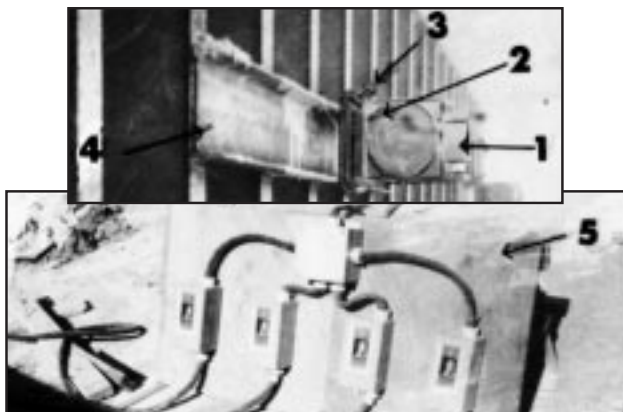
SOLUTION: 8 VIBCO 2P-450's external vibrators mounted to each 8' x 20' x 1' thick wall section (4 each side in reverse high low arrangement see lower photo). Vibrators turned on when concrete reached 6" above lower row of vibrators and remain on until pour is completed.

RESULTS: Smooth, void-free surface. Hand touch up eliminated. Not only was time saved after stripping but contractor found pour time was faster because no more waiting time as when internal vibrators were used.



ABOVE: The Pour! 3 inch slump.

BELOW: Close-up of mounting. (1) 2P-450 VIBCO Vibrator and (2) adapters bolted to (3) SB bracket and (4) channel. Each vibrator is safeguarded by overload protection (5) use of #8 wire insures adequate current despite long wire runs from power source.



LC-2 Bracket

EQUIPMENT USED:

2PL-1600
115/230 Volt
1 Phase 5/2-5A
3600 VPM
(3 Phase Available)

(Page 6 & 7 Concrete Handbook)

ALTERNATIVE PNEUMATIC EQUIPMENT:

CCL-4000 or
SVRLS-4000

(Page 6 Concrete
Handbook)



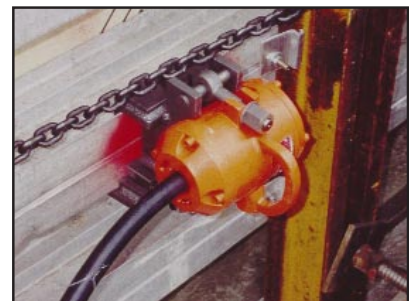
1-800-633-0032

THE BIG DIG IN BOSTON – MODEL SVRLS-4000 USED ON FORM FOR VENTILATING SHAFT



The exterior walls of concrete were to be as free from as many blemishes and bug holes as possible. Form was made up of aluminum stiffeners mounted against a plywood face. For a smooth architectural finish model SVRLS-4000 Pneumatic Vibrator with 15000 vibrations per minute at 100 PSI was recommended. A special bracket was designed to grip the aluminum form stiffeners. Vibrators were placed on 6' centers and 6' between rows. The contractor marked the vibration locations with spray paint prior to the pour to eliminate any confusion where to place vibrators once the pour was started. Vibrators were started when concrete reached the first row and continued until concrete reached the next row of vibrators. These were then started. By tapping against the wall with a 2 x 4 the contractor could determine how high up in the form the concrete was. The finished wall came out over expectations. No patching necessary.

Special Bracket designed by Vibco with Lug-Bracket for vibrator allowing vibrator to be moved from bracket to bracket.



EQUIPMENT USED

PNEUMATIC:

MODEL SVRLS-4000

15000 VPM at 100 PSI

50 CFM & 85 dB

Special Bracket designed by VIBCO

(Page 6 Concrete Handbook)

Bracket specially
made by
VIBCO!

MODEL SVRFS-4000 PNEUMATIC VIBRATORS ON BRIDGE COLUMN FOR BRIDGE BETWEEN SOMERSET & FALL RIVER, MA (Summer 2000)



Columns had a large amount of steel reinforcements. The first pour with internal vibrators came out with large voids and honeycombs. Model SVRFS-4000 high frequency pneumatic vibrators were recommended instead of internals. The same portable bracket that was designed for the Efcu-Forms page 13 was used and straddled 2 form stiffeners. They were easily moved up the form as the pour progressed. Vibrators were placed on 6' centers around form and next row 6' higher. Vibrating procedure and time followed instructions on page 14. The honeycombs disappeared, the finish was excellent without any patching.



Vibrators placed on 6' centers around form.
Next higher row 6' up.



Special Bracket straddling two
form stiffeners.



EQUIPMENT USED

PNEUMATIC:

MODEL SVRFS-4000

11500 VPM at 80 PSI

40 CFM & 80 dB

(Page 14 in Concrete Handbook)

Bracket specially
made by
VIBCO!

PROBLEM:

Internal re-bars made it difficult to use internal vibrators and the form was also too tall for internal vibrators to reach bottom. The columns came out with large voids and unvibrated surfaces.

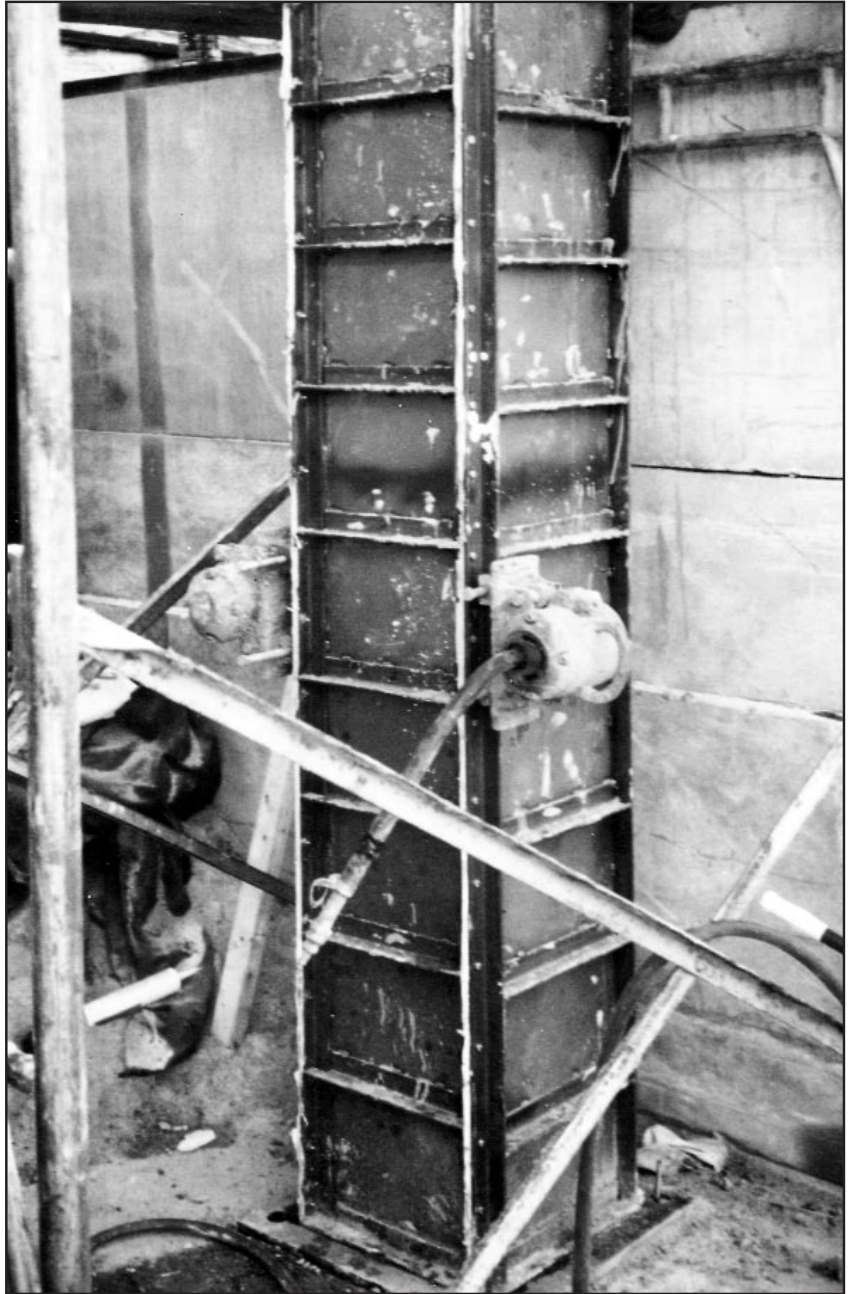
SOLUTION:

Contractor had large compressor on job site and 2 pneumatic model SVRLS 4000 high frequency vibrators were recommended mounted on a clamp-on bracket with a lug bracket (page 6 of Concrete Handbook).

Lug-bracket was chosen so that contractor could move the same vibrators to other permanently mounted lug brackets on his wall forms. Vibrators were mounted 2' from bottom and 7' from bottom then moved 5' each time. Vibrators were started when concrete reached them and stopped when concrete reached the opposite higher vibrator which then was started.

RESULT:

Excellent surface finish was achieved without any rework. Concrete completely consolidated.



EQUIPMENT USED **PNEUMATIC:**

MODEL SVRLS-4000
12000 VPM
40 CFM & 80 dB
with Clamp-On Bracket
(Page 6 Concrete Handbook)



ALTERNATIVE **ELECTRIC** **EQUIPMENT:**

MODEL US-1600
115 Volt - 1 Phase
5 amps - 9000 VPM
MODEL UC-2
Clamp-On Bracket
(Page 11 Concrete Handbook)



Overall view of job site . . .



Testing one US-900 on piling.



Men feeling to see if vibration is carried to all four sides...it is.

JOB SITE: Sea-Train Office Bldg.

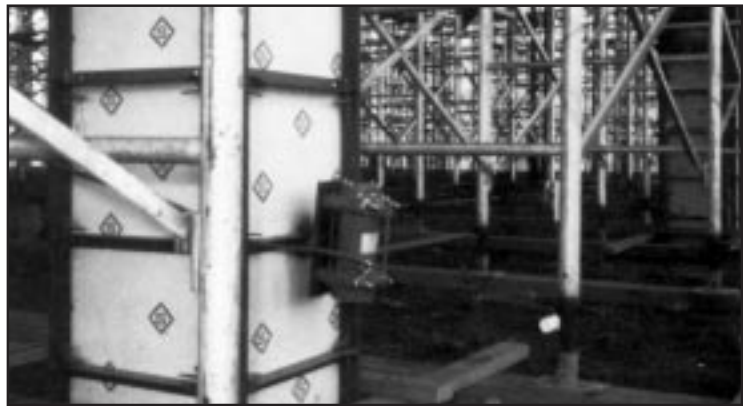
PROBLEM: To assure placement of dense concrete with architectural finish in 18" square x 28 foot tall supporting piers.

EQUIPMENT: Concrete, 2" slump supplied by transit-mix truck, to be placed into Symons forms. VIBCO US-900 electric external vibrators fitted with bolt-on brackets. Power available: 115 volt, AC, from field generators.

SOLUTION: The Symons forms had angle L-iron stiffening frames to which US-900 bolt-on adapters could be attached. Vibrators mounted to forms in a staggered manner on opposite sides at the 2', 7', 12', 17', 22', and 27' levels. They were operated in succession for about one minute each until concrete reached about 6" above each vibrator. Vibrators were moved to next higher position as pour progressed.

RESULT: No honeycombs! No unsightly holes! No patching up! A good-looking job done quickly and efficiently!

CONTRACTOR COMMENT: The best equipment purchase they ever made!



Close-up of US-900 on inside pier.



EQUIPMENT USED ELECTRIC:

MODEL US-900
115 Volt - 1 Phase - 10000 VPM
MODEL UC-1
Clamp-On Bracket

(Page 11, 16 & 17 Concrete Handbook)



ALTERNATIVE PNEUMATIC EQUIPMENT:

MODEL CCF-2000
6000 VPM - 35 CFM

CCFC-3 Clamp-On Bracket

(Page 14 & 15 Concrete Handbook)

ROUND COLUMN FOR BRIDGE SUPPORT



A round column form was used for casting support columns for elevated highway thru Bridgeport, Connecticut. Internal vibrators could not be used due to closeness of high tension electrical wires, and close spacing of steel reinforcing rods. Vibco's Model SVRFS-4000 Pneumatic Vibrators were used with clamp-on brackets. They were placed on 4' centers around the form. Next row 4' up and 45° off first row. Vibrators were started when concrete reached them and continued to vibrate until concrete reached next row. These were then started and the lower row vibrators were moved to next higher position.

Contractor was excited about the ease of using external vibrators and the finish achieved. In his own words: "The column looks just like marble, no patching was necessary."



EQUIPMENT USED PNEUMATIC:

MODEL SVRFS-4000

11500 VPM at 80 PSI
40 CFM & 80 dB

CCFC-3 CLAMP-ON BRACKET

(Page 14 in Concrete Handbook)



ALTERNATIVE PNEUMATIC EQUIPMENT:

MODEL CCF-4000

7000 VPM
40 CFM & 75 dB

CCFC-3 Clamp-On Bracket

(Page 14 Concrete Handbook)

EFCO-FORMS WITH SVRLS-4000 HIGH FREQUENCY VIBRATORS

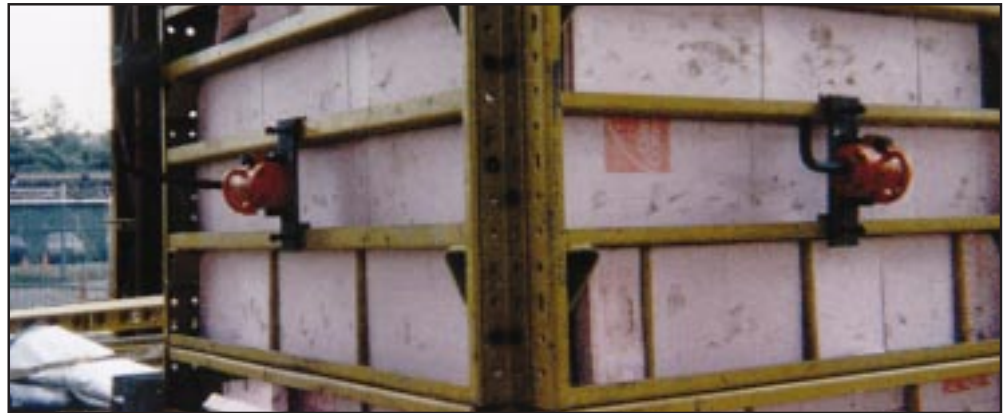


JOB SITE: Renovation of bridge columns on Rt. 95 Conn.

PROBLEM: Internal vibrators would not reach bottom of column due to reinforcement bars.

SOLUTION: Model SVRLS-4000 (page 6 of Concrete Handbook) was recommended. VIBCO designed a special bracket to be attached to the EFCO form and fit between two horizontal stiffeners. When loosening the clamping bolts it could be removed and moved up the form as the pour progressed. A total of 8 vibrators were used – one on each side. Vibrators were started when the concrete reached them and continued until it reached the next group of vibrators 6' up. They were then stopped and moved 6' above top row of vibrators. Vibration time approx. 5 min. Concrete was trucked in from local ready mixed plant. (6" slump)

RESULT: Columns came out perfect. The customers word was - "They look just like marble..."



EQUIPMENT USED PNEUMATIC:

MODEL SVRLS-4000
12000 VPM
40 CFM & 85 dB
Special Bracket designed by VIBCO
(Page 6 Concrete Handbook)

ALTERNATIVE PNEUMATIC EQUIPMENT:

CCL-4000
6000 VPM
35 CFM & 78 dB

General Rules for Selecting, Sizing and Placing External Vibrators

For the successful use of external vibrators you must determine:

1. VIBRATION PENETRATION
2. EFFECTIVE VIBRATION AREA
3. SIZING AND PLACING OF VIBRATORS
4. VIBRATION PROCEDURE & VIBRATION TIME

1. **VIBRATION PENETRATION:** As a general rule, when the thickness of the concrete in the form exceeds 6 inches, use vibrators (staggered) on both sides of the form. In columns the reinforcement steel will aid in vibration transfer to the center of the column.
2. **EFFECTIVE VIBRATION AREA:** The sinusoidal vibration waves are strongest at the vibrator and as they move away in a circular pattern (like the waves when a stone is thrown into water) and reach a 3-5 foot radius. Generally figure a 3 foot radius from the vibrator as an effective vibration area. Some of the vibration will travel to a 5 foot radius. At the 5 foot radius the vibration from the next vibrator should overlap the first.
3. **SIZING AND PLACING OF VIBRATORS**
 - (A) **SIZING:** There are many ways to select and size vibrators. Not to make the selection confusing, we will list the most common ones (for other selections consult a VIBCO applications engineer)

ELECTRIC VIBRATORS:

Model US-900: 115 volt single phase - 4.5 amps
10,000 vibrations per minute

Model US-1600: 115 volt single phase - 5 amps
9,000 vibrations per minute

(Both can be run off field generators.)

PNEUMATIC VIBRATORS:

Model CCF, CCW or CCL-2000: 80-100 PSI - 40 CFM
6,000 vibrations per minute

Model CCF, CCW or CCL-4000: 80-100 PSI - 45 CFM
7,000 vibrations per minute

GENERAL RULES FOR SELECTING, SIZING & PLACING EXTERNAL VIBRATORS, cont'd.

3. SIZING AND PLACING OF VIBRATORS (cont'd.)

PNEUMATIC VIBRATORS cont'd:

| | |
|--------------|--|
| Model SVRLS, | 80-100 PSI - 40-50 CFM |
| SVRFS-4000, | 11,500 to 15,000 vibrations per minute |
| SVRWS-4000: | (For architectural finish) |

COMPARABLE VIBRATORS:

US-900 & CCF, CCL, CCW-2000's: Used on smaller forms, low production with effective vibration area of 2.5 to 3' radius

US 1600 & CCF, CCL, CCW-4000's & SVRL, SVRF, SVRW-4000: Used on high production, larger forms with an effective vibration area of 3' plus.

(B) *PLACING OF VIBRATORS:*

STEP 1. For walls, make a dimensional drawing of the form, if 6 inch thick concrete, draw up front only. If over 6 inches, make a drawing of both sides (see *Figure 1 A & B*). For columns, make a drawing of all 4 sides see *Figure 2 A & B*).

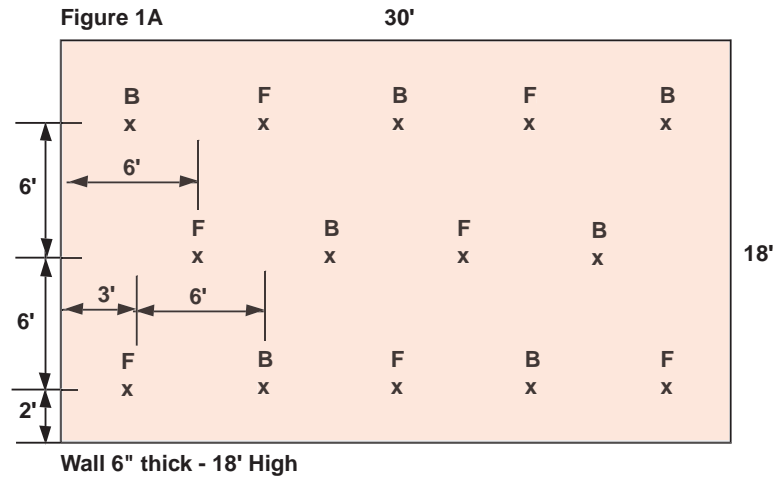
STEP 2. Draw in circles of 3' radius and 5' radius. The 5' radius should overlap, one circle for each vibrator position. (see *Figure 2 A & B*)

TIP: A good idea is to start first row of vibrators 2' up the form from the bottom. Since all the form weight is resting here and some of the vibration should also travel under the form.

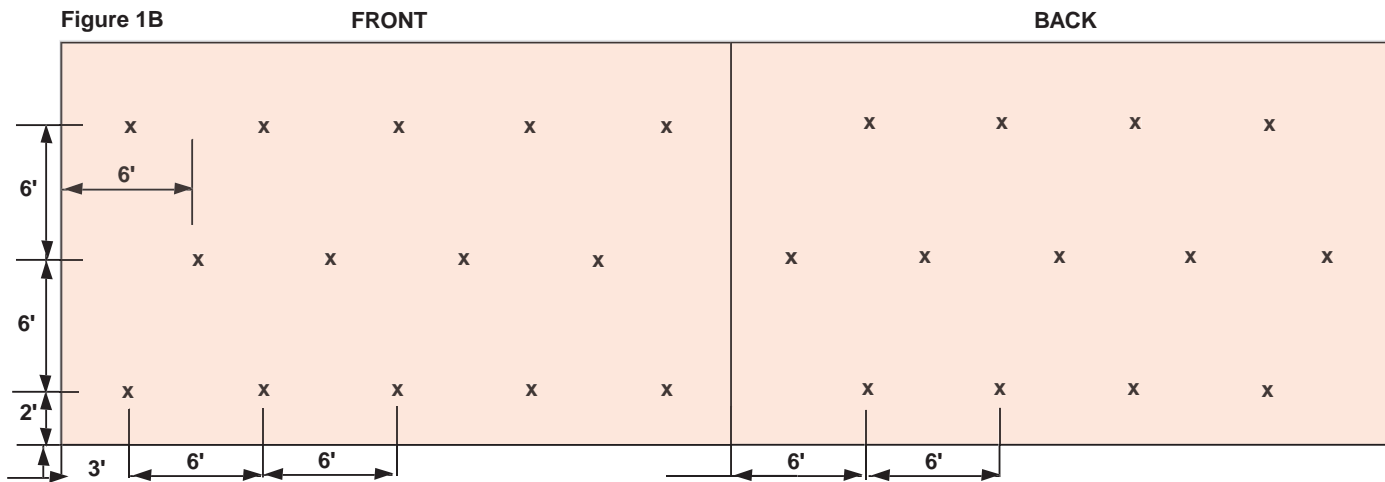
You can make your own decisions where to place the vibrators on the form – just remember the simple rule that the effective vibration area is on a 3' radius and that the 5' radius is the maximum and the adjacent vibrator's area should overlap.

When you have drawn up your form and placed the vibrators, you will know how many vibration positions you have. Now you will have to decide how many vibrators you need. A good rule of thumb is to have enough for the first row of vibrators. Remember the bottom row of vibrators must be moved to the next row up and started when the concrete reaches that row. If this is too much climbing and rushing while the pour is going on, you might want to get additional vibrators.

Another consideration when using the electric is that the US-900 and US-1600 high frequency vibrators have a 50% duty cycle – in an hour you can use them 30 minutes. These 30 minutes can be 30 minutes continuous running or 1, 2, 3, etc. minimum minutes "on" with the same or longer "off" time – but not exceeding a total running time of 30 minutes in one hour. The pneumatic units have a 100% duty cycle and can be operated continuously.

WALL 6" THICK 18' HIGH

WALL 6" THICK: It is only necessary to vibrate one side. Front side will have the best finish. If opposite side also has to have a better finish, stagger vibrators on both sides. Shown in Figure (1B).

WALL 8" THICK 18' HIGH - BOTH SIDES NEED TO BE VIBRATED IN STAGGERED ROWS.

GENERAL RULES FOR SELECTING, SIZING & PLACING EXTERNAL VIBRATORS, cont'd.

3. SIZING AND PLACING OF VIBRATORS (cont'd.)

- (C) *BRACKETRY*: The bracketry to be selected can be one of the standard brackets shown on the preceding applications or you can design your own in conjunction with VIBCO's application engineers.

4. VIBRATION PROCEDURE AND VIBRATION TIME

- (A) *VIBRATION PROCEDURE*: Place vibrators to be used in their lowest position. It's a good idea to pre-mark the vibrator positions using a paint spray can. Do not start vibrators until the concrete reaches them or is about 6" above them.

TIP: If internal vibrators are used, do not start the external ones until the internals have stopped or moved to a higher position. The reason is, internal vibrators throw air bubbles away from the vibrator head against form side leaving air holes and pockets on surface. External vibrators throw air bubbles into the mix, up and out, leaving surface against form smooth and blemish free.

- (B) *HOW LONG TO VIBRATE*: The time you need to vibrate varies depending on concrete slump, additives, stiffness of form, vibrator force, etc.

To determine the vibration time needed, it is advisable to make a test run; for example: On a column, take the time from the start of the vibrators to when the concrete reaches the 1/2 way mark to the next higher row, look at the concrete surface (use a flashlight if column is high). When no more air bubbles are breaking on the surface, and a glistening surface appears on top of the concrete, you have vibrated enough. The time this took is your vibration time for the vibrators in each position for all the columns of that size.

If you do not want to measure the time, you will have to watch the concrete surface for bubbles breaking and the glistening slick surface each time, before moving the vibrators.

NOTE: If the walls or columns are too high to determine the vibration time by observing air bubbles breaking on the surface – the contractors on page 8 and 13 elected to run the vibrators until the concrete reached the next higher row. The lower vibrators were then stopped, moved up and restarted. "Over-vibration" was a concern, but the tight rebars and the weight of the vibrated concrete prevented any segregation. It was the opinion that the concrete came out more homogenous with a better finish and strength. Caution should be taken if the concrete mix has a high slump with large aggregates.

TIP: "Over-vibration" is something every contractor is afraid of (when the aggregate and sand separate and all the aggregate ends up in lumps or at the bottom of the form). The concern is well founded, but it takes a long vibration time and a lot of vibration force to reach this point. Our experience has been to see "under-vibration" rather than "over-vibration," too little vibration time or force to get a homogenous mix free of air bubbles.

GENERAL RULES FOR SELECTING, SIZING & PLACING EXTERNAL VIBRATORS, cont'd.

5. HELPFUL HINTS AND CORRECTIONS AFTER THE FORM IS STRIPPED

- (A) Bleeding of cement and water: tighten seals in form or use less water or lower slump concrete.
- (B) Honeycomb: often from bleeding, but if not, increase vibration time. If honeycombing on lower surface, move vibrators close to bottom of form.
- (C) Small pin holes in finish: difficult to determine cause. Usually from too wet mix; additives or form oil; air entraining when form wall too flexible and flexes too much during vibration, sucking in air. Large pin holes: if all over, try to reduce water content, vibrate longer after pour, add additional vibrators or re-vibrate before initial set.
- (D) Separation of aggregates: vibration time too long or too much water in mix.

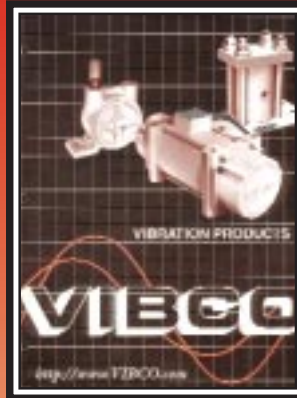
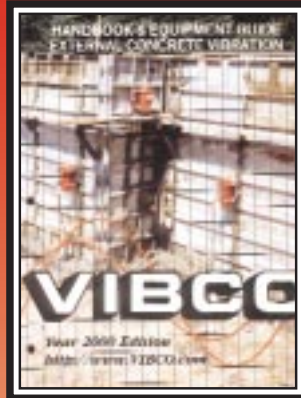
IF YOU HAVE ANY QUESTIONS
CALL AND ASK FOR ASSISTANCE
FROM A VIBCO
APPLICATIONS ENGINEER:

1-800-633-0032

Let us send you free copies of our catalogs
and discover all the VIBCO products designed
to help you work smart.

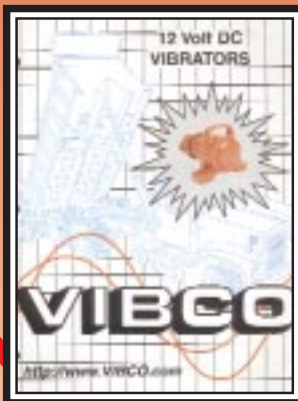
**HANDBOOK &
EQUIPMENT
GUIDE
EXTERNAL
CONCRETE
VIBRATION**

- How-To-Booklet
- 71 Application Photos
- Selection & Locating Guide
- Catalog #8401



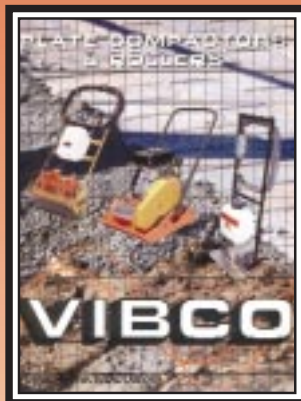
**GENERAL
CATALOG**

- Pneumatic Vibrators
- Electric Vibrators
- Hydraulic Vibrators
- Catalog #9001



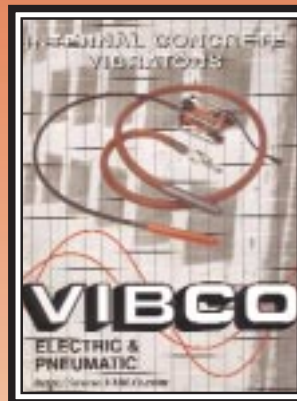
**12 VOLT DC
VIBRATORS**

- Dump body vibrators
- Salt & sand spreaders, etc.
- 20 to 3500 lbs. force
- Catalog #9112



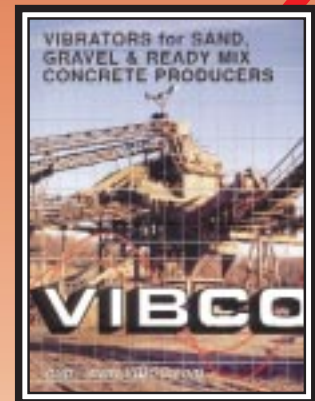
**PLATE
COMPACTORS &
ROLLERS**

- 12" to 24" plates
- Reversible and single directional plates
- Rollers 12" and 36" sizes available
- Catalog #9808



**INTERNAL
CONCRETE
VIBRATORS**

- Electric 1-3/8" to 2-1/2" Head Size
- Pneumatic 1-3/8" to 3"
- Interchangeable head and shaft
- Catalog #9123



**SAND & GRAVEL
VIBRATORS**

- 60 Application Photos
- Selection & Sizing Guide
- Pneumatic Electric & Hydraulic
- Catalog #9803

SILENT
We're the  Vibrator Guys!



VIBCO, INC.

75 Stilson Road, P.O. Box 8
Wyoming, RI 02898
E-Mail: vibrators@vibco.com
Phone: (401) 539-2392 / (800) 633-0032
FAX: (401) 539-2584
<http://www.VIBCO.com>

West Coast:
Phoenix, Arizona 85254
Phone: (480) 596-1809
(800) 633-0032
FAX: (480) 596-1614

Canada:
2215 Dunwin Drive
Mississauga, Ont. L5L 1X1
Phone: (905) 828-4191
(800) 465-9709
FAX: (905) 828-5015

SEE US AT www.VIBCO.com

CATALOG 0103