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VIBRAFORM MANUAL

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The VIBRAFORM manual is to be used as a basic instruction book on how to make conventional cement blocks and bricks. How to set up your 'VIBRAFORM' machine and how to maintain your 'VIBRAFORM' machine.

There are numerous factors to be taken into account when making quality blocks and bricks. The type of aggregate and cement use as well as the curing of the bricks and blocks are some of the factors that may have an influence on block and brick quality.

It is always important to do trial runs and mixes and have a reputable lab test the strength of your bricks and blocks. Lab reports should be filed and kept as a record.

Hydraform and/or Vibraform will not be held responsible for not achieving acceptable quality levels in block and brick production as the Vibraform machine owner and operator is responsible for quality control.

1. THE BASICS OF BLOCK AND BRICK MAKING

1.1 Input materials for a cement block or brick

➤ Aggregate

Aggregate is the stone, sand and ash you want to vibrate and compact down and bind together with the cement. A good aggregate is an aggregate that is free from chemicals, clay and organic material. A good aggregate will bond well with the cement paste and not react with it.

As a rule of thumb the denser your finished brick or block the stronger the brick or block will be. You must choose your aggregates according to your needs.

To achieve a dense block with an aggregate that can be vibrated and compacted down easily you need to have an aggregate with evenly graded particles ranging from fine dust up to larger stone of around 9mm. Blending different aggregates often produces the best results.

See Appendix A . Aggregates.

➤ **Cement**

Vibraform only recommends a SABS marked 42.5 MPa ordinary Portland cement.

Cement is your most costly material and by doing trials with different aggregates you will be able to minimize on cement content and so decrease your costs.

Cement should always be stored in dry place, off the floor and should be use within three months of the date of manufacture.

Never use cement that has lumps in it and only use cement from a well known brand that has an SABS mark of approval on it.

➤ **Water**

Only clean clear potable water should be used in the manufacture of the blocks and bricks.

Any organic material in water will prevent the cement from setting. Chemicals and impurities could also affect the strength of the end product.

Never use salty or brak water.

It is advisable to get your water tested for impurities.

1.2 **Brick and Block Making**

1.2.1 **Getting started**

Concrete Slab

A concrete slab on which you will make and cure your blocks and bricks is advisable. Your slab size would be dependent on the daily production of your machine and should be around 400m² for a weekly production of around 21 thousand bricks or 6 thousand blocks. Put a very gradual slope on your slab to allow for sufficient run off of water.

A concrete slab gives you the following advantages:-

- Less block or brick breakages
- Less contamination of aggregate
- A better surface to cure on

- Easier to move blocks/bricks

If you have a static machine it should be bolted down onto a thickened slab to prevent excess vibration transmitting through to your stacked and curing blocks.

Cement Storage

Cement can be supplied in 50kg bags or in bulk.

For large daily production bulk cement stored in a cement silo is recommended.

Bags of cement should be stored under cover off the floor and away from any damp conditions. Packing the bags close together also prevents any moist air circulation around the bags.

Always store the cement bags so that they are used on a first in first out basis. This will ensure that the oldest cement is used first.

Aggregate storage

The stockpile of aggregate should be protected from rain by storing it under a roof or covering it with plastic. Do not let the aggregate get contaminated with ground soil or any organic matter such as leaves from a tree. Position your aggregate close to your mixing plant.

1.2.2 Block Making process

Batch mixing

For high quality bricks and blocks a pan mixer should be used. For low quality bricks and blocks hand mixing on the ground can be used.

Always run a series of trials with different mix proportions. By evaluating your results you can adapt your mix to be more cost effective.

Start your trial mixes with 1 part cement to 6 parts aggregate. This translates to one bag of cement to 3 level wheelbarrows of aggregate. Test your block or brick strengths at 28 days.

Mixing process

Pan mixer

Place half of your aggregate into the pan mixer then add the cement followed by the remaining aggregate. Allow the cement and aggregate to mix dry until a consistent even colour is produced. Then start adding in water until the correct moisture content is reached.

By Hand

Spread your aggregate out over a concrete surface. Then add your cement by spreading it over your aggregate evenly. Shovel your aggregate up into a pile. Spread the pile out again and build it up into a second pile. Spread the second pile out again and add water by sprinkling it evenly over the spread out aggregate. Mix water into aggregate and then pile the mixture up for a third time. This method usually adequately mixes your batch. Hand mixing is labour intensive and time consuming. It also tends to be more wasteful.

Water content

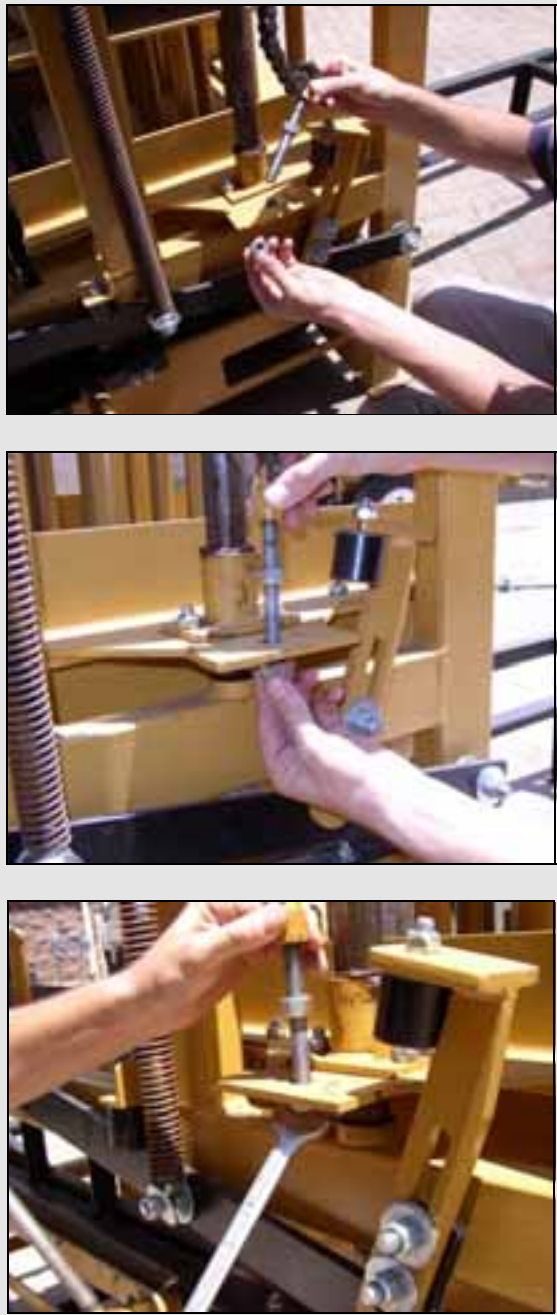
The moisture content within you mix is crucial. It is important for the following reasons:-


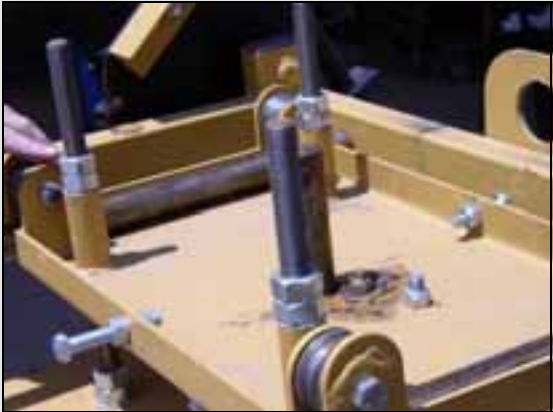

- The correct water content allows for good dense compaction by lubricating the aggregate. Too much water will lubricate the aggregate to such an extent that the block/brick will fall apart or sag when removed from the mould.
- With the correct water content the block/brick will release easily from the mould. No suction between the mould and block will be created.
- A very slight water rippling effect can be seen on the sides of the green blocks/bricks when the correct moisture content is reached.




Do not allow your mixed batch to stand for more than half an hour. This will prevent strength loss in your cement and the lubricating water will not dry off.




Your mix and aggregate may need to be adjusted to get a quality looking brick. See Appendix A for more details on type of aggregate.


1.2.3 Machine set up, maintenance and operation




<u>Adjustment</u>	Description
	<p>Connect lifting chains to mould box, using a 19 mm spanner and adjust to equal heights ensuring the mould box is laying flat on the pallet. This will ensure blocks/bricks will come out with equal heights.</p>




<u>Adjustment</u>	Description
  	<p>Use square tubing, cut to required brick height, as spacers. Adjust tamper level bolts using a 29 mm spanner. This is to get the blocks/bricks level over the entire mould.</p>




Adjustment	Description
	<p>Stopper adjusting bolt for tamper.</p>
	<p>Mould box locking mechanism adjustment bolts, ensure rubber stopper is firmly against the mould box.</p>
	<p>Ensure tamper carriage slide rods are greased at all times</p>




Operation	Description
	<p>Connect lifting chains to mould box, using a 19 mm spanner and adjust to equal heights ensuring the mould box is laying flat on the pallet.</p>
	<p>Load mix into load bay. After sliding tamper carriage to back along slides.</p>
	<p>Using the rake, push the mix into the mould box ensuring it is completely filled.</p>

<u>Operation</u>	Description
 <p>The first photograph shows a person's hand using a long-handled rake to push a light-colored, granular mix into a rectangular mould box. The mould box is positioned on a yellow conveyor belt. The second photograph shows the person continuing to push the mix further into the mould box. The third photograph shows the mix being pushed towards the end of the mould box, with some material spilling out.</p>	<p>Using the rake, push the mix into the mould box ensuring it is completely filled. Press the vibration button for pre-vibration and then fill the mould box again.</p>

Operation	Description
	<p>Pull tampers towards you, the scraper will remove any excess mix from the mould box.</p>
	<p>Push tamper lever to the left which will drop tamper into mould box.</p>
	<p>Lock mould box locking mechanism in place with your foot.</p>

<u>Operation</u>	Description
 	<p>Press vibration button for a few seconds.</p>
	<p>Unlock mould box locking mechanism with your foot. (see also next picture)</p>

Operation	Description
	<p>Unlock mould box locking mechanism.</p>
 	<p>Pull down on handle, lifting tamper and mould box together.</p>

<u>Operation</u>	Description
	<p>Place new pallet onto pallet loader.</p>
	<p>Push pallet loader handle towards back of machine to push out pallet with fresh bricks on and load new pallet.</p>
	<p>Carry pallets with fresh bricks on away to be cured.</p>

1.2.4 Curing of bricks and block

Curing is one of the most essential parts of brick and block production. Correct curing has a big effect on the quality of the end product and also the cost of the end product. Often with good curing the cement content of your blocks can be reduced drastically.

It is recommended that the freshly made green blocks are covered immediately with a 250micron black plastic and cured by keeping the plastic over the bricks/blocks for a minimum of 7 days. Remove the curing plastic briefly to thoroughly wet the blocks/bricks twice a day starting from the day after production.

A record should be kept with the curing block of when they were produced so the curing plastic can be removed on the morning of the eighth day after production.

With 7 days curing the bricks/blocks will have reached approximately 75% of their final strength.

1.3 Quantities and daily outputs

Vibraform Brick and Block Machines

Block and Brick outputs for Sand and Cement

(All values are theoretical and approximate and should be verified with trials)

A 1 to 12 mix is not recommended by Hydraform.

140mm Hollow Block (390 x 190 x 140)		(volume = 6.846 litres)
Mix 1 to 6 (Approximately 5 x 50kg bags cement per cubic meter of sand)		
Blocks produced		
1 cubic meter Sand		109
1x 50kg Bag Cement		22
Mix 1 to 8 (Approximately 4 x 50kg bags cement per cubic meter of sand)		
Blocks produced		
1 cubic meter Sand		110
1x 50kg Bag Cement		28
Mix 1 to 12 (Approximately 2.5 x 50kg bags cement per cubic meter of sand)		
Blocks produced		
1 cubic meter Sand		109
1x 50kg Bag Cement		44

140mm Maxi Brick (290 x 140 x 90)		(volume = 3.65 litres)
Mix 1 to 6 (Approximately 5 x 50kg bags cement per cubic meter of sand)		
Bricks produced		
1 cubic meter Sand		207
1x 50kg Bag Cement		41
Mix 1 to 8 (Approximately 4 x 50kg bags cement per cubic meter of sand)		
Bricks produced		
1 cubic meter Sand		206
1x 50kg Bag Cement		51
Mix 1 to 12 (Approximately 2.5 x 50kg bags cement per cubic meter of sand)		
Blocks produced		
1 cubic meter Sand		205
1x 50kg Bag Cement		82

Metric Stock Brick (225 x 112.5x 75)		(volume = 1.898 litres)
Mix 1 to 6 (Approximately 5 x 50kg bags cement per cubic meter of sand)		
Bricks produced		
1 cubic meter Sand		393
1x 50kg Bag Cement		79
Mix 1 to 8 (Approximately 4 x 50kg bags cement per cubic meter of sand)		
Bricks produced		
1 cubic meter Sand		397
1x 50kg Bag Cement		99
Mix 1 to 12 (Approximately 2.5 x 50kg bags cement per cubic meter of sand)		
Blocks produced		
1 cubic meter Sand		396
1x 50kg Bag Cement		158

Mampara Brick (220 x 110 x 70)		(volume = 1.694 litres)
Mix 1 to 6 (Approximately 5 x 50kg bags cement per cubic meter of sand)		
Bricks produced		
1 cubic meter Sand		441
1x 50kg Bag Cement		88
Mix 1 to 8 (Approximately 4 x 50kg bags cement per cubic meter of sand)		
Bricks produced		
1 cubic meter Sand		444
1x 50kg Bag Cement		111
Mix 1 to 12 (Approximately 2.5 x 50kg bags cement per cubic meter of sand)		
Blocks produced		
1 cubic meter Sand		441
1x 50kg Bag Cement		176

Super Mampara Brick (210 x 100x 70)		(volume = 1.47 litres)
Mix 1 to 6 (Approximately 5 x 50kg bags cement per cubic meter of sand)		
Bricks produced		
1 cubic meter Sand		507
1x 50kg Bag Cement		102
Mix 1 to 8 (Approximately 4 x 50kg bags cement per cubic meter of sand)		
Bricks produced		
1 cubic meter Sand		512
1x 50kg Bag Cement		128
Mix 1 to 12 (Approximately 2.5 x 50kg bags cement per cubic meter of sand)		
Blocks produced		
1 cubic meter Sand		508
1x 50kg Bag Cement		203

Method to Calculate output.

Calculate the density of your aggregate by weighing a known volume of the aggregate.

Density = mass / volume = kg per cubic meter

So if one 20 litre bucket of aggregate weighs 25kg then Density = $(25/20) \times 1000 = 1250\text{kg/cubic meter}$

So for a 1 to 6 mix the calculation would be as follows:

	Mass (kg)
Batch for 1 cubic meter of aggregate	
1 cubic meter of aggregate (see above)	1250
5 bags cement at 50kg per bag	250
140 liters of water at 1kg per litre	<u>140</u>
Total Mass	<u>1640</u>

Weigh a freshly made wet brick to get its mass.

So say the mass of one wet maxi brick = 7.9 kg therefore $1640/7.9 = 207$ bricks from one cubic meter of aggregate

APPENDIX A: AGGREGATES

There are a number of types of aggregates that can be used for brick and block making. These aggregates may need to be blended to suite the quality of the final product.

Never use aggregate that has clay, organic matter or excessive salts in it.

SAND

There are different types of sand. Some types are more suitable than others for use in brick and block making. Some types of sand may need to be blended with other aggregates to get the correct consistency and suitability.

COARSE RIVER SAND

This sand is usually very good for block/brick making. It should have particle sizes ranging evenly in proportion from fine dust up to 5mm in size.

Suggestions for use:-

- Unblended
- Mixed with fine sand
- Mixed with ash or slag
- Mixed with crusher sand and dust

Some coarse river sands do not have enough fines in them. This could result in the block/brick sagging and/or breaking. Add crusher sand or dust to help prevent this.

RIVER SAND

River sand of medium or fine grade can be used for block/brick making but choose sand that is evenly graded from fine dust up to 3 or 4mm in size. River sands are not as cohesive as crusher run sands and natural mined sands.

Suggestions for use:-

- Unblended

- Mixed with fine sand
- Mixed with ash or slag
- Mixed with crusher sand and dust

CRUSHER RUN SAND

This is usually very good for block/brick making. It tends to be more cohesive than other sands. This means that the block/brick compacts down well and the freshly made product does not fall apart easily. Crusher sand is also evenly graded from dust to larger particles. Always check that the crusher sand does not contain clay. Particle sizes should all be smaller than 5mm.

Suggestions for use:-

- Unblended
- Mixed with river or natural sands
- Mixed with a little stone

NATURAL MINED SAND

This sand is mined from quarries and occurs naturally. Slightly coarse evenly graded natural sand is the best for use with blocks and bricks. Natural sand is usually cohesive and makes a strong fresh product. Make sure the natural sand does not contain clay.

Suggestions for use:-

- Unblended
- Mixed with crusher run
- Mixed with a little stone

FINE SANDS, SEA SAND

These sands are not good for making blocks/bricks for the following reasons. They tend to have a high cement demand. They do not compact well and they do not produce a very cohesive mix.

Suggestions for use:-

- Always try and blend this sand with crusher run sand

STONE

Stone ranging from 5mm to 9mm can be used to blend in with finer aggregates. Stone used on its own will not work. Adding stone will often add strength to your cured product but could make the surface of the blocks/bricks more rough and porous.

ASH AND SLAG

Ash and slag by products from power stations, metal works and other industries are often used in block production. These materials are usually obtainable for very low costs.

It is important to get any ash or slag you use tested for its suitability for use with cement and other aggregates. Ash or slag may contain high quantities of unsuitable chemicals.