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A. Introduction

1) Welcome to Hydraform

Hydraform provides innovative and sustainable building technologies for the construction of both upmarket and low cost housing estates, schools, universities, clinics and commercial structures anywhere in the world.

Local communities can benefit from building with the Hydraform machine range: unskilled men and women become active participants in the building process. The practical experience gained and the training provided by Hydraform gives people an opportunity to empower themselves by learning new skills.

The Company was launched in 1988, with the objective of producing a cost effective building system for the Developing World.

The Company has sold machines in more than 50 countries on six continents. Hydraform products are used and trusted by many NGO’s, Governments, Private Investors, Developers, International Agencies, Mining Houses and Entrepreneurs worldwide.

Hydraform offers training worldwide. Full training in block production and building methods is provided on site with all the technical assistance whenever and wherever it is needed. Training and support can also be provided on site or the training school at the office in South Africa.

Hydraform is the leading manufacturer of interlocking block making machines, and also produces standard brick and block making machines (Vibraform machines), and roof tile machines.

The Hydraform system is different to conventional bricks in that it replaces regularly used bricks and mortar with Hydraform blocks that interlock and are dry-stacked.

Vibraform machines can make a range of cement products, from paving bricks, hollow cement blocks to retaining wall blocks. These products are more conventional and well known in the construction industry

The roof tile machines produce concrete roof tiles.
2) Machine Description

VIBRAFORM machines are conventional concrete brick, block and paver making machines. They make product by compressing and vibrating river sand, crusher dust, stone, ash, slag and other aggregates mixed with cement and water. VIBRAFORM machines are available in diesel or electric options.

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
- How to maintain your ‘VIBRAFORM’ machine

There are numerous factors to be taken into account when making quality blocks and bricks, it is therefore always important to do trial runs and mixes and have a reputable laboratory test the strength of your bricks and blocks on a daily, weekly and monthly basis. 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.
3) VIBRAFORM Machine Safety

Hydraform and Vibraform machines are equipped with safety signs which are there for your own protection and these signs must not be removed, replaced or tampered with.

It is important to give attention to your own safety and the safety of others around you. Please don’t disregard these signs. They are applied to the machine for your own safety.

No hands: this sign shows you that no hands must be in the area especially when the machine is in operation.

These signs indicate the moving parts on the specified machine and must not be tampered with during operation. These parts could cause serious damage.
4) Disclaimer

**Machine, Training and Building Manual**

This manual has been prepared for the clients use as to advise on the best possible use of the machines and block making systems. The manual incorporates years of experience in the field.

**Other Factors to be considered**

Soils, cements, mix preparations, material codes, building materials, building codes, local regulations, external conditions etc are all important considerations to take into account to produce quality product and achieve acceptable building standards.

**Disclaimer**

Hydraform cannot be held responsible for not achieving acceptable quality levels in block production, building and construction due to the many factors that are out of our control.
5) HYDRAFORM WARRANTY (for office use)

HYDRAFORM
ESTABLISHED 1988

WARRANTY REGISTRATION CERTIFICATE

The manufacturers guarantee that the machine is free from defects of design, workmanship, and material for a period of 6 months from the date of delivery.
The guarantee is confined to defects, which render the machine unusable or materially impair its function due to faulty materials, workmanship or design. Defects of this nature should be notified at once in writing to the nearest Hydraform office, and substantiated. Replaced parts become the property of the manufacturers. The manufacturers will meet all reasonable costs of the replacements in all cases of expressly admitted claims. Repairs require the prior permission of the manufacturers. The guarantee does not apply to natural wear and tear, nor to defects resulting from negligence or misuse. The guarantee becomes null and void in the event of failure to observe the operating instructions or if the machine is repaired by the purchaser or third parties without authorization by the manufacturers.

MACHINE TYPE______________________DELIVERY DATE______________

SERIAL NUMBER_________________________

ACCEPTED CLIENT_______________________

DATE_________________

In order for the machine warranty to be activated please email/fax a signed copy of this page to:

(fax) + 27 11 913 2840
(email) info@hydraform
WARRANTY REGISTRATION CERTIFICATE

The manufacturers guarantee that the machine is free from defects of design, workmanship, and material for a period of 6 months from the date of delivery.

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MACHINE TYPE______________________DELIVERY DATE______________

SERIAL NUMBER_________________________

ACCEPTED CLIENT_______________________

DATE________________
B. The Basics of Block and Brick Making

1) Input Materials for Cement Blocks and Bricks

1.1) 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/graded materials often produces the best results.

See Appendix A. Aggregates.
1.2) Cement

Vibraform only recommends 42.5 MPA (or higher) ordinary Portland cement (OPC). If this grade is not available a higher percent of 32.5 MPA must be used in the product mix.

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 used within three months of the date of manufacture.

Never use cement that has lumps in it and only use cement from a well-known, quality brand.

Cement sets when mixed with water by way of a complex series of hydration chemical reactions. The different constituents slowly hydrate and crystallise while the interlocking of their crystals gives the cement its strength after the initial setting. Immersion in warm water will speed up the setting. The time it takes for cement to set varies; and can take anywhere from twenty minutes for initial set to twentyfour hours, or more, for final set.

1.3 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.

**Brak water / contaminated water**
2) Quantities and Daily Outputs – Based on volume batching

2.1) Block and Brick Outputs for Sand and Cement

Vibraform Brick and Block Machines

**Block and Brick outputs for Sand and Cement**

Bag cement = 33 litres

1000kg sand (material) = 1m³

Blocks: 20% additional vibration compaction

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

Mixes are subject to change if using higher MPA cements or with variations in types of materials i.e. aggregates used.

*Note: 1 wheelbarrow = 65 litres

**140 mm Maxi Brick (290 x 90 x 140)**

Volume = 3.65 litres + 20% compaction = 4.38 litres

**Mix 1 to 6**

- 3 wheelbarrows aggregate (195 litres)
- 1 x 50kg bag cement (33 litres)
- Total: 228 litres
- Bricks produced = 52

**Mix 1 to 8**

- 4 wheelbarrows aggregate (260 litres)
- 1 x 50kg bag cement (33 litres)
- Total: 293 litres
- Bricks produced = 66

**Stock Brick (220 x 105 x 72)**

Volume = 1.66 litres + 20% compaction = 2 litres

**Mix 1 to 8**

- 4 wheelbarrows aggregate (260 litres)
- 1 x 50kg bag cement (33 litres)
- Total: 293 litres
- Bricks produced = 146
**Super Brick (220 x 100 x 90)**
Volume + 20% compaction = 2.38 litres

Mix 1 to 8
- 4 wheelbarrows aggregate (260 litres)
- 1 x 50kg bag cement (33 litres)
- Total: 293 litres
- Bricks produced = 123

**Hollow Block 4” (390 x 190 x 90)**
Volume + 20% compaction = 8 litres

Mix 1 to 8
- 4 wheelbarrows aggregate (260 litres)
- 1 x 50kg bag cement (33 litres)
- Total: 293 litres
- Blocks produced = 36

Mix 1 to 10
- 5 wheelbarrows aggregate (330 litres)
- 1 x 50kg bag cement (33 litres)
- Total: 363 litres
- Blocks produced = 45

**Hollow Block 6” (390 x 190 x 140)**
Volume + 20% compaction = 12.45 litres

Mix 1 to 8
- 4 wheelbarrows aggregate (260 litres)
- 1 x 50kg bag cement (33 litres)
- Total: 293 litres
- Blocks produced = 23

Mix 1 to 10
- 5 wheelbarrows aggregate (330 litres)
- 1 x 50kg bag cement (33 litres)
- Total: 363 litres
- Blocks produced = 29.2
**Hollow Block 8” (390 x 190 x 190)**

Volume + 20% compaction = 16.9 litres

**Mix 1 to 8**

- 4 wheelbarrows aggregate (260 litres)
- 1 x 50kg bag cement (33 litres)
- Total: 293 litres
- Blocks produced = 17

**Mix 1 to 10**

- 5 wheelbarrows aggregate (330 litres)
- 1 x 50kg bag cement (33 litres)
- Total: 363 litres
- Blocks produced = 21.5
2.2) 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) x 1000 = 1250kg/cubic meter

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

<table>
<thead>
<tr>
<th>Batch for 1 cubic meter of aggregate</th>
<th>Mass (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 cubic meter of aggregate (see above)</td>
<td>1250</td>
</tr>
<tr>
<td>5 bags cement at 50kg per bag</td>
<td>250</td>
</tr>
<tr>
<td>140 liters of water at 1kg per litre</td>
<td>140</td>
</tr>
<tr>
<td><strong>Total Mass</strong></td>
<td><strong>1640</strong></td>
</tr>
</tbody>
</table>

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.

3) Block and Brick Making

3.1) Block making process

The block density is a good indicator of weight. By weighing the block, you will be able to ascertain its density. Always be aware of breakages to the corners and edges of your product. Strength can be tested by knocking two blocks together after curing and being dried out. A ringing sound indicates good strength while a hollow sound means that the blocks are weak.

3.2) Batch mixing – Volume batching

For high quality bricks and blocks a pan mixer must 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 you 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.
The strength of concrete depends on the relevant proportion of water and cement. Therefore the higher content of water the weaker the concrete. Water used per 50kg of cement should be 0.4 x50kg or 20 litres. The mixes used for block making are semi dry, the water acts as a lubricant and helps with the compaction of the product via pressure or vibration.
Test your mixes:
- Make a ball of concrete in your hand
- If the mix is too dry the ball cannot be formed and will crumble
- If too wet it loses its shape and moisture sticks to your hand

If the content is about right, a ball will be formed and slight water sheen can be seen on the surface of the concrete mix.
Try and measure the water content added so that you can establish the correct amount needed per mix. This will still vary due to the water content in the aggregate being used.
3.3) Mixing Process

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.
3.4) Water Content

The moisture content within the 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.

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.

3.5) Getting Started - Concrete Slab

A concrete slab on which you will make and cure your blocks and bricks is advisable. Your slab size is dependent on the daily production of your machine and should be around 600m² for a daily production of around 10 thousand bricks or 3 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:-

- Should always be used for the movable machine
- Less block or brick breakages
- Less contamination of aggregate
- A better surface to cure on
- Easier to move blocks/bricks
3.7) Cement Storage

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

For large daily production - 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.

3.8) 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.
C. Machine Setup, Maintenance and Operation

1) Machine View with Labels

1. Tamper Trolley with Mounting
2. Vibration Button
3. Hopper
4. Mould Box Mount
5. Mould Box Lift Arm
6. Mould Box
7. Tamper
2) Yard Setup with Diagrams
2.1) Organising Your Site

These are the things that you must think about in order to turn your site into an efficient Brick/Block yard.

- **ACCESS**: Trucks must be able to deliver your materials easily and take away your bricks and blocks. This must not get in the way of the people making your products.

- **STORAGE FOR MATERIALS**: The sand and stone must be stored close to where you mix the concrete and in piles separated by a wall or partition. Make sure that rain water drains away easily. You must take even greater care of your cement stock because it will go hard and be unusable if it gets wet. Do not stack the pockets straight on the ground because they will absorb moisture from the soil. Protect the pockets from rain.

- **PRODUCTION AREA**: Your days production of bricks/blocks cannot be moved for at least a day. Therefore the ideal size of the slab must be large enough for two days production.

- **PRODUCT**: The bricks and Blocks that you have made should be stacked reasonably close to the production area and in a place that is good for loading trucks.
### 3) Product Making With Machine

<table>
<thead>
<tr>
<th>Adjustments</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1" alt="Adjustment Image" /></td>
<td>Adjust lifting chains to give sufficient and even lift on the mould box.</td>
</tr>
<tr>
<td><img src="image2" alt="Adjustment Image" /></td>
<td>Adjust forward slide stop bolt to a position so that the tampers just clear the mould box.</td>
</tr>
</tbody>
</table>
Adjust the return stop bolt so that the tampers lie directly over the mould box and the tamper falls in and out of the mould box easily.
<table>
<thead>
<tr>
<th>Maintenance</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1.jpg" alt="Maintenance Image" /></td>
<td>Check motor, electrical connections, pulleys and V-belts daily before production starts.</td>
</tr>
<tr>
<td><img src="image2.jpg" alt="Maintenance Image" /></td>
<td>Daily clean and grease all slide shafts.</td>
</tr>
</tbody>
</table>
Use a grease gun to grease the vibration shaft bearings once a week.
<table>
<thead>
<tr>
<th>Operation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Move the machine into position over a smooth concrete surface and lower the mould box onto the slab by lifting the mould box lever arm into the up position.</td>
</tr>
<tr>
<td></td>
<td>Push the Tampers forward along the slides to give you access to the mould box</td>
</tr>
</tbody>
</table>
Tip the batch mix into the load tray using a wheel barrow.

Use the rake to push the mix over and into the mould.
Level off the mix with the top of the mould box

Pre-vibrate by giving a short push on the vibration button.
Re-fill and level the mould box after pre-vibration.

Using the rake pull the tampers back over the mould box.
Drop the tampers onto the mix in the mould box by shifting the tamper release lever over to the left.
Push the vibration button until the height adjusting nuts touch the top of the tamper carrier bushes.
Lift the mould box up off the compacted blocks by pulling down on the mould box lever arm.

Roll the machine forward and away from the freshly laid blocks and start at the beginning for next blocks.
4) Product Mould Changing and Machine Setting

<table>
<thead>
<tr>
<th>Operation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1.jpg" alt="Operation Image" /></td>
<td>Set the mould box in front of the machine with the pulley facing the motor.</td>
</tr>
<tr>
<td><img src="image2.jpg" alt="Operation Image" /></td>
<td>Push the machine over the mould as shown. Lift the handles up to allow the mounting plates to align with mould box holes.</td>
</tr>
</tbody>
</table>
Place nuts and bolts to hold the mould in place. Do not tighten fully yet.
Lift the tamper to the tamper carrier and insert nuts and bolts.

Once all nuts and bolts are in place it is safe to tighten the mould box.
Once the tamper has been set with the mould box it should be tightened.
Loosen the bolts on the hopper and adjust to be level with the mould.
Add your height adjusters to the mould.
Pull on lever to drop tamper on the height adjusters. This would give your required product height.

Lower tampers into mould box onto height adjusters. Adjust the four levelling bolts, to get an even height over the whole mould box.
D. **Curing Of Bricks and Blocks**

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. Blocks and Bricks are usually sold after 7 days curing whereas pavers should be cured for a minimum of 14 days.

E. **Maintenance**

1) **Start of Operation**

Before the day begins, perform the following tasks:

- Grease the pillow blocks (bearings that rotate the vibrator shaft on mould)
- Check bolts and tighten
- Adjust chain tension on arms
- Check tension on pulley
- Check that the motor is securely fixed
- Check the mould height adjuster are correct for current mould production
- Clean the concrete slab of all stone or sand as this could affect product quality and heights

2) **End of Operation**

After the day’s work, the residual cement/mix should be cleaned from the machine and mould box. For hardened dirt, a metal scraping brush can be used.

Hitting the tamper to remove dirt should be avoided as this may damage the legs over time and could affect the quality of the brick/block made.

After every shift the machine needs to be cleaned thoroughly. We strongly recommend that after each cleaning, the machine is washed down or sprayed with diesel. This prevents concrete from sticking to the metal and makes cleaning the next day much easier. After the production day the machine should be moved to a secure location and locked up until the next production day.

3) **Periodical**

- Check handles and arm chains for wear
- Check for visible cracks in the frame/arms in cases of heavy long-term usage
- Check mould cavities are still shapely
- Check thread on height adjusters
- Check bearings on a mould box are in good working order
- Check all pulleys for wear
- Check wheels are functional and working correctly

**F. Trouble Shooting**

1) Machine Related

**Insufficient Vibration.**
Check the mould box is sitting level on the concrete slab. Also check the vibration shafts, bearings, pulleys and v-belts for wear and correct operation.

2) Product Related

**Product Heights not achieved.**
First that the machine is set up to the moulds heights, check the height adjusters (threaded bars) are set equally to the height of the product being produced.

Insufficient vibration could also cause desired product height not to be achieved.

Different materials may require different water contents / mix designs / vibration duration to achieve desired product height.

**Crumbles or breaks.**
This shows the product has low strength. Adjust your mix and make sure you have the correct amount of water, cement and aggregate ratios. Check B-3.2 Batch Mixing (pg 17).

**Corners break.**
This shows that there is little compaction check mix and adjust machine accordingly. See Appendix A for more details on type of aggregate.

**Porous surface.**
The product has too many large particles. Adjust your mix accordingly and add a bit more fine particles. See Appendix A for more details on type of aggregate.

**Dense surface.**
The product has too many small particles. Adjust your mix accordingly. See Appendix A for more details on type of aggregate.

Too many fines can also cause product height to be too high

3) Spare Parts and Enquiries

Contact aftersales@hydraform.com for any spares enquiries or call - 011 913 1449.
G. Guarantee Details

Guarantee period is 6 months from the ETA date according to the standard guarantee conditions. The guarantee excludes fair wear and tear.

1) Items not included in the guarantee

- Maintenance
- Oils, grease and filters
- Electrical material defects
- Does not include anything that has not been quoted for

2) Clients Responsibility

- To arrange all extra material needed, e.g. Hydraulic oils, aggregate, cement etc...
- The client will provide 2 persons, 8 hours per day for help with installation without charge (locally).

3) Client to Supply

- Cranes and forklifts for loading
- All electrical works on the machine to be done by a qualified electrician
H. 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; they do not produce a very cohesive mix; and the high salt content is corrosive to all metals including.

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.