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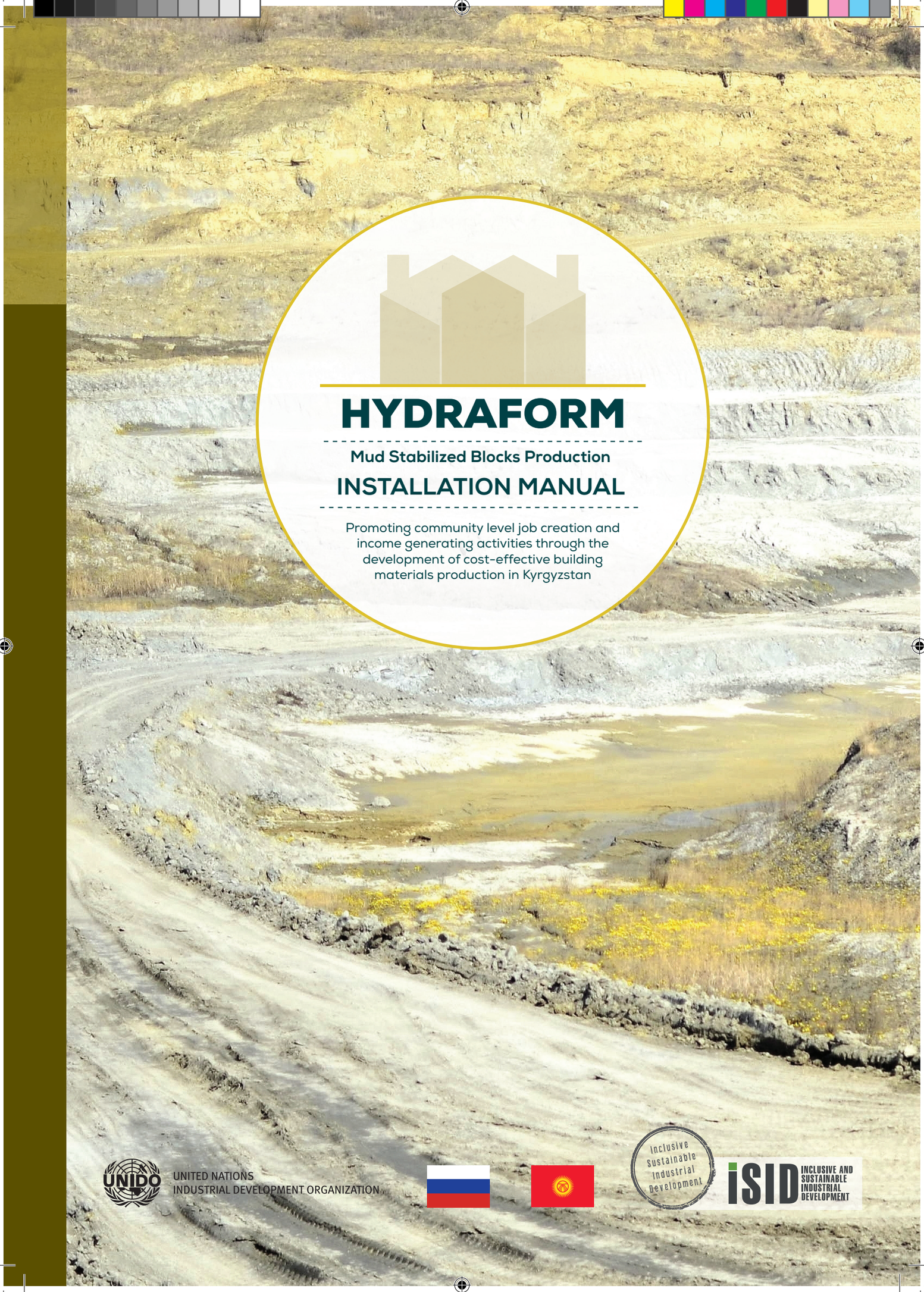
UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
Vienna International Centre, P.O. Box 300, 1400 Vienna, Austria
Tel: (+43-1) 26026-0 · www.unido.org · unido@unido.org



HYDRAFORM

Mud Stabilized Blocks Production

INSTALLATION MANUAL

Promoting community level job creation and income generating activities through the development of cost-effective building materials production in Kyrgyzstan

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Vienna International Centre
P.O. Box 300, 1400
Vienna, Austria
Telephone: (+43-1) 26026-3570
Fax: (+43-1) 26026-6842
E-mail: IUMP@unido.org
http://www.unido.org/iump

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HYDRAFORM

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INSTALLATION MANUAL

Dear Hydraform Machine Owner

This manual has been prepared to assist you in block making and building using HYDRAFORM Machine and HYDRAFORM BUILDING SYSTEM.

Please ensure that this manual is read and understood by your trained operator in conjunction with formal Hydraform Training.
For any clarification please contact:

For any clarification please contact:

Hydraform (India) Pvt. Ltd.
602 –B, Ansal Majestic Tower, PVR Complex
Vikas Puri, New Delhi-110018, India
Ph. 91 11 28542642/ 43
www.hydraformasia.com
Email: info@hydraformindia.com

Hydraform SA (Pty) Ltd.
P.O. Box 17570, Sunward Park, Boksburg
1470, South Africa
Tel : +27(0) 11 913 1449
Email: Sales@hydraform.com

Machine, Training and Building Manual
Hydraform manual has been prepared for clients' use to advise on the best possible use of the machine, block making and building system incorporating years of experience in the field.

"Other Factors" to be considered
Soils, Fly Ash, cements, Coarse Sand, Crusher Dust, Gypsum, Lime, mix preparations, material codes, building materials, building codes, local regulations, external conditions, site logistics, labour efficiencies and supervision etc. are, all important to produce a quality block and achieve acceptable building standards.

Disclaimer
Hydraform (India) Pvt. Ltd. Cannot be held responsible for not achieving acceptable quality levels in block production and building as the "Other Factors" are out of our control.

1. INTRODUCTION

This manual should be read in conjunction with the Hydraform Building, and Machine Manuals, which are supplied with your machine. This manual has been written both to offer first hand knowledge and guidance about Block Production running and maintaining the Machines.

STABILIZED SOIL BLOCKS

Hydraform machines can produce 'stabilized soil blocks'. The ideal 'stabilizer' is Ordinary (or Normal) Portland Cement (OPC); this is mixed with subsoil and about 5%- 10 % water to produce a mix which feels slightly moist. The mix is molded under high pressure to produce interlocking blocks.

FLY ASH BLOCKS

Hydraform machines can produce "Fly ash blocks" with combinations of coarse sand/stone dust, cement or lime/gypsum from HYDRAFORM machine.

Advantages: Hydraform blocks can be made:

- much stronger than hollow cement blocks, bricks or other locally available alternatives;
- considerably less expensive than hollow/solid concrete blocks ;
- made on site, so transport costs are eliminated;
- environmentally friendly – low energy input and no depletion of trees for burning, does not use top soil meant for agriculture purpose, uses waste like fly ash and other materials;
- most attractive, with a face-brick appearance in the natural colours of different soil/fly-ash, with beveled edges;
- as interlocked to facilitate fast construction because the blocks can be largely dry stacked (built without mortar).

2. HYDRAFORM MACHINES

THE HYDRAFORM RANGE

Hydraform manufactures a wide range of block making machines. Machines are either in stationary or Mobile platform in the M7 series, with varying production capacities running on electric or diesel engine. The specifications are:

MACHINE	POWER	PRODUCTION RATING	TYPE	ATTACHMENT/ OTHER INFO
M7MI	11Kw diesel Engine/Electric Motor (3 phase 440 Volts)	Up to 200 Blocks/hr	Mobile	With Integrated Pan Mixer (+-140 ltrs) on mobile platform
M7D	10KW Diesel Engine/ 7.5 k.w Electric Motor	Up to 200 Blocks/hr	Mobile	
M7E	7.5 Kw Electric Motor	Up to 200 Blocks/hr	Stationary	
M7S2E	11 Kw Electric Motor	Up to 400 Block/hr	Stationary	Twin workstation with Common Power Pack and extended hoses
PAN MIXER	7.5 k.w Electric Motor	Up to 450 ltrs	Stationary	Suitable for 2x M7E or one M7S2E

Note: The above specs are indicative and may change without notice. Please consult Hydraform on actual specs.

POWER SOURCES

Hydraform blockmaking machines are available with two different power sources: diesel engines or electric motors of reputed makes.

3. SITE MANAGEMENT

BLOCK MAKING LABOUR

The following workforce is the labour requirement to achieveoptimum daily production up to 1,500 blocks, with all activities taking place simultaneously:

	TASKS	LABOUR
1	Mixer Loading, mixing & unloading	2
2	Feeding in Hopper	1
3	Block machine operator	1
4	Block Lifting & Stacking	2
5	Curing of Blocks	1
	TOTAL	7

* if Soil/sand is not sieved than 2 extra person will be required

BLOCK PRODUCTION

We recommend that the block making crew be employed as a team of contract workers who are paid for per satisfactory block produced. The Team Leader reports to the Foreman who supervises production and assesses block quality.

SITE ORGANISATION

The Foreman running a block making site must ensure that:

- Prepared soil/fly ash and other raw material is always available for the machine – the machine must not stop making blocks;
- Each heap mixed contains the correct amount of soil or fly ash, coarse / river sand and cement; it is easy to lose count of the number of wheelbarrows tipped on to a heap;
- Correct block length and quality are maintained;
- The blocks are covered immediately they are made and do not dry out during the 14-day curing period;
- The Hydraform machine is checked and correctly maintained and is cleaned every day – the cement/sand/soil / ash mixture is very difficult to remove after 48 hours
- The following day's work is planned the day before, and
- All workers are aware of safety precautions to be taken around the machine, particularly the pre-compression ram.

4. MATERIAL SELECTION

SOIL / FLY ASH SELECTION & STABLISATION

Main raw materials for manufacturing of SOIL based blocks consists of;

- Soil
- Cement (OPC grade)
- Coarse Sand / Stone dust (if required)
- Water (Potable quality)

The term soil stabilisation implies improved in strength and durability of soil i.e a less stable soil after treatment improves the strength and resistance to erosion and water absorption with purpose for which it is adopted whether it is for roads, buildings, embankments etc.

The use of chemical admixture of various types is the oldest and most widely used technique. We know that soil mass consists of air & water voids. Air present in voids can be expelled out of voids when the soil is kept in contact with water but the increase in moisture content or reduction can be attained with mechanical compaction with optimum moisture content.

A variety of soils can be stabilised by using cement in range of 5-12%, which leads to increase in strength & water resistance properties.

The soil used in SOIL-CEMENT mixture for construction of blocks shall be free from deleterious contents such as organic matter of vegetable origin, mica, and saline impurity. Its grading shall be such as to require the least amount of admixture to make it suitable for stabilisation with cement. Black cotton soil & similar soil, which are uneconomical to stabilise shall be excluded. Soil with ph value less than 7.0, soil containing more than 0.5% organic matter are avoided.

A) SOIL: This consists principally of sand, clay and silt. Hydraform blocks cannot be made from pure sand (which cannot be compressed) or from soil with a very high (>30%) clay content. High-clay soils require the addition of sand, and a higher cement content, to prevent the blocks from cracking.

B) CLAY: This is 'plastic' – it expands and contracts – giving the soil the necessary 'plasticity' for stabilized soil block making. Excessive clay content causes surface cracking when it 'relaxes' after high compression. Most often, these cracks are less than 1 mm deep, but blocks made from soils with very high clay contents can crack right through. Remember that the deeper you dig, the higher the clay content you are likely to find.

C) SELECTING SOIL: Dig a hole 1 m deep and examine soil taken from the bottom. If cracked lumps appear, the soil has high clay content. If it is very sandy, dig deeper to see if there is more clay.

D) TOPSOIL: Topsoil is not used because organic matter (roots, leaves, and grass) inhibits setting of the cement.

E) SOIL TESTS: The most commonly-used test is to compress a 'sausage' of slightly moist (not wet) soil in the hand, then open the hand; if the sausage does not feel 'sticky' from high clay, and breaks cleanly under thumb pressure, the soil is probably suitable for making blocks. However to have better quality of soil, for block production, the soil to be used should be got tested from reputed labs for PARTICAL SIZE DISTRIBUTION ANALYSIS and the normal range of ingredients of soils, if falls in the range shown below can be used for block production.

PARTICLE SIZE	OPTIMUM GRADING	ACCEPTABLE RANGE
FINE GRAVEL	7%	0-10%
COARSE SAND	30%	20-35%
FINE SAND	23%	20-30%
SILT	20%	15-30%
CLAY	20%	10-30%

The quality of these blocks shall conforms to IS-1725 (Testing of Engineering soil as per IS-2720, part-4)

F) TEST BLOCKS: Once you have selected your soil, make four or five test blocks without cement, cover them with polythene and inspect closely after two hours; if there is no cracking on the block surface, the soil is suitable.

FLY ASH BASED RAW MATERIAL COMBINATION

Fly ash is a useful by-product from thermal power using pulverized coal as fuel and has considerable pozzolanic activity .This national resources can be gainfully utilized for manufacturing of FLY-ASH blocks as a supplement to common burnt clay building bricks leading to conservation of natural resources and improvement in environment quality.

Fly ash based blocks are obtained from mixture, consisting of fly ash in major quantity, lime and/cement and an accelerator acting as a catalyst. Fly ash blocks are generally manufactured by inter grinding or blending various raw materials which are then moulded into blocks and subjected to curing cycles. Coarse sand is also used as a raw material to control water absorption in the final product.

RAW MATERIALS USED

It can be a combination of following:

- Fly Ash
- Coarse Sand / Crusher Dust
- Cement
- Gypsum (optional)
- Lime (Optional)

QUALITY OF MATERIAL

Fly Ash shall confirm to IS:3812-1981 Grade – 1 or Grade – 2

- Sand shall generally confirm to the requirement of IS: 2116 – 1980 or IS: 383 – 1970. (Except for the particles size grading which shall confirm IS: 2116 - 1980)
- Cement shall confirm to IS: 269 – 1976 or IS: 455 – 1976 or IS: 1489 – 1991 for ordinary Portland cement (OPC).
- Gypsum, Anhydrite, a by product of aluminum fluoride industry with Ca SO4 purity of 96% or more than 80%.
- Water shall be potable IS: 456 – 2000.
- Lime shall confirm to class C hydrated lime of IS: 712: 1984.
- Crusher dust shall confirm that particles are not bigger than 4-6 mm.
- Raw material should be in powdered / crushed form to get best results.

NOTE: Since raw materials change from site to site, please consult Hydraform engineers for proper raw material and mix design, block making process and quality control procedure.

MIX RATIOS OF RAW MATERIALS

Mix Ratios. The higher the cement content of a mix, the stronger the blocks will be. Wheelbarrows are used to measure soil, and cement is usually packed in 50 kg bags or 'pockets':

- a standard builder's wheelbarrow contains 65 litres, and
- a 50 kg bag of cement contains 33 litres, so
- 1 wheelbarrow holds 2 pockets of cement, (as a thumb rule).

A) SOIL BASED

NO.	MATERIAL	PERCENTAGE
1	Soil	30%-60%
2	Coarse sand	40%-60%
3	Cement	8%-12%

B) FLY ASH BASED

NO.	MATERIAL	PERCENTAGE
1	Fly Ash	40% - 50%
2	Coarse Sand	30% - 50%
3	Cement	8% - 12%
4	Gypsum	2% - 5%

C) Check the capacity of your wheelbarrows by filling them with soil, using a graduated container.

NOTE: A standard builder's wheelbarrow filled to rim level contains 65 litres; the same wheelbarrow, heaped to maximum capacity, will hold 92 litres.

The above ratios of different raw materials is indicative type only, however the actual design mix shall depend upon the block strength requirements and quality of materials based on field lab test.

MOISTURE CONTENT

This determines block length:

- The drier the mix, the longer the block and, conversely,
- The wetter the mix, the shorter the block.

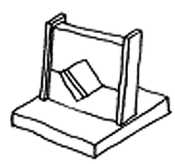
5. TOOLS AND EQUIPMENT

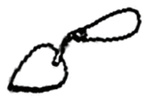
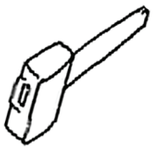
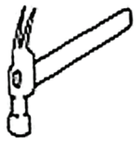
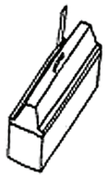
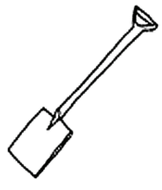
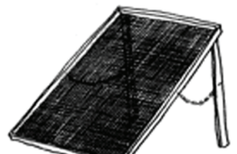
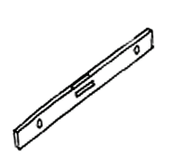
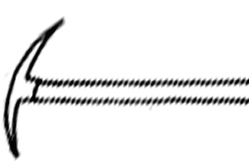
TOOLS & EQUIPMENT FOR BLOCK MAKING SOIL DUG ON SITE

The following tools and equipment are required:

- 2 No. soil sieve with up to 6 mm mesh, size 1.2 m x 2.4 m (see sketch);
- 3 No. builder's wheelbarrows, preferably heavy duty;
- 4 No. hoes, for digging soil;
- 6 No. round- or square-nosed shovels with steel shafts, for loading and mixing soil;
- 1 to 2 No. picks, as necessary;
- 1 No. galvanized or plastic bucket, 10 to 15 litres, for loading soil into the hopper;
- 2 No. watering cans, c/w roses;
- 1 No. block measuring tool (see sketch);
- 1 No. 100 mm paintbrush or block brush, for brushing loose soil/ fly ash off blocks and machine;
- 1 No. fuel funnel;
- 1 No. paint scraper, 2 in or 4 in, for cleaning the wear plates and ram heads;
- 1 No. open-ended spanner, 17 mm, for various uses on the engine and machine;
- 2 No. ring or open-ended spanners, 13 mm, for adjusting the machine hydraulic pressure;
- Diesel engine tool kit (in case of engine)
- 1 No. drum, 20 litres, for diesel fuel;
- 2 No. drums, 210 litres, with open tops for water storage (if water is not piped to the site);
- 1 No. container axle grease, 500 g, for wheelbarrow wheels and the machine top ram assembly;
- 1 No. engine oil, SAE 40, 5 litres;
- 1 No. roll (per week's production planned) polythene sheeting, 75 to 100 micron, 3 m x 100 m rolls.

TOOLS FOR PRODUCTION AND CONSTRUCTION

				
30 M TAPE MEASURE	5 M TAPE MEASURE	WIRE CUTTER	PLIERS	BUILDER'S LINE
				
BRICK HAMMER	PAINT BRUSH	LINE HOLDERS BOBBINS	STEEL CHISEL	BLOCK CUTTER SUPPLIED WITH M7

				
JERRY CAN FOR DIESEL (20-25 L)	WATERING CAN	10 L BUCKET	STEEL BOLSTER CHISEL	WATER LEVEL
				
BLOCK BRUSH	WOOD FLOAT TROWEL	40 mm STEEL SCRAPER	LARGE TROWEL	SMALL TROWEL
				
4 POUND HAMMER	2 POUND HAMMER	RUBBER HAMMER	STEEL FLOAT	CORNER STEEL FLOAT
				
WHEELBARROW	FIRST-AID KIT	TOOLBOX	SPADE	SHOVEL
				
GAUGE ROD 1M X 30 MM	WOOD PROFILES 38 X 38 MM 152 X 38 MM	PLASTIC ROLL 2.2 M X 2.2 M	SIEVE: 8 MM MESH IN METAL FRAME 2 M X 1 M WIDE WITH STAND	
				
FACTORY BROOM	1 M AND 3 M SPIRIT LEVEL	METAL SQUARE	PICK AXE	

HYDRAFORM BLOCK TESTER

It measures the compressive strength of blocks, easily and efficiently. Casted block which has been cured for a period of 7-14 days and after 3 to 4 weeks can be tested to ascertain the Wet and Dry field compressive strength resp. Block gains maximum strength after 28 days hence it should be tested after 28 days to ascertain the Block strength. Clean the two crushing pads before testing a block, and ensure that they lie absolutely flat against the block surfaces, otherwise a falsely (low) reading may be indicated by the block tester. Block gains full strength after 28 days and thus be tested for full strength after 28 days and when dry.

6. BLOCK STATISTICS

A standard 220 mm Hydraform block weighs between 10- 12 (approx) kg (depending on raw material and mix used) and measures:

- width 220 mm (8.7 in);
- depth 115 mm (4.5 in);
- Length 210 mm (8.3 in) to 230 mm (9.1 in) for soil based & length 220mm (8.7in)to 240mm(9.5in) for fly ash based blocks, dependent on the moisture content of the mix and the soil./fly ash blocks resp. which are longer or shorter should be broken up and re-made.

OTHER HYDRAFORM BLOCKS

Interchangeable moulds are available for a variety of blocks including the plane edged and without Interlocking block.

BLOCK LENGTH

This is regulated by controlling the moisture content of the soil. The ideal block length is 220/230 mm, and this length must not vary by more than 10 mm either way. Maximum length can be of 230/240 mm, and minimum length 210/220mm, except for half blocks.

MEASURING BLOCKS

Small length variation does not affect the construction as it gets adjusted in the length of the wall. In order to achieve straight 'bonds' (the vertical joints between blocks in a wall), it is most important that the machine operator monitors block length carefully. He MUST MEASURE EVERY FIFTH BLOCK, AND THE FIRST BLOCK OF EVERY NEW MIX.

MIX

He must not start making blocks from a new mix until the block length is correct. The Foreman must continually monitor both block length and quality. This will greatly assist the block layers to build attractive walls quickly.

HALF BLOCKS

These are made by using a small hopper for pouring mix in the compression chamber. Your yield per bag of cement will double and your production rate will be higher.

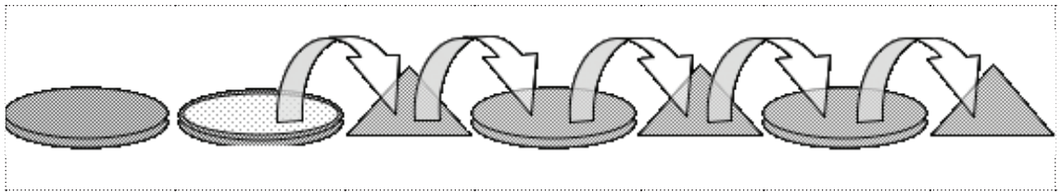
SIEVING SOIL

The maximum particle size suitable for Hydraform blocks is 6 mm. The sieve mesh size should be not more than 8 mm, and expanded metal or weld mesh are the recommended meshes. Make your sieve as durable as possible. The sieve should be mounted at an angle of approximately 45° and the supports dug into the ground. Do not allow too much sieved soil to accumulate underneath the sieve, and clear the residue regularly so that this does not build up at the bottom of the frame.

7. RAW MATERIAL (HAND) MIXING

MIXING

This is a most important aspect of block making. THE SOIL/ASH SAND/CEMENT MIX MUST BE USED WITHIN ONE HOUR. The cement starts setting as soon as it comes into contact with moisture, and after one hour a high proportion of the binding properties of the cement are lost. If the raw materials are not thoroughly mixed, block strength will vary – some blocks will be strong while others will be weak; block length will vary. The heap should be spread out in a wide circle and the cement sprinkled evenly over the soil. The mix should then be piled up into a mound. Water should be added a little at a time – too much water will produce short blocks. Repeat this procedure two more times. Do not attempt to increase production by making more than two mixes, or by increasing the number of wheelbarrows of soil per mix. Once the soil / ash and cement are mixed, use that mix within one hour.



Spread soil into a wide circle	When previous mix is half finished sprinkle cement envenly over soil and add water	Heap up the soil	Spread soil out for second time	Heap up soil for second time	Spread soil out for third time	Heap up soil for third time

PAN MIXING

Required quantity of sieved soil /Fly ash and coarse sand should be first fed in to Pan mixer and dry mixing be started for one minute rotation, after that cement quantity be added for dry mixing. When homogenous mixing is achieved then water be started pouring in to mix till the mix is sufficient to roll in to a ball in a hand, is achieved then only the mix be used for Block making.

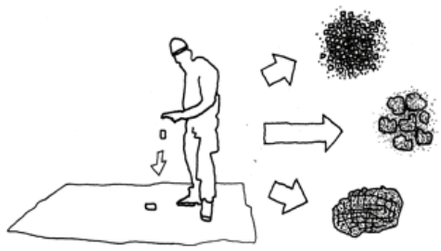
Loading of Pan mixer: Pan mixer loading should be with wheel barrows. Each wheel barrow is of +- 60 liters. Loading with wheel barrows makes mixer loading faster and in equal measures. A ramp should be made as illustrated above. The length of ramp should be at least 3.5 - 4 times the drum height of mixer. In other words an inclination of 15- 20 degree is preferred for effective and efficient loading of mixer. Ramp should be of 6 ft width. Length can be single or with one bend if full length space is not available.

It may be noted that delay in mixer loading would slow down the block productivity due to longer mixing cycle and resultant delay in availability of mixed material to production labour.

BLOCK COLOUR

This is derived from the soil/Fly ash being used. We are often asked if block colour can be modified by using cement dyes; this is possible, but it could cost become expensive because most of the dye is contained within the block. Our experience is that the natural colors of soils/ Fly ash are by far the most attractive.

CHECKING THE MOISTURE IN THE MIX: THE DROP TEST



1. X TO DRY

2. GOOD!

3. X TO WET

This is a preliminary field but important test. Squeeze a handful of the dampened soil in to a ball and drop it on a hard surface from a height of about 1 metre.

Three results are possible as illustrated above.

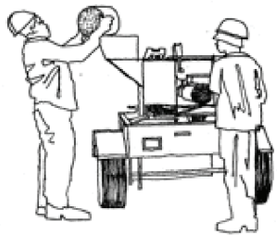
A) If the sample shatters into many pieces or completely break up, the mix is too dry and more water must be added.

B) If the sample stays in one piece and simply becomes a flattered ball or disc the Mix is too wet.

C) Ideally the sample should break in to four or five big pieces. Experience has shown that this indicates that the right amount of water has been added.

BLOCK QUALITY

- The more consistent your blocks, the easier and faster they are to build into an attractive wall. The machine operator must look at every block and discard any block which is sub-standard.



Every single block you make costs money, so do not allow poor blocks to be made,

The structures that your blocks create will stand for a very long time, so take pride in the blocks which you are making

8. MACHINE CAPACITY UTILIZATION

CARING FOR YOUR WORKERS

Block making is hard work, and feeding your labourers morning and midday meals with sweet tea has a highly beneficial effect on block production. Make sure that there is plenty of cool, clean drinking water for them. Wherever possible, provide shade over the mixing area and the machine by rigging shade cloth over a simple gum-pole frame. This also slows drying of the soil/cement mixes. Women can perform most block making tasks and are generally willing workers.

SOIL

- Soil must be dug and sieved to cover a minimum of two days' production:
  2 days' production = 1,500 blocks per day = 3,000 blocks.
- The soil required for 3,000 blocks is:
  3,000 / 172 blocks per m3 =17.44m3 x 1,000 / 65 ℓ = 268 wheelbarrows of sieved soil.
- Similar quantity of dry fly ash must be arranged in stock for smooth block production

COARSE SAND / STONE DUST

- Coarse Sand / Stone dust if required for blending in soil or Fly Ash must also be available in stock

WATER

- Water must be available close to the operation, preferably by hosepipe.

CEMENT

- Cement should be issued and stacked under cover before any production begins.
- A continuous supply of the soil/sand/cement mix to the machine is vital to production. It is important, however, that cement is not mixed into the next mix until only half of current mix remains, or a high proportion of the binding properties of the cement will be lost. This gives enough time for thorough mixing before the current mix is finished. Same applies to Gypsum if is being used in the fly ash based mix.
- Production falls by 3 blocks per minute if the machine stops.

- Production will drop by 300 blocks per day if there is a 5-minute delay between each 10-wheelbarrow mix!
- No mix must be left unused before lunch
- End of the day Before packing up, the soil or Fly ash and other raw materials must be measured out to see for any shortages for next day.
- The machine must be THOROUGHLY CLEANED– the cement/Ash/ sand/soil mixture is very difficult to remove after a few days. The machine should be ready to run within 10 minutes of starting work the next morning. Left over mixed material if not removed at the end of work, the efficiency of mixer as well as wear & tear of blocks shall be greatly affected.
- The block making site should preferably be located close to the building site. Make the blocks at the building site, not the soil pit /fly ash source, it is much easier to move soil/ fly ash than to move blocks. The blocks should be stacked neatly to avoid wasting space.
- A day's production of 1,500 blocks should occupy a space of approximately 5.5 m2. A typical block making site is shown below.
- The machine is located at the building site – this reduces the number of people required for carrying blocks.

9. SETTING UP AND OPERATING MACHINE

SETTING UP THE MACHINE

Always ensure that the machine is level before operation. In order to make loading soil/fly ash and removing blocks easier, the machine may be lowered by digging troughs for the wheels.

PRE-START CHECKS

Carry out all the checks listed under 'Daily Maintenance' before starting the engine.

TOWING MACHINES

Machines with roadworthy undercarriages may be towed at slow speeds on even road. Towing any trailer increases driving risks, especially when emergency braking is required, so reduce speed. Before moving off, check that the machine is properly connected to the vehicle with the safety chain over the tow ball. Tyre pressures should be checked and adjusted, particularly if the machine sways during towing.

REVERSING

Move the bottom of the steering wheel in the direction you wish the machine to move. As soon as the machine begins to swing, move the steering wheel the other way, with the turn, to prevent jack-knifing. Have someone guide you when reversing a machine.

PRE-COMPRESSION RAM SAFETY

The Machine Operator should exercise extreme care when operating the pre-compression ram, illustrated at left. Workers loading soil, handling blocks and cleaning the ram heads and wear plates are exposed to the danger of serious hand injuries.

NOTE: The Machine Operator should not operate the pre-compression ram unless he is sure that it is safe to do so and that all workers' hands are clear of the compression chamber area.

MAKE BLOCKS IN THIS SEQUENCE:

1. lower the main ram;
2. open the pre-compression ram;
3. fill the compression chamber with the raw material mixture in the hopper;
4. close the pre-compression ram;
5. raise the main ram to compress the block;
6. open the pre-compression ram;
7. raise the main ram fully to eject the block;
8. Remove and stack the block

10. STACKING AND CURING

HYDRATION

Wherever cement is used, it is vitally important that it be properly 'cured' (kept wet). Cement needs water to hydrate, or gain strength, and it requires 3-4 weeks curing to achieve full strength. Ordinary Portland Cement (OPC) achieves only about 60% strength in the first 7 days, and about 85% in 14 days. Curing is particularly important with Hydraform blocks where the cement requirement is low. In case of Fly ash blocks, the FRESHLY casted blocks should be stacked vertically in a single row only and not in two or more blocks columns whereas soil based blocks can be stacked in 2 or 3 blocks columns.

STACKING & COVERING

Follow this procedure carefully:

- Make and stack the blocks where you are going to build. It is easier and less expensive to move soil than blocks.
- Level and wet the ground (preferably cemented) on which the blocks are to be stacked.
- Soil based blocks can be horizontally stacked and fly ash based blocks be vertically stacked immediately after casting.
- Stack the blocks no more than 5 high and 5 rows wide after casting of one day. (or to fit your tarpaulin, as shown at right).
- Cover the blocks from the first row laid down. They dry out quickly if left uncovered, and cracking can occur.

WATERING

This is vitally important for block strength:

- The day after the blocks are made, uncover and water them generously twice every day – once in the morning and once in the evening – then cover again immediately. Watering frequency may be increased if ambience temperature is very high
- Keep the blocks covered and watered for at least 14 days. Additional block strength will be gained by curing for up to 28 days.
- Make sure that the blocks are properly covered so that they do not dry out – seal the edges of the polythene or tarpaulin carefully. A groundsheet (as illustrated) improves the retention of water within the stack.
- Remember that the better the blocks are cured, the stronger and more durable they become.

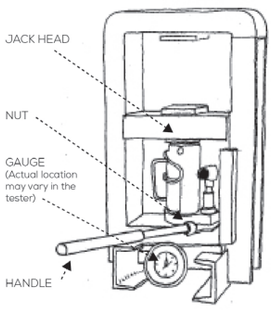
CURING UNDER COVER

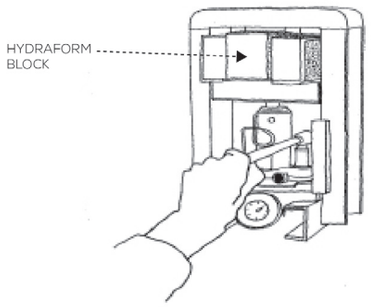
Curing Hydraform blocks under cover, or in a shed, does not mean that you do not need to cover them – they will dry out quickly, even under shade. Unless you have a sprinkler system which will keep the blocks wet all the time, covering is essential. Polythene sheetings are available in rolls, and you require the 3 m x 100 m size. Covering your blocks with polythene will cost you less than 1.5% of the total cost of a block.

11. QUALITY CHECKS

PROBLEM	CAUSE	REMEDY
1. Rough surface on blocks	Mix too dry	Add more water to mix
	Rough plates	Inspect plates and change if necessary
	Soil build up in joints or on wear plates	Clean excess soil or fly ash from joints and plates
2. Cracking on blocks	Too much water in mix	Use less water in mix. Add cement to mix already made to dry out
A. Horizontal cracks seen as block ejected from chamber	Compression pressure too high	Reduce pressure
B. Cracks developing during 7 day curing period	Blocks losing too much water, too fast during curing	Cover blocks properly with plastic and water twice daily as per Hydraform recommendations
	High clay content	Add coarse sand to mix
		Add more cement
3. Blocks being damaged and broken during stacking and storage	Careless handling of blocks	Closer supervision of stacking
	Blocks too weak	Check production process and/or add more cement to mix
4. Blocks shorter than chosen length	Too much water in mix	Use less water in mix
	Compression pressure too high	Reduce pressure
5. Blocks longer than chosen length	Mix too dry	Add more water to mix
	Compression pressure too low	Increase pressure
6. Block length changing continuously	Water content changing continuously	Keep water in mix constant. Check water content by checking length of block with ruler
	Soil properties changing continuously	Use same soil source for all production

12. TESTING OF BLOCKS





Place block in tester and jack slowly until block fails and gauge reaches a maximum.

This is a simple tool designed to give indication of the strength of the blocks being produced.

13. TRANSPORTATION OF THE BLOCKS

1. Do not transport wet blocks.
2. Before transportation of the block it should be Dry Cured for at least five day.
3. During transportation blocks should be properly stacked.
4. During transportation blocks should not touch the sides of the truck/transportation me dium

14. TROUBLE SHOOTING BLOCK MAKING PROBLEMS

SOIL PROBLEMS

Choosing the best soil for block making requires experience with a variety of different soils. By making test blocks without cement (as described in 'Soil Selection & Testing') you will gain experience in selecting the most suitable soils for making blocks. Soil properties can change significantly within small areas of land, and this will become apparent during block making. Try to find soil which:

- Is free of gravel or hard laterite lumps – this saves sieving and extends your wear plate life;
- Has a relatively low clay content; when very high-clay soils are used, the outer surfaces of the blocks 'relax' when the pressure is removed; this is caused by the 'plasticity' (or compressibility) of the clay which expands when it is not under pressure, as a football

contracts and expands when it is kicked, and
- Is free of roots, leaves and grass; organic matter inhibits the setting of cement.
- Generally, the clay content of the lower layers of soil is higher than that found in the upper levels. If you find clay content increasing, 'mine' your soil from the upper levels, always removing the topsoil first.

SURFACE CRACKING

This is the most common problem found in blocks, and is generally caused by the plasticity of high-clay soils. The cracks are usually less than 1 mm deep, but the face-brick appearance of the block is lost. Take the following action:

- Reduce the moulding pressure; this will not affect either block length or block strength provided the pressure is maintained at factory-set levels.
- Reduce the moisture content slightly; block length will increase, but must not exceed 230 mm.

CRACKING DURING CURING

If cracks develop during the 14-day curing period, the blocks could be drying out too quickly. It is important that:

- The blocks are properly covered, and that the edges of the polythene are tightly sealed, and
- The blocks are watered at least twice a day – they need to be kept wet for at least 14 days.

SEVERE CRACKING

In extremely high-clay soil, e.g., black cotton soil, cracks right through the blocks can develop during curing. If this occurs:

- Add sand to the soil, determining the amount required by trial and error; coarse river sand is best, but any sand will dilute the clay content;
- If the blocks continue to crack, increase the cement content.

BLOCKS STICKING TO RAM HEAD

If blocks stick to the lower ram head, a light sprinkling of dry cement or fine plaster sand will improve release.

SCORE MARKS ON BLOCK FACES

These are caused by compressed soil trapped in the retaining bolt recesses in the wear plates, particularly when high-clay soils are used. When you see shiny, rounded lumps of soil protruding from the wear plates, use a 2-inch paint scraper to clean inside the compression chamber, before the marks appear.

WEAK BLOCKS

Breaking of the 'top' corners (at the end of the block which first emerges from the compression chamber) is the first sign of weak blocks. Weakness can occur because:

- The blocks are too long, generally due to insufficient moisture in the mix;
- There was insufficient cement in the mix, or
- The blocks have not been properly cured, the most common cause of weak blocks.

LOW BLOCK PRODUCTION

If you organize your site in such a way that the machine makes blocks continuously, your production will be excellent. A well-motivated team is capable of producing 1,800 blocks in an eight-hour day working.

ROUNDED EDGES & REDUCED INTERLOCKS

These faults indicate that the wear plates need to be Replaced. See 'Engine & Machine Maintenance'.

15. TROUBLESHOOTING MACHINE PROBLEMS

REDUCED MACHINE SPEED

If the rate at which the hydraulic system works is sluggish, check for:

- A clogged air filter element; check the suction indicator; if this is down, hiding the green ring, shut down the engine and clean the air filter element; if the indicator does not re-turn to the normal position when the engine is re-started, replace the air filter element;
- A dirty fuel filter or clogged fuel line; check that fuel is flowing freely from the tank by removing the inlet fuel line from the injector pump; if fuel flows freely, replace the fuel filter element;
- Dirty hydraulic suction filter element; this is situated on top of the hydraulic reservoir, underneath a cover secured by four 13 mm nuts to the return line hydraulic filter housing; replace if necessary;
- Insufficient hydraulic fluid; check the sight glass and top up if necessary;
- Cold hydraulic fluid; in cold weather, it can take 15 to 30 minutes for the fluid to warm up, when the machine speed will increase.

STARTING PROBLEMS

If starting problems occur, they can be due to:

- An airlock in the fuel feed; this may occur if the engine is allowed to run out of fuel, and the engine will not re-start; loosen slightly the brass banjo bolt on the injector pump with a 17 mm spanner; crank the engine until fuel squirts out, known as 'bleeding'. Do not over-tighten the banjo bolt.
- Incomplete decompression; the engine will not turn when cranked; crank slowly whilst lifting the curved black decompression lever;
- Dirt in the fuel injector; a mechanic should attend to this.
- If the engine has stood for a long time and will not start, remove the white plastic plunger situated behind the dome-shaped aluminum rocker cover; pour a teaspoon of engine oil into the small inner pipe, then push the plunger back into the outer pipe; the engine will usually start, making a lot of smoke at first.

16. ENGINE & MACHINE MAINTENANCE

THE DIESEL ENGINE

The Kirlosker make diesel engines have proved to be very reliable and efficient engines, and they will give you many years of reliable service if they are properly maintained. For machine with electric motor, connection should not be exposed and periodically checked by trained electrician.

SERVICE INTERVALS

Assuming 8-hours per working day and 25-days per working month, the filters, elements and components should be replaced or checked at the intervals given below:

WEEKLY	A) Check the tightness of the two Allen grub screws holding the ram head extension to the main ram piston, using the 4 mm Allen key in the Engine tool kit (see illustration below); B) Grease the nipples of the pre-compression ram assembly;
MONTHLY	A) Replace oil filter element & SAE 40 engine oil (approximately 1.9 litres) at 250 hours; B) Replace in-line type diesel fuel filter at 150 hours;
EVERY 3 MONTHS	A) Replace bowl type diesel fuel filter at 500 hours; B) Replace air filter element at 500 hours; C) Check and adjust valve clearances at 500 hours: • inlet 0.10 mm; • exhaust 0.20 – 0.25 mm;
EVERY 6 MONTHS	A) Replace hydraulic fluid filter at 1,000 hours;

CHANGING THE WEAR PLATES

Replace the wear plates when the blocks lose their clean, sharp edges and the top and bottom interlocks become rounded. This may occur at between 30,000 to 90,000 blocks, depending on the abrasiveness of the soil/sand. Follow this sequence:

1. raise the pre-compression ram and stop the engine;
2. remove the 12 bolts and washers holding the front and rear wear plates;
3. loosen the wear plates using a block of wood and a hammer; if this does not succeed:

• reverse the two bottom bolts on each wear plate, screwing these into the lowest holes on the inner surfaces of the wear plates, but not into the compression chamber wall;

• start the engine and raise the main ram head very slowly against the bolts, cushioning the ram head with a piece of wood; this will push the wear plates out;

4. Remove the side wear plates in the same way;
5. Clean and grease the interior walls of the compression chamber;
6. Fit the new side wear plates, ensuring that the top edges are level with the top of the compression chamber;
8. fit the new front and rear wear plates, again ensuring that the top edges are level with the top of the Compression chamber;
9. start the engine and move the main ram head up and down, checking that the clearance is approximately 1 mm all round;
10. if necessary, loosen the two bolts in the ram head extension and adjust the position of the ram head on the table Hydraulic Hoses. Check the hoses for wear or leaks at regular

intervals and replace these as necessary. When a hydraulic hose bursts or begins to leak, it cannot be repaired, nor can the fittings be re-used.

DAILY MAINTENANCE

PRE-START CHECKS

It is IMPORTANT THAT THE FOLLOWING CHECKS ARE CARRIED OUT EVERY DAY before the engine is started – they take only a few minutes and can save you serious problems:

- engine oil – check that the SAE 40 oil level is above the lower mark on the red-handled dipstick (the volume of oil between the two marks is 0.9 litres); always have spare engine oil available;
- hydraulic fluid – check that the fluid level is above the lower mark on the sight glass; top up with Type 68 hydraulic fluid as necessary, making sure to clean thoroughly around the filler cap so that no dirt enters the tank; wash in clean paraffin and dry thoroughly; filled to the top mark on the sight glass, the reservoir on most models holds 107 liters, and the M7ExM holds 117 litres, M7S2E holds 300 litres;

- diesel fuel – top up as necessary; the fuel tank holds approximately 7 litres, enough for 4½
- hours' running; do not allow the engine to run out of fuel – you are likely to cause an airlock in the fuel feed system if this happens; do not spill diesel fuel on the engine mountings;
- fuel tank water/sludge trap – if your machine is fitted with a transparent plastic water/ sludge trap, and if this contains either water or a deposit of sludge, open the finger valve at the bottom and release a small amount of diesel fuel to flush it out;
- Air inlet & air filter element – remove the cover by unscrewing the wing nut and pull
- out the air filter element; gently tap the element on a hard surface to remove loose dirt;
- using a clean rag, wipe all dirt from the inside of the housing; replace the filter
- element (either side first) and then refit the cover carefully, ensuring that the rubber gasket is not pinched; once a week, ask your foreman to blow out the dirt from the element with compressed air; the air must be blown from the inside of the element.

WORKING CHECKS

There will be times when block production is interrupted while the moisture content of the soil/cement mix is adjusted. Use these breaks to:

- check the diesel fuel level in the tank;

remove the soil build-up around the main ram piston, under the compression chamber;

- check the machine hydraulic pressure, and
- Check the level of the hydraulic fluid.

FINAL DAILY MAINTENANCE

At the end of every working day:

- Hose down the machine thoroughly to remove all soil, especially under the compression chamber and around the hydraulic reservoir – this becomes very difficult to remove after 48 hours;
- Cover the engine with polythene unless the machine will be stored under cover, and
- Make sure that the machine is secure for the night.

BLOCK MAKING LOG BOOK

We suggest that you keep a simple block making log book.

CALCULATE YOUR CEMENT

Blocks yield by dividing the blocks produced by the number of bags of cement used, e.g., if your team uses 13 bags of cement to make 1,348 blocks, the yield is: 1,348 / 13 = 75 blocks per bag.

MAINTENANCE LOG BOOK

A maintenance record is easy to keep and a most useful reference. We cannot stress too highly the importance of proper servicing of your engine and machine.

A suggested format:

DATE	WORK CARRIED OUT	SAE 40 OIL	S-68 FLUID	FILTERS				REMARKS
				OIL	FUEL	AIR	HYD	
				1				
				1	1	1		Valve clearances checked.
				1				
				1				
				1	1	1	1	

UNITED NATIONS
INDUSTRIAL DEVELOPMENT ORGANIZATION

United Nations
Industrial Development Organization
Vienna International Centre
P.O. Box 300, 1400 Vienna, Austria
Telephone: (+43-1) 26026-3570
Fax: (+43-1) 26026-6842
E-mail: IUMP@unido.org
http://www.unido.org/iump