Emptying and Transporting Difficult Pit Latrine Sludge in Blantyre, Malawi

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- WASTE, Malawi
Technical challenge – desludging pit latrines

• Pit latrine sludge is “difficult” –
  – > 15% total solids
  – Lots of large and small rubbish
  – Pit toilets difficult to access by truck
Technical challenge – desludging pit latrines

• 3 types of equipment selected:
  – Vacutug, Diaphragm Pump, ROM
• tested in Blantyre Malawi for
  – Effectiveness & Efficiency
• During 2014 – 650m³ of pit sludge from:
  – Line & Unlined pits
  – Household pits (300 trips = 240m³)
  – School and market toilets (512 trips = 410m³)
Technical Equipment : ROM

successfully tested in pits over 800 times over 14 months

Specifications

• 800 liter sludge tank
• 200 liter clean water tank
• Honda engine 6,6 kW / 9hp Vacuum pump 2.500l/min
• High pressure Installation, set on 60 bar
• 3” hose x 30 m for increased access
• (heavily modified)
## Technical Equipment: ROM

<table>
<thead>
<tr>
<th>Strengths</th>
<th>Weaknesses</th>
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</thead>
<tbody>
<tr>
<td>Very good quality – reliable and durable</td>
<td>High purchase price (including freight)</td>
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<tr>
<td>Integrated machine – complete with fluidiser</td>
<td>Requires well trained staff to operate and maintain</td>
</tr>
<tr>
<td>Compact – towed or on truck bed</td>
<td>lack of spares support for vacuum section</td>
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<tr>
<td>Simple &amp; fast – 9 trips / day</td>
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<tr>
<td>Simple to repair in field</td>
<td></td>
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<tr>
<td>Economical</td>
<td></td>
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<tr>
<td>Engine spares available</td>
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</tbody>
</table>
Operation – Desludging – essential process

- Inspection of pit / toilet for safety from collapse
- Fluidisation
- Fishing of rubbish
- Desludging
- Clean up
- Transport
- Disposal / treatment site
Operation – Desludging – fluidization

- Fluidization: high pressure jets at 60 – 100 bar
- Use of special nozzles
- Most pits require 15% – 20% water
- Desludging – tested to 15% total solids
- Tested on abandoned pits
- Fluidise sludge in 10 mins
- Used for clean up
Operation – Desludging – fluidization

Special nozzles can fluidise sludge even pits abandoned 2 years
Operation – Desludging – fishing

Type of rubbish:
• Trash – old clothes, shoes, bottles, plastic bags,
• “secret” – menstrual clothes, medicine bottles, condoms
• Stones, rocks, bricks (suspended!)

Amount of trash fished out –
• Household pit 20 – 40 lts
• Institutional pit 50 -100 lts
Operation – Desludging – fishing

Most sludge is so thick – rocks are suspended

Large rubbish can block suction
Operation – Desludging - fishing

Blocked discharge – but vacuum tanks not sensitive to small rubbish

Fishing is messy but essential – clean up required
Operation – Desludging

Suction was tested to 30 m and 2 m elevation
Operation – Desludging – transport

To temporary storage or treatment site
Technical Equipment: key specifications

1. Fluidizer – ie high-pressure water at around 60-100 + nozzle + 200 lts water tank for fluidising & cleaning up
2. Vacuum pump - 0.5 bar and 2000 litres per minute.
3. 3“ flexible suction and outlet hoses
4. 30 m suction pipe & fluidizing hose
5. Mounted on a small truck or trailer + Working with decentralised storage / treatment
6. Holding tank of 1000 litres – inside tank accessible
Technical Equipment: Advantages of equipment

For owner/operator

– Up to 8 – 9 trips per day (6 – 7 m³ pit sludge)
– Clean and safe operation
– Economical – less water used for fluidising sludge
– Can desludge most pits

For the pit owner

– Extend life of pits (even abandoned, unlined pits)
– Little inconvenience (i.e. no smell, spillage)
– Value for money (thick sludge removed)
Working with manufacturer – already in production
Technical Equipment : Vacutug

Specifications

- 6 kW diesel engine
- Self propelled @ 3 - 6 km/hr
- Vacuum pump 2.200l/min.
- 500 liter sludge tank
- 30 meter 3” hose for increased access
- No clean water tank
Specifications

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## Technical Equipment: Vacutug

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<tr>
<td>• Lower purchase price</td>
<td>• Self propulsion too slow – better if towed</td>
</tr>
<tr>
<td>• Strong suction power</td>
<td>• Safety issues</td>
</tr>
<tr>
<td></td>
<td>• No special capacity to fluidise sludge</td>
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<tr>
<td></td>
<td>• Frequent breakdowns - unreliable</td>
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</table>
Technical Equipment: Vacutug
Technical Equipment: Diaphragm Sludge Pump

Specifications

- Diaphragm sludge pump with diesel engine
- Solids handling up to 40 mm
- Dry run without damage
- Self priming to 7.5 m
- Mounted on two-wheel trolley
- Kit with 3 m³ flat pack sludge tank
## Technical Equipment: Diaphragm Sludge Pump

**tested on 10 pits – unsuccessful**
**tested on 10 septic tanks – successful**

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<tr>
<td>• Compact and portable</td>
<td>• No integral fluidiser</td>
</tr>
<tr>
<td>• Simple design and operation</td>
<td>• Cannot handle even small solids that block valves</td>
</tr>
<tr>
<td>• Durable</td>
<td>• Unsuitable for pit sludge with rubbish</td>
</tr>
<tr>
<td>• Excellent for septic tanks</td>
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Technical Equipment: Diaphragm Sludge Pump