User Manual - PuPu Pump

FSM Action Research Project



Operation and Maintenance Guide

This manual provides instructions on the safe and proper operation of a PuPu pump, including setup, use, cleaning, and maintenance.

https://fsmaction.org

PuPu Pump



The PuPu Pump is a portable, petrol-powered pump used to empty faecal sludge from pit latrines and septic tanks. It uses compressed air to suck sludge into the pump and then discharge it through a hose into a drum or storage tank. It is ideal for areas with limited access or where sludge needs to be pumped over a distance away from the pit

CapEx	USD 4,000 (Ex Factory). Final landed cost will depend on the destination country, shipping charges and applicable taxes.
OpEx	Petrol, engine oil, and periodic servicing.
Operators	Best operated by two people—one manages the engine and pump while the other monitors the suction hose and collection containers
Add-ons	Containment drums/IBC tanks, transport system, hoses

How it works

The petrol engine powers an air compressor that creates suction and pressure inside the pump. When the control lever is turned to the left, the pump sucks sludge into the reservoir. When the lever is turned to the right, the pump builds pressure and pushes the sludge through the discharge hose into a drum or storage tank

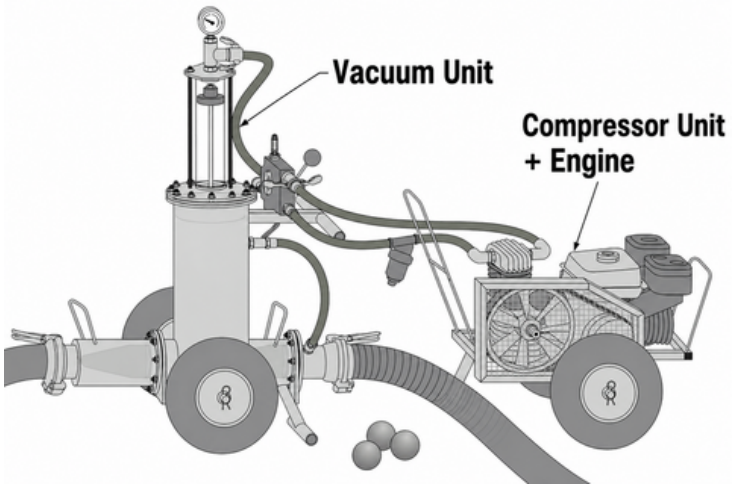
Advantages

- Lightweight and Mobile – Ideal for dense areas with limited accessibility.
- Handles Thick Sludge – Equipped with a water and air injection system for easier sludge mixing and pumping.
- Can pump sludge directly from pit to transport tank over large distances and elevations
- Minimal Sludge Exposure – Closed hose system reduces operator contact with sludge.

Limitations

- Can only pump sludge from pits with a maximum depth of 8 meters
- Additional Equipment Needed – Requires a containment and transportation system
- Ongoing Maintenance Costs – Regular engine servicing, including oil and filter changes, is required.

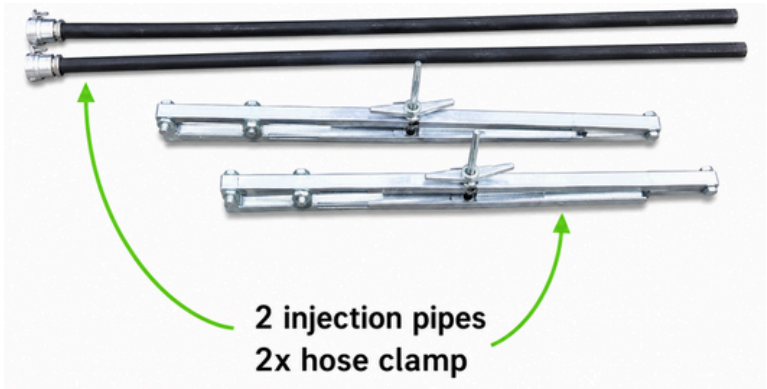
Components and parts



Combined unit weight	Approx. 100 kg (pump 50 kg, compressor 50 kg)
Hose diameter	100 mm (4 inches)
Maximum suction depth	8 metres
Maximum pumping distance	0–100 metres, depending on sludge viscosity
Combined unit weight	Approx. 100 kg (pump 50 kg, compressor 50 kg)









Step-by-Step Operating Procedures

Pump Assembly

STEP 1	**Fit the control valve assembly** – Fit the control valve assembly to the top plate of the pump cylinder and secure firmly.
STEP 2	**Fit the top cover and sight-glass** – Fit the top cover with the transparent sight-glass indicator tube, checking the seal is not cracked.
STEP 3	**Fit the outlet valve assembly** – Attach the outlet valve assembly to the discharge side of the pump body and tighten securely.
STEP 4	**Fit suction and outlet caps** – Fit the suction cap and outlet cap to confirm both seal correctly when not in use.



1 Fit control valve assy



2 Fit top cover



3 Fit outlet valve assembly



4 Fit outlet valve assembly



5 Fit suction cap

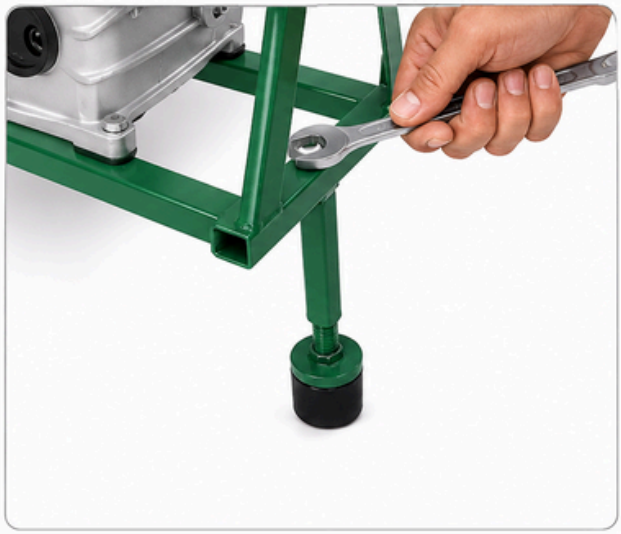


6 and outlet caps

Step-by-Step Operating Procedures

Compressor Assembly

STEP 5	**Fit the stand** – Fit the compressor support stand and secure with the correct bolts.
STEP 6	**Fit the wheels** – Fit both wheels to the compressor trolley and confirm they turn freely.



7 Fit stand



8 Fit wheels

Final Check

- Confirm all bolts, couplings, and clamps on both the pump and compressor are tight.
- Rock each assembled unit gently to check nothing is loose.
- Record the assembly check in the Equipment Inspection Log

Step-by-Step Operating Procedures

Positioning and Hose Connection

STEP 1	**Position both units** • Wheel the pump and compressor onto stable, level ground near the pit. • Keep the compressor exhaust facing away from the work area.
STEP 2	**Connect the suction hose** • Connect and lock the suction hose to the pump. • Ensure the hose is straight, with no kinks or twists.
STEP 3	**Connect the outlet hose** • Connect and lock the outlet hose to the pump. • Fit the bend and insert the pin into the outlet bend. • Ensure the hose is straight, with no kinks or twists.



1 Connect suction hose



2 Connect outlet hose



3 No kink in the hose



4 Connect bend to final hose.



5 Make sure the hose is not twisted.



6 Connect air hoses



7 Pin should be out.

Step-by-Step Operating Procedures

STEP 4	**Connect the air hoses** – Connect the air hose(s) between the compressor and the pump's control valve



Connect air hoses

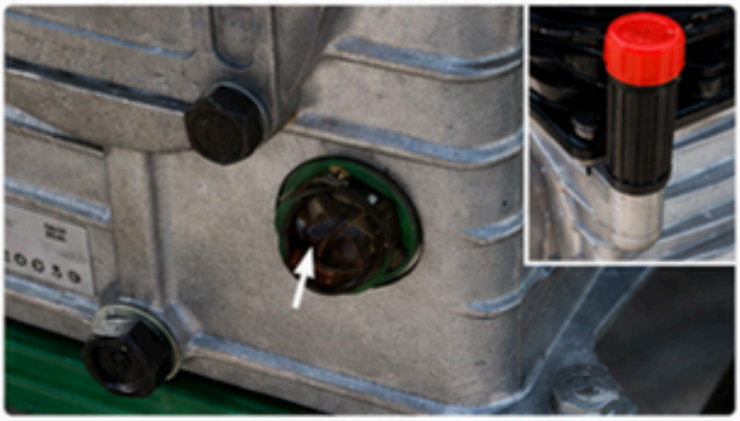
Starting the Engine

STEP 5	**Check fluids** – Fill engine oil until it overflows at the fill point. – Fill compressor oil until 3/4 of the sight glass is covered. – Put the pump control handle in neutral before starting.
STEP 6	**Start the compressor engine** – Open the fuel valve. – Move the choke lever forward (closed position). – Switch the engine to "on". – Pull the starter rope firmly until the engine fires. – Once running, move the choke lever backward to the open/run position.

Step-by-Step Operating Procedures



Fill engine oil until overflow



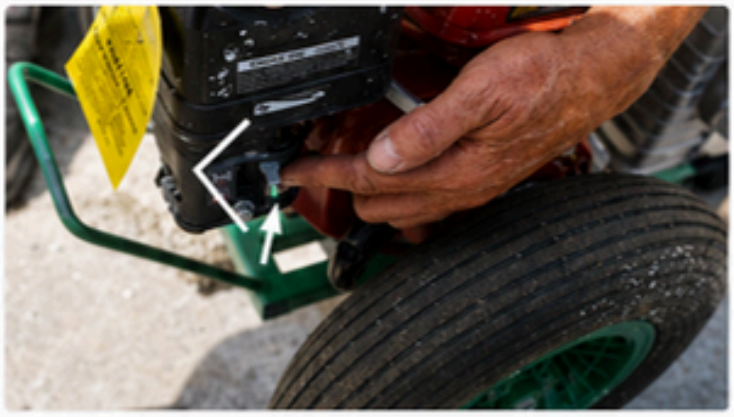
Fill compressor oil until 3/4 glass covered



Put pump control handle in neutral



Open fuel valve



Move choke lever forward



Switch to "on"



Pull rope to start

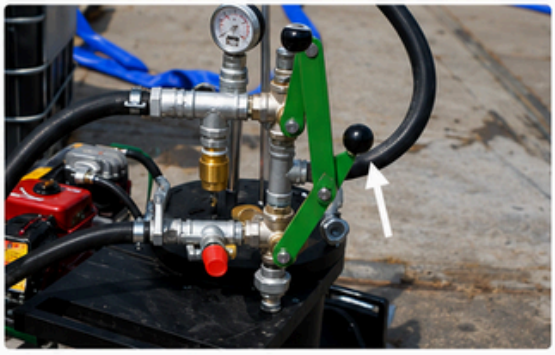


Move choke lever backward

Step-by-Step Operating Procedures

Pumping

STEP 7	**Initiate suction** – Lift the control handle to the suction position. – Note: the first suction of the day may take a while , the outlet hose collapses initially to act as a valve before the pump starts filling. – If automatic suction does not begin, step gently on the outlet hose to help start the process.
STEP 8	**Watch the sight-glass indicator** – Wait until the indicator has risen to the top of the sight-glass , this shows the chamber is full and ready to discharge.
STEP 9	**Switch to discharge** – Move the control handle down to push the sludge out through the discharge hose. – A second crew member should walk along the outlet hose while pumping to confirm sludge is passing without obstruction, and to keep the hose free of sharp bends.
STEP 10	**Repeat the cycle** – Return the handle to suction once discharge is complete, and repeat until the pit is emptied or the container is full. – If sludge is too thick to draw, stop and use the water injection procedure (Section 8.2) before continuing.



Lift control handle for suction
The outlet hose will collapse initially to act as a valve. Only then, the pump will start filling.
If the automatic suction does not work, step on the outlet hose to help.



Note: The first time suction will take a while.



Wait until the indicator has reached the top, then move handle down for pushing sludge out.



The outlet hose should not have sharp bends and should not be twisted to avoid blockages.



While pumping is under way, somebody should walk along the outlet hose to make sure the sludge can pass without obstruction.

Step-by-Step Operating Procedures

Water Injection (for Thick Sludge)

When sludge is too thick to pump, water can be injected into the chamber to make it pumpable. This is normally done before pumping starts, while the suction and outlet caps are still fitted.

STEP 11	**Set up for water injection** – Connect a hose to the injection pipe, and a second hose to the outlet cap with its valve closed. – Drop the suction side into the water reservoir. – With the control handle in neutral, start the compressor.
STEP 12	**Draw and release water** – Pull up the control handle to suck water into the pump until the sight-glass indicator reaches the top. – Return the handle to neutral, then open the outlet valve. – Move the handle down , water ejects from the injection pipe into the pit to help loosen the sludge.



Connect hose to injection pipe



Connect hose to outlet cap and close the valve



Drop suction valve into the water reservoir



Control handle in neutral



Start the compressor



Pull up control handle and suck water into the pump until indicator is in top



Control handle in neutral



Open outlet valve

Step-by-Step Operating Procedures

Air Injection / Mixing (Stratified Sludge)

If sludge is stratified , a dry layer on top, a liquid layer, and sediment below , air injection (bubbling) can help mix it into a pumpable consistency. This can be done in two ways: connecting the compressor outlet hose directly to the injection pipe, or connecting an extra hose to the cap on the pump outlet. In both cases, put the control handle down to let air flow through the pipe and bubble through the sludge.



Option 1) Connect the compressor outlet hose directly to the injection pipe



Option 2) connect the extra hose to the cap on the pump outlet



and put the handle down



for the air to flow through the pipe.

Float / Indicator Monitoring

The sight-glass indicator is the operator's primary feedback instrument during pumping. Never leave the unit unattended while it is running; an operator should watch the indicator continuously and be ready to switch the control handle immediately once it reaches the top or bottom of its travel.

Step-by-Step Operating Procedures

Pump Emptying (Between Loads)

STEP 13	**Empty the pump and hoses** – After stopping pumping, keep the compressor running with the control handle in neutral. – Lift the suction side and put down the stand. – Disconnect the suction hose, allow it to drain, and set it aside; fit the suction cap. – Put the control handle down to use air pressure to push remaining sludge from the pump and as much as possible from the outlet hose. Continue for a few minutes until no more sludge appears — the person at the tank should signal when clear. – Return the control handle to neutral.



After stopping to pump, both the pump and the hoses should be emptied. Keep compressor running with control handle in neutral.



Lift suction side and put down the stand.



Disconnect suction hose, allow it to drain and put it on the side.



Fit suction cap.





Put control handle down to use the air to push out the sludge from the pump and as much as possible from the outlet hose. Continue this for a few minutes until no more sludge comes out of the hose. The person at the tank should signal this to the operator. Put control in neutral.

Step-by-Step Operating Procedures

Pigging (Clearing the Outlet Hose)

Pigging pushes a foam ball through the outlet hose using air pressure, forcing any remaining sludge out ahead of it. Carry this out at the end of every job

STEP 14	**Prepare to pig** – Confirm the pin is inserted in the outlet bend. – Lower the pump so it sits level again. – Fit a clamp on the outlet hose near the coupling, open the coupling, and insert a pigging ball. Close the coupling and remove the clamp.
STEP 15	**Push the pig through** – Put the control handle down so air pushes the pigging ball out of the pump and into the outlet hose. – A second crew member should walk along the hose to follow the pig and smooth out the hose so it can move forward freely. – The pig will stop when it reaches the pin in the bend — stop the engine and move the control handle to neutral, then wait until the air pressure in the hose has receded to zero before proceeding.



Insert the pin in the outlet bend





Lower the pump so that it is level again



Put a clamp on the outlet hose near the coupling



Open the coupling



Insert pigging ball



Close the coupling



and remove the clamp

Step-by-Step Operating Procedures

Shutdown and Packing Up

STEP 16	**Disconnect and stow** – Disconnect the hose from the pump and fit the outlet cap. – Disconnect the bend from the hose and recover the pigging ball. – Disconnect all remaining couplings, roll up the hoses, and fit the hose carrier handles.
STEP 17	**Shut down the engine** – Switch the compressor engine OFF. – Close the fuel valve. – Allow the engine to cool before loading for transport.
STEP 18	**Secure the load** – Confirm storage drums / IBC tank are sealed securely. – Complete the Daily Job Sheet



Disconnect hose from the pump



and fit the outlet cap. Packing –up





Disconnect the bend from the hose and recover the pigging ball



Disconnect all couplings



Roll up the hoses and fit the hose carrier handles

Preventive Maintenance

Frequency	Maintenance Task
Daily	Visual inspection of hoses, couplings, and frame; check engine and compressor oil and fuel; clean unit after use
Weekly	Check and tighten all bolts and fittings; inspect wheels and tyres; check condition of end caps and seals; clean/inspect the suction-line air filter
Monthly	Replace if heavily soiled or damaged
Quarterly / as scheduled	Replace if blocked or discoloured
As needed	No excessive play or noise

Always refer to the engine and compressor manufacturer's service manuals for recommended maintenance intervals and spare-part specifications

Troubleshooting Guide

Use the table below to identify and resolve common operational problems. If a problem cannot be resolved using this guidance, stop operations and contact the supervisor or a qualified technician — do not force any component.

Problem	Cause	Corrective Action	Preventive Action
Engine will not start	No fuel; fuel valve closed; choke not set correctly	Check fuel level, open fuel valve, set choke, retry start	Confirm fuel and valve position during pre-op check
Slower than normal pump operation	Air filter in the suction line is clogged	Unscrew the filter cap, remove and clean the filter	Clean the air filter on the weekly maintenance schedule
No suction / not drawing sludge at all	Hose not submerged; air leak in suction hose; couplings not fully seated	Ensure the hose is submerged; check all couplings for leaks; reseat and re-tighten fittings	Inspect couplings and hose condition before each job

Problem	Cause	Corrective Action	Preventive Action
High vacuum on the gauge, indicator not moving up (blockage on suction side)	Suction line partially blocked	Put handle down to force sludge from the pump, return to neutral, clamp the outlet hose, put handle down, wait for good pressure or the pressure relief valve to open, then open the by-pass valve to push the blockage out; remove the clamp and resume	Screen large debris at the pit before pumping; inspect suction line before each job
High pressure on gauge but indicator not moving down (blockage on outlet side)	Blockage inside the pump chamber or in the outlet hose	Put handle in neutral, remove the pump top, remove debris, refit the top and resume; or locate the hose blockage by feel, clamp both sides of the coupling, open, clear debris, and reconnect	Fit and maintain trash screening; inspect hoses regularly
Low suction pressure, indicator stops moving upward (debris blocking the indicator)	Debris inside the pump obstructing the sightglass mechanism	Switch to pressure and repeat short cycles until the indicator returns to normal; if this does not clear it, open the pump and remove the debris manually	Avoid pumping known debris-heavy pits without screening first
Outlet hose kinked or twisted during pumping	Poor hose layout	Stop, straighten the hose with smooth curves, resume pumping	Walk the hose line continuously during pumping; lay hoses out before starting
Sludge too thick to pump	High-solids or compacted sludge	Use the water injection procedure (Section 8.2) to loosen the sludge before resuming	Assess sludge consistency during assessment; carry sufficient wate
Fuel leaking from engine	Loose fuel cap; cracked fuel line; damaged carburettor float	Stop engine; tighten cap; inspect and replace fuel line; contact technician	Check fuel system during weekly inspection
Unusual engine or compressor noise / vibration	Low oil; loose mounting bolts; belt misalignment	Check oil; tighten all bolts; inspect belt; stop and investigate	Tighten and inspect fasteners weekly