



Glass Crusher

Adapted from MSF-Cambodia

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Need for Glass Crusher

Under normal circumstances, it is recommended for health structures of low-income countries to dispose their sharps directly into a sharps pit without any treatment. However, empty glass ampoules are difficult sharps to dispose of directly because of their volume; in big amounts they tend to fill up a sharps pit very fast. It is therefore recommended to reduce their volume first before final disposal.

Glass vials are an equal problem, as often their volume is even bigger. But unbroken empty vials as such don't have sharp edges (unlike opened ampoules) and they are a lot more solid, thus they aren't that breakable. Therefore, it is debatable if intact vials should be considered as sharp waste. It is always recommended to see if there are alternative uses for empty vials; e.g. used for body fluids or excreta samples to be investigated in the laboratory, used to store scents or perfumes. Whatever the secondary use, the vials should always be emptied and rinsed thoroughly, and their label should be removed completely. Care should be taken that the vials aren't abused; e.g. filled with water or other liquids / chemicals and resold as drugs. In certain situations, there won't be any other alternative than disposing of the vials.

Burning or even incinerating ampoules and vials isn't an option because the glass might explode, causing potential injuries to the operator and/or damages to the volume reducer / incinerator. The molten glass could also clog up the grid of the volume reducer / incinerator. An alternative could be the glass crusher.

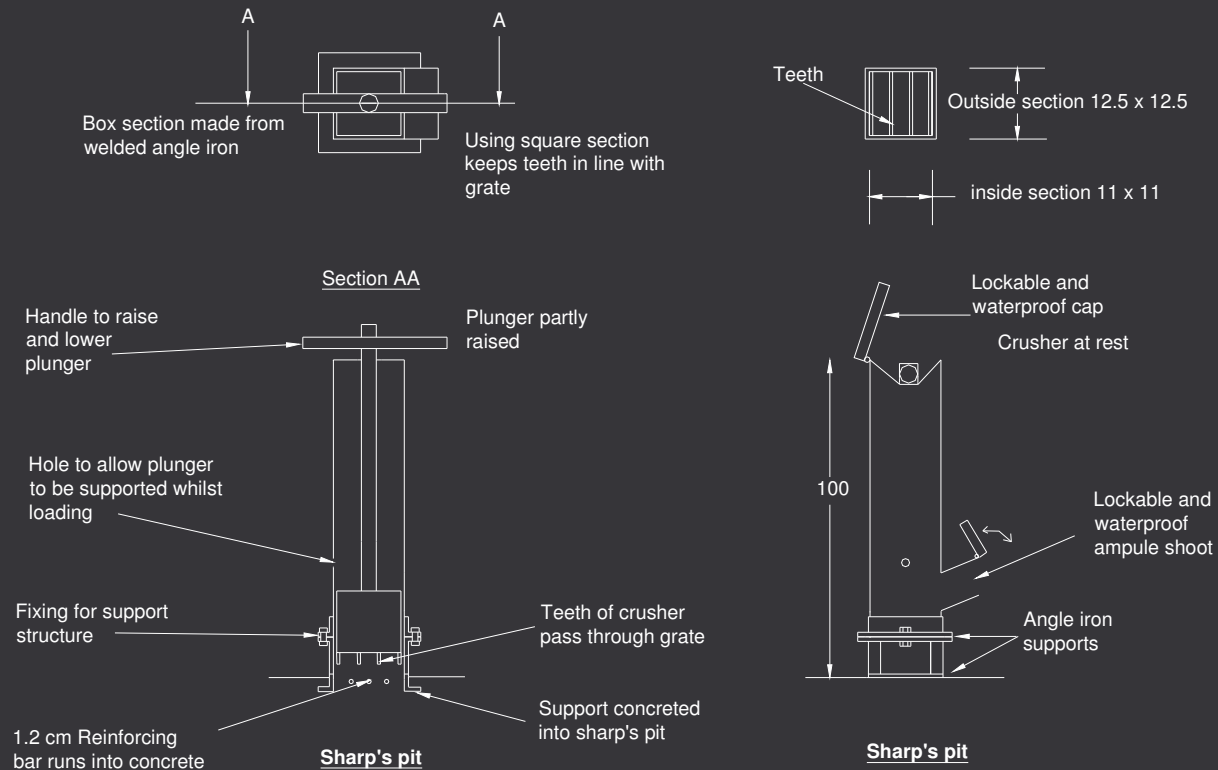
Several attempts have been made to design an appropriate glass crusher. Initially, glass crushers were independent facilities that needed to be emptied after use, followed by the manual disposal of the sharp residues in a sharps pit. This practice was very dangerous because the person emptying the crusher got in immediate contact with the broken pieces and glass splinters. A second generation of glass crushers were directly be installed on the sharps pit. This has the advantage that once the glass has been crushed, it is immediately disposed of in the sharps pit. Unfortunately, most of these designs had still some technical flaws; e.g. having to remove the hammer out of the crusher in order to reload the crusher, thus coming again in contact with glass splinters .

The glass crusher prototype made by MSF-Cambodia some years ago seems to have the most promising potential; it is simple in design, reloading can be done without removing the hammer from the crusher and sharp residues fall straight into the sharps pit. Therefore, the operator doesn't get in contact with crushed glass residues. Still some modifications can be made to the original design to make it even more appropriate, depending on the situation. The Cambodian glass crusher is presented hereafter, including some suggestions for improvements of the original design.

Presentation of Glass Crusher

Trial Ampule Crusher, for Sothnicum Hospital

Crusher to be installed along side conventional sharps tube



The overall dimensions can be adjusted to fit local materials, depending on whether or not box section or angle iron is available. However after testing there are two important dimensions to be noted, these are for the distance between the teeth and the distance between the reinforcing bars. These dimensions result from adjustments made to the design to counter the problems caused by the rubber bungs used in the 100 ml Ampoules.

The distance between the reinforcing bars should $<2.0 \text{ cm} > 1.8 \text{ cm}$ this is large enough to allow the rubber bungs to pass and is small enough to stop the smaller ampoules falling through without breaking.

The distance between the teeth should be $>3.2 \text{ cm}$ this avoids the rubber bungs getting caught between the teeth, when the plunger is raised.

Notes for operation:

Do not over fill, this can cause a layer of broken glass to build up and block the grate. The crusher will easily function with a loaded depth of 20cm of ampoules before operation.

Remove the plastic straps, which are sometimes found on the larger ampoules before inserting the ampoule in the crusher - the plastic can be incinerated.

Construction of Crusher Body

Crusher body is made of 2 pieces of U-profiles or 4 pieces of metal angles (L-profiles). Adapt the crusher dimensions to the height of the operator(s): when standing up next to the crusher, he/she should be able to take the plunger's handle with slightly bended elbows and without bending the knees. It might also be necessary to make the whole surface of the crusher bigger, not only to be able to collect more glass at one time, but also to have a bigger size of the loading shoot, which would permit an easier loading of the crusher.



Side view of crusher with shoot ^

The angle (green arrow) in between the shoot and the body might be smaller, to ease the loading of the crusher.

Crusher body completed with shoot door and plunger locking mechanism >



Construction of Crusher Support

Crusher support is made of metal angles (L-profile) and the grill of reinforcement bars (min. 12 mm in diameter). The square opening dimensions of the support should permit the crusher body just to slide inside.



Detail crusher foot top ^

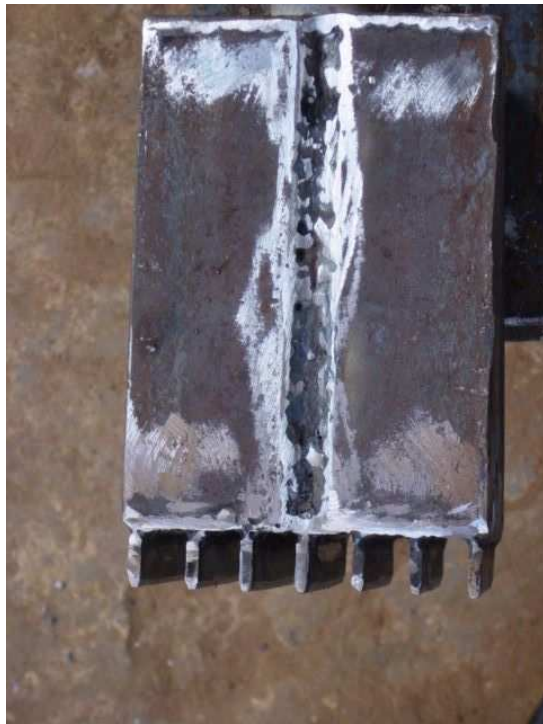
Detail crusher foot bottom with grill (upside-down view)>

The grill might be made of angle iron (together with the plunger) in order to avoid blockages (see further)



Construction of Crusher Plunger

Crusher plunger foot is made of 2 pieces of U-profiles or 4 pieces of metal angles (L-profiles) and the teeth can be straight metal strips or metal angles (watch out that the spacing of the teeth matches the spacing of the grill). The handle bar is made of square or round pipe. Use thick walled material as this plunger will receive a lot of battering.



< Detail plunger foot



Finished plunger >

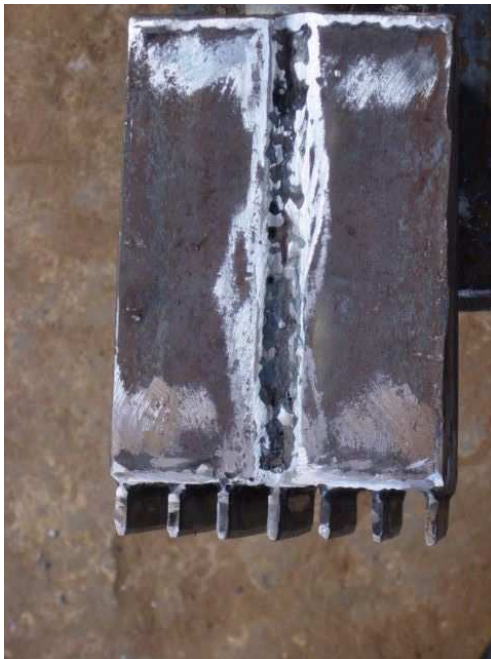


Detail of Crusher Plunger Foot

Choosing the correct spacing of the teeth and matching grill is important:

- Narrow spacing will get blocked by the rubber bungs and the aluminium caps of the vials.
- Wide spacing will allow small ampoules to fall through the grill without being crushed.

Therefore is it important to assess which glass waste is mostly generated and adapt the glass crusher accordingly.



Narrow spacing: ampoules ^



^ Aluminium caps caught on narrow spaced grill



Wide spacing: vials ^

Remark: A design with teeth of angle irons, both for the plunger foot (hammer) as for the crusher foot (grill) might reduce blockages.

Crusher Base

Crusher base is made of reinforced concrete as it will get battered a lot. Slots have to be foreseen to fit the grill of the crusher support. Bolts should be integrated in the concrete base, matching the holes of the support foot.



Crusher base ^

Crusher assembly (base, support, body & plunger) ready for installation >



Installation of Crusher on Sharps Pit

Remark: More space should be provided in between the crusher and the normal drop pipe of the sharps pit, in order that the waste manager can easily operate the crusher.



Loading & Operating Crusher



1. Lift the plunger and block it with the locking rod



2. Open the shoot door and start loading small batches of glass waste (DO NOT OVERLOAD!!!)

Remark: Individual loading of glass waste (as seen in the picture) might be dangerous. It would be better to be able to pour the waste in the shoot, which needs a bigger shoot opening.



3. Lift the plunger, remove the locking rod and start crushing the glass

Remark: It is better to stand on the other side of the crusher as this allow a better operation position (standing closer to the crusher whilst not hindered by the shoot), causing less strain on the operator's back and arms.

Volume Before & After Crushing



Remark: This is only a demonstration because in reality, the crushed glass will fall straight in the sharps pit.



Remarks on loading

In order to avoid blockages:

- Remove all plastic wrapping from the glass that needs to be crushed.
- Don't overload per batch



Attention: wear protective clothing when operating or maintaining the glass crusher!!!

Condition after 1 Year

After 1 year, the glass crusher was still working, although there was some damage to the crusher's plunger.

