De Montfort Mark 8a Incinerator

Introduction

This is the recommended incinerator for all but large hospitals.

The instructions which follow are meant to be used in all countries. The building instructions give the number and position of the bricks, but not the overall dimensions of the incinerator. This is because bricks differ slightly in size between one country and another, and it is simpler to adjust the overall size of the incinerator to the available bricks than to have to cut bricks to an exact dimension.

Similarly, only approximate dimensions of the steelwork are given. The correct procedure is to lay out the first two layers of bricks, and then measure the length and breadth of the steel which fits on top. The steel top can then be made to fit the finished brickwork.

The steel tunnel and ash door can also be dimensioned to fit the brickwork by taking measurements from the brickwork once the tunnel is formed in the first five layers of bricks.

Summary of characteristics

Use: designed especially for most healthcare facilities, except large hospitals (more than 300 - 400 beds)

Capacity: 12 kg/h

Lifespan (average): 3-5 years

Approximate unit cost in USD (materials only): 250 - 1'000 depending on the availability of refractory bricks

Time necessary to build: 3-4 days

Remarks: Where the load to be burned consists almost entirely of sharps boxes filled with used hypodermics, special conditions apply:

1. The plastic in the syringes has a very high calorific value and additional fuel will not be required after the initial warm up period.

2. Boxes should be introduced one at a time. There will be a brief delay, then an increase in smoke level followed by a gradual decrease. The next box should be introduced when the smoke level is observed to be decreasing.

3. Tests have shown that this means that boxes of up to 100 syringes can be burned at a rate of about one every 10 minutes.

4. Introducing boxes at a higher rate than this will result in very high smoke rates and molten plastic at the base of the incinerator.
**List of materials**

<table>
<thead>
<tr>
<th>Item</th>
<th>Dimensions</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fire bricks</td>
<td>200 (approx.)</td>
<td></td>
</tr>
<tr>
<td>Sand</td>
<td>200 kg</td>
<td></td>
</tr>
<tr>
<td>Fire cement (high alumina)</td>
<td>50 kg</td>
<td></td>
</tr>
<tr>
<td>Rolled steel angle (mild steel)</td>
<td>30x30x3mm thick</td>
<td>12 metres</td>
</tr>
<tr>
<td>Rolled steel channel (mild steel)</td>
<td>100x40x5mm thick</td>
<td>4 metres</td>
</tr>
<tr>
<td>Flat sheet (mild steel) for loading door</td>
<td>600 x 750 x 3mm</td>
<td>1 sheet</td>
</tr>
<tr>
<td>Flat sheet (mild steel) for ash door</td>
<td>250 x 250 x 3mm</td>
<td>1 sheet</td>
</tr>
<tr>
<td>Flat sheet (mild steel) for chimney spigot support</td>
<td>250 x 150 x 3mm</td>
<td>1 sheet</td>
</tr>
<tr>
<td>Mild steel pipe</td>
<td>150mm diameter x 3mm thick (approx)</td>
<td>4 metres</td>
</tr>
<tr>
<td>Hinges for ash door</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pipe, for loading door hinge</td>
<td>1 inch</td>
<td>1</td>
</tr>
<tr>
<td>Rod, for loading door hinge</td>
<td>3/4 inch</td>
<td>1</td>
</tr>
<tr>
<td>Masonry plugs (rawlplugs), screws, etc</td>
<td>no 10</td>
<td>16</td>
</tr>
<tr>
<td>Welding rods (mild steel)</td>
<td></td>
<td>40</td>
</tr>
<tr>
<td>Steel cable (optional)</td>
<td>5 mm 7 strand</td>
<td>40 metres</td>
</tr>
<tr>
<td>Turnbuckles (optional)</td>
<td>M8 x 150 mm long</td>
<td>4 (not essential)</td>
</tr>
<tr>
<td>Wire Mesh (optional)</td>
<td>Any fine gauge</td>
<td>loose fill</td>
</tr>
<tr>
<td>Fuel tank, tap and pipe (optional)</td>
<td></td>
<td>1 set</td>
</tr>
</tbody>
</table>

**Note**

If required, the incinerator body can be clamped together with steel bars. It can also be surrounded by an outer case of common bricks to give extra strength and weather protection. In this case, the two thicknesses of brick should be “capped” with cement.

Materials should be obtained before starting the construction!

**Complete layout**

![Figure 1: De Montfort incinerator Mark 8a](image-url)
Concrete foundation: $L \times W \times H = 2\text{m} \times 2\text{m} \times 0.15\text{m}$
Refractory bricks: $L \times W \times H = \text{approx. } 230 \times 110 \times 65\text{ mm}$
Mortar: Refractory cement (high alumina)
LAYER
1
LAYER
2
LAYER
3
LAYER
4
LAYER
5
Make a viewing hole by creating a gap in the cement between layer 6 & 7. Insert a piece of wood that can be removed.
LAYER
7
LAYER
8
LAYER
9
LAYER
11
Minimum ~ 900 mm

Flue & Secondary combustion chamber

Primary combustion chamber
LOCATORS: Pieces of metal channel are welded to the top frame as locators

HINGES: 3mm metal plate is used for the loading door hinges
The loading door is made from a frame of metal angle (30 x 30 x 3) with a plate of 3mm steel welded on top.
The loading door is hinged with a metal bar threaded through the locating holes.

A baffle plate made from the same materials can be welded to the underside for extra strength.
FITTING THE TOP FRAME TO THE INCINERATOR BODY

Seal with refractory cement
The brick arch at the front is supported by a steel tunnel (3mm thickness). Steel angle (30x30x3) welded around the front edge of the tunnel forms the support for the ash door, which is hinged.

The ash door (3mm thickness) covers _ of the area of the arch. The remainder forms the air inlet.

Dimensions for brick size (230 x 100 x 65), may need to be adjusted.
BODY OF INCINERATOR
WITH ASH DOOR AND
TOP FRAME
The chimney spigot is made from a frame of metal angle (30 x 30 x 3) with a plate of 5mm steel welded on top and a piece of steel pipe (3mm thickness).
The chimney is made from a steel pipe (3mm thickness). It is sealed to the spigot with fire cement.

Chimney guard for safety

120 – 150 mm

4 m
Ensure there is enough space for the top frame locators to fit between the inner and outer walls.
The gaps between the refractory bricks and outer wall can be filled with refractory cement.

Paint to inhibit corrosion.
SHELTER

Rain cap for chimney

Ensure good seal

Sloping roof, made from steel sheet

Concrete foundation

Channel to divert rain way from chimney
**Operation**

The incinerator should be started by putting waste paper, cardboard or similar easily ignited material over the grate. Burning paper can then be dropped on top, and when a good flame is established, more combustible material added till the combustion chamber is half full. If available, about 100 cc of kerosene, diesel oil or used lubricating oil can be poured on top to speed the heating process. Only dry, non-infected waste should be added for the first 10 minutes or until a fierce flame is established.

The combustion chamber should be kept at least half full, and infectious and/or wet waste should be added above dry materials to ensure that it dries before reaching the combustion zone. Additional liquid fuel can be added if it is suspected that the combustion rate is decreasing. Any plastic waste available will also help to raise the temperature of combustion, but both this and the oil will give rise to black smoke if used to excess.

The incinerator will be most efficient if it is operated for fairly long periods once it is ignited. The grate and the flue passage to the base of the chimney must be kept clear by poking a steel rod through the air inlet hole from time to time. It may also be necessary to push down the load from time to time to prevent it “arching” above the grate. The last load before closing down should be as dry and safe as possible, so that no unburned material is left.

**Maintenance**

As with any type of equipment, there is a need to perform some regular maintenance to ensure both that the system will continue to work properly and to prolong the life span of the incinerator.

**Before each operation.**
- Check that ashes have been completely cleared from the grate and floor of incinerator.
- Check that loading door closes properly onto the sand seal in an air-tight manner. Loosen sand if necessary.

**Annual inspection and rectifications**

<table>
<thead>
<tr>
<th>Component</th>
<th>Check</th>
<th>Rectify if necessary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chimney</td>
<td>Vertical fixings</td>
<td>Reset or renew</td>
</tr>
<tr>
<td>Chimney support plate</td>
<td>Corrosion</td>
<td>Replace if necessary</td>
</tr>
<tr>
<td>Top sand seals</td>
<td>Cement seal to brickwork, Adequate sand level</td>
<td>Re-seal with refractory cement. Top up sand</td>
</tr>
<tr>
<td>Ash door</td>
<td>Corrosion, hinges, catch, blockage in door-frame</td>
<td>Repair and clean as necessary</td>
</tr>
<tr>
<td>Brickwork</td>
<td>Missing cement</td>
<td>Replace with refractory cement</td>
</tr>
<tr>
<td></td>
<td>Evidence of thermal damage to bricks</td>
<td>Line inner surface of bricks with 10 mm refractory cement</td>
</tr>
</tbody>
</table>

**Disclaimer**

Since the safe and successful use of the incinerator, which operates at very high temperatures, is entirely dependent on the building, operation and maintenance thereof, the University and the organizations supplying the drawings and instructions can bear no responsibility for any mishaps to personnel or inadequate technical performance of the incinerator.

**Information & questions**

Any questions relating to these instructions should be referred to: Professor D.J. Picken (De Montfort University, Leicester, UK)

Contact formular available at: