

De Montfort Mark 7 Incinerator (Flatpack)

Introduction

This design is specially for those occasions when a large number of incinerators are to be built at one location and transported to the places where they are to be used. It has the same dimensions as the Mark 8a, and has identical performances.

The **incinerator body** is constructed from five concrete flat castings held together by nuts, bolts and steel straps.

The **incinerator roof** and the **loading door** are fabricated from 3 mm mild steel sheet with reinforcements. Any gaps between concrete castings are sealed with fireclay. The loading door frame is built into the top panel and the ash door frame and the air pipes onto the front panel. The chimney stack is made from thin stainless steel chimney liner supported on an angle steel frame bolted to the rear panel.

Each concrete panel is made from an inner layer of high alumina cement 15mm thick, and an outer layer of insulating cement made from a mixture of vermiculite and Portland cement 75 mm thick. A reinforcing mesh is cast into each panel, and 20 mm diameter steel tubes cast into the front, centre and rear panels to mate with holes cast into the two side panels. The incinerator can thus be bolted together, using 10 mm screwed rod, and the joints sealed with fire cement.

The instructions on the following pages cover the manufacture of the components and the assembly.

Summary of characteristics

Use: designed especially for emergency situations.

Capacity: 12 kg/h

Lifespan (average): 6 - 12 months (the design does not anticipate that it will be used over a long period)

Approximate unit cost in USD (materials only): 250-1'000 depending on availability of vermiculite and steel.

Time to make components: 2 weeks to allow setting time

Time to erect on site: 4 - 5 hours

Remarks: If the ground on which it is to be assembled is not firm, a concrete base must be provided as for the other designs.

Because the manufacture includes cement setting in **moulds**, it is recommended that a few of these should be made and kept at a central store as flatpacks in advance of the need.

If the ground on which it is to be assembled is not firm, a concrete base must be provided as for the other designs.



List of materials

| Item | Quantity | Purpose |
|--|----------------------|-----------------------------|
| Planed Wood (150mmx15mm) | 8 metres | mould frames for cement |
| Planed wood | 2 metres x 1 metre | |
| Refractory Cement | 4 x 25 kg bags | Inner lining of walls |
| Vermiculite | 200 litres | Outer walls |
| Portland (white) cement | 5 x 25 litre bags | Mix with vermiculite |
| Screwed rod (10mm D) | 5 metres | fastening walls together |
| Flat steel sheet (3mm) | 600mmx750mm (approx) | For loading door |
| Flat steel sheet (3mm) | 250mmx250mm (approx) | For ash door |
| Flat steel sheet (5mm) | 250mmx150mm (approx) | chimney spigot support |
| Rolled steel channel (100x40x5) | 4 metres | For sand frames |
| Rolled steel angle (30x30x3) | 30 metres | frames and chimney supports |
| Stainless steel chimney liner (120 mm D) | 4metres | chimney |
| Sand | 400 kg | |
| Nuts and bolts (10 mm) | 20 | |
| Hinges | 2 | |

Complete layout

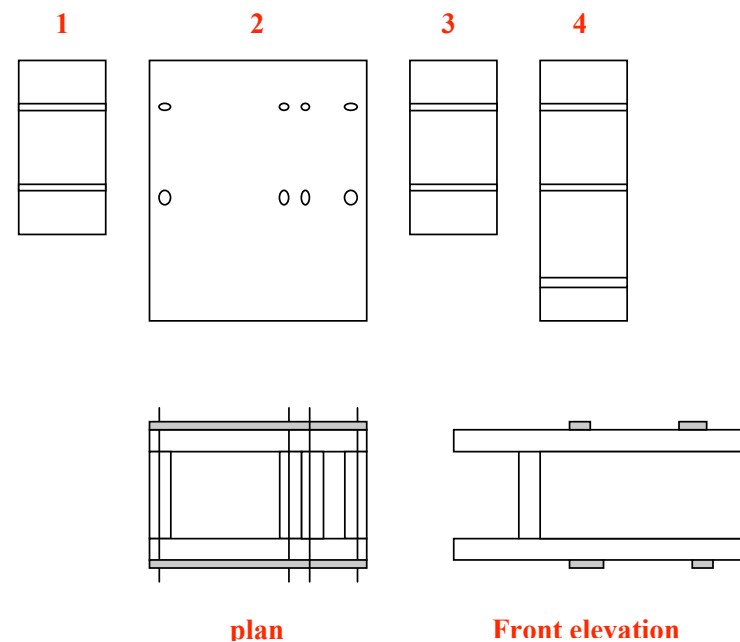


Figure 1: De Montfort incinerator Mark 7 (flatpack)

Construction of panels

Each panel should be cast in a rectangular **wooden former** in the following manner.

A 15 mm thick layer of high alumina medium density fire cement should first be cast in the bottom of the former. For one of the two side panels, the vermiculite cement must be cast first, and the fire cement on top in order that each panel can be assembled with the fireclay on the inside.

A 75 mm layer of vermiculite cement should then be cast on top of the fire cement. A reinforcing grid should be cast in the centre of the vermiculite cement, and the 20 mm tubes cast in place and positioned using screwed rods pushed through holes drilled through the wooden former.

Front and two centre panels (figure 2)

Dimensions are 250 mm x 625 mm. Two 20 mm tube are cast 125 mm from each end, 50 mm deep and located by rods pushed through holes drilled through the wooden former.

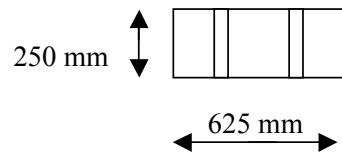


Figure 2



Photo 2: Cement former assembled for front and centre cross-pieces



Photo 3: Front panel (identical to the two centre panels)

Side panels (figure 3)

Nine 20 mm tubes are cast 125 mm and 500 mm from top. One off 875 mm from top, 50 mm from sides and central, 125 mm apart.

Note that the two side panels are handed, i.e. the right hand one is the mirror image of the left hand one. This is necessary to **ensure that the refractory cement on both panels is on the inside** of the incinerator.

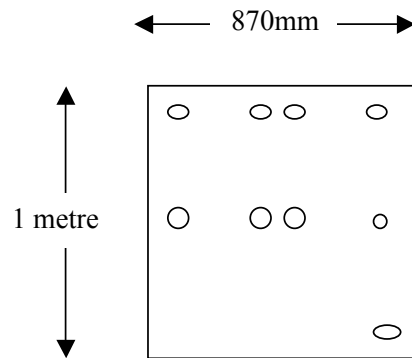


Figure 3

Rear panel (figure 4)

Dimensions are 250 mm x 1 metre. Three 20 mm tubes are cast 125 mm, 500 mm and 875 mm from the top and 50 mm deep.

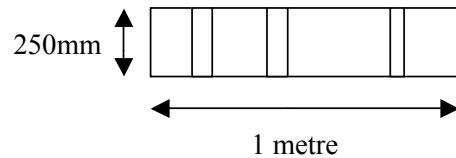


Figure 4



Photo 4: ... former side plates with ... cement and screwed rods



Photo 5: First cement side; composite slab removed from former

Checking assembly of panels

The panels are bolted together using 9 lengths of 10 mm screwed rod, each 500 mm long passing through the cast-in tubes. Care should be taken **not to over-tighten the nuts**, as this could result in cracking the side panels.

Strips of 30x3 mm steel are used to distribute the load along the sides of the incinerator as shown in Figure 1 and Figure 6.



Photo 6: Fitting rear panel first before centre and front panels



Photo 7: Checking the proper assembly of panels before delivery

Construction of steel components

Making the sand seals (These should be supplied ready made to site)

These are made from 100x30x5 mm rolled steel channel, welded together to make two rectangular troughs as shown on Figure 5 below. 2x 30 mm steel strip 200 mm long is welded to the sides and ends of the channels to act as locating brackets when the sand seals are placed on the panels.

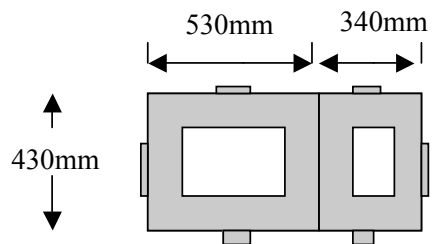


Figure 5: 2 steel channels, welded together

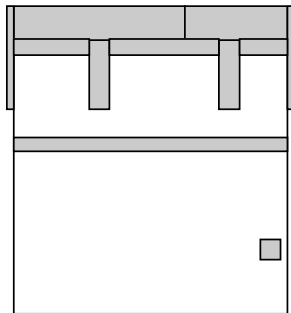


Figure 6: Sand seals fitted to body

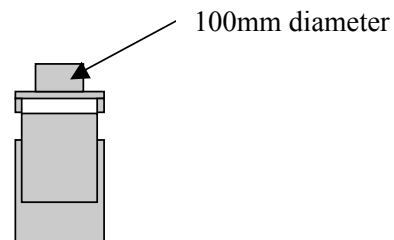


Figure 7: Chimney spigot



Photo 8: Steel top complete



Photo 9: Fitting steel top

Attach Ash Door and ash tunnel (figure 8)

The ash door is attached to the front panel by cementing in the ash tunnel.

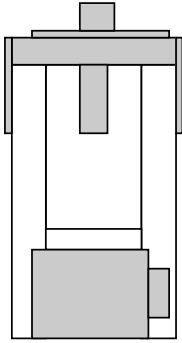


Figure 8: Ash door fitted to front, leaving room for air holes

Attach Chimney

The chimney is supplied as a 120 mm stainless steel tube, 4 metres long. it is fitted over the chimney spigot, and supported by the two rolled steel angle supports. (Note that it will not be perfectly straight). The chimney is sealed to the spigot using fire cement.

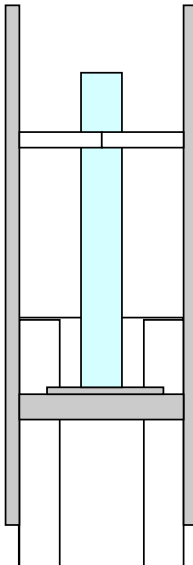


Figure 9: Attach 2 rsa 30x30x3 to support chimney

Final preparation

All gaps between the panels must be sealed with fire cement. The floor must be covered with a 25 mm layer of fire cement to protect the concrete base.

Firing should be delayed for 12 hours to allow initial curing of the fire cement.

Making and Fixing the Loading Door

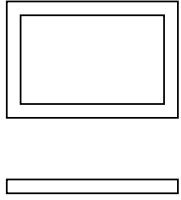


Figure 10 weld angle steel frame and attach to 3 mm ms plate

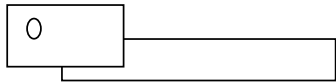


Figure 12 Attach matching hinge brackets to door frame

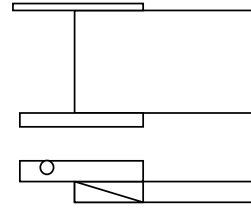


Figure 11 attach hinge brackets to door

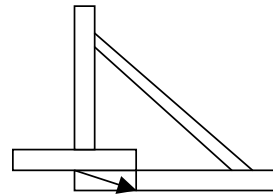


Figure 13 Attach handle to door

Important note for Users

All manufacture except for assembly should be complete **before the incinerator is delivered to site.**

Parts list for “Flatpack” to be delivered to site

1. Two matching side panels
2. Three identical panels for front and centre
3. One rear panel
4. Nine lengths of 10 mm screwed rod, with nuts and washers
5. Four lengths of 30x2mm steel strip 900mm long to distribute load from screwed rod to side panels
6. One bag fire cement (25 kg) for sealing panels and floor
7. Steel channel sand seal with hinge bracket and locating strips attached
8. Loading door with hinge bracket and handle
9. Steel hinge for loading door
10. Chimney plate and spigot
11. 4 metre stainless steel chimney
12. Two 4 metre rolled steel angles 30x30x2 for supporting chimney
13. Two chimney support brackets
14. Eighteen 5mmx25mm set screws and nuts
15. Front panel
16. Ash door with hinge, latch and securing plates
17. Twelve 10mm masonry bolts for securing plates to panels
18. Steel Grate
19. Ash Scraper



Photo 10: “Flatpack” ready for loading



Photo 11: components in van



1. One square metre of earth cleared and levelled



2. Sides are assembled and gaps filled with fire cement



3. Complete but no chimney



4. Incinerator complete and operational.
Chimney support brackets attached and chimney erected

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 in fuel consumption if it is operated for fairly long periods once it is ignited, but 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 on the grate.

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

| Component | Check | Rectify if necessary |
|-----------------------|---|--|
| Chimney | Vertical fixings | Reset or renew |
| | Corrosion | Repair any holes or weak points. Replace chimney or section thereof if necessary |
| Chimney support plate | Corrosion | Replace if necessary |
| Top sand seals | Cement seal to brickwork. Adequate sand level | Re-seal with refractory cement. Top up sand |
| Ash door | Corrosion, hinges, catch, blockage in door-frame | Repair and clean as necessary |
| Concrete panels | Cracks | Patch with refractory cement |

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:

http://www.mw-incinerator.info/en/601_contact_us.html