Specification for Concrete Sliding 'Platform Door'

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(for photographs of this door see www.damsforafrica.com > anti-theft products > platform door)

1. Scope

This specification relates to the manufacture and installation of a concrete sliding 'platform door' closing off an opening to a structure, for the prevention of theft/vandalism.

In section the door is L shaped, with a vertical front panel and a horizontal (or stabilizing) panel. The vertical panel closes off the door opening. The horizontal panel is connected at its one end to the lower end of the vertical panel, while its other end is extended away from it. It thus serves to move the door's centre of gravity away from the vertical panel and towards the centroid of the horizontal panel, making the door more stable against overturning. The characteristics and functionalities of the door are briefly described further on, and more fully described in SA patent 2012/04733.

It is assumed that the door is to be installed in a structure that has an existing door opening and sufficient internal space for the door to slide fully open on the inside. It is further assumed that the floor has sufficient strength to support the weight of the door, and that the finished elevation of the floor is level to a tolerance of plus minus 5mm, and similarly that the inside walls are vertical to a tolerance of plus minus 5mm.

It is also assumed that the structure has no other openings, such as windows, large enough for a person to get through. Any windows that may be present in an existing structure should be closed off according the specification 'Specification for Closure of Windows'. Such a closure makes provision for ventilation via 100mm diameter ventilation holes.

2. Dimensions

The size of the sliding door will vary depending on the size of the door opening. Typically the door will clear the floor by 5 to 10mm, and its vertical panel will be approximately 10mm away from the inside face of the wall. In elevation the door overlaps both door posts by approximately 100mm, and also overlaps the soffit by the same amount.

Accordingly the vertical panel is specified as follows:

Height of panel, H1	= height of doorway + 100mm
Width of panel, W1	= width of doorway + 200mm
Thickness of panel, T1	= 120mm

(In cases requiring exceptional levels of security the thickness may be increased to 150mm.

The horizontal (stabilizing) panel is specified as follow:

Height of panel, H2	= 200mm
Width of panel, W2	= width of doorway + 200mm
Length of panel, L2	= height of doorway/2.5

It is clear that by using the above relationships a platform door can be made and retrofitted for any doorway opening. However, in the interests of standardization, and where the opening of the structure has not yet been established, the following two doorway sizes and platform doors are recommended.:

Doorway opening for 'single door'	= 800mm wide x 2050mm high
Front panel	= 1000mm wide x 2150mm high x 120mm thick
Stabilizing panel	= 1000mm wide x 200mm high x 740mm long
Mass (based on 2500kg/m3)	= 1015 kg

Doorway opening for 'double door'	= 1500mm wide x 2050mm high

Front panel	= 1700mm wide x 2150mm high x 120mm thick
Stabilizing panel	= 1700mm wide x 200mm high x 740mm long
Mass	= 1726 kg (based on 1523 kg/m3)

The door is supported by four wheels that run on two 20mm diameter stainless steel rails that are grouted into the floor slab. Usually two grooves are provided in the floor slab by the main contractor for this purpose (see 3.6). Alternatively, in the case of a retrofit door, two shallow grooves may be cut into the existing floor-slab using an angle grinder, followed by core drilling holes spaced at 200mm for grouting in lugs attached to the underside of the rails (see 3.6).

The length of the SS304 rails = 2 x W1 + 600mm

Therefore applying this relationship to the single door the rails will each be 2600mm long, and 4000mm long for the double door.

3. Description

3.1 Shape

In cross section the door is L shaped, with a vertical upright panel, and a horizontal panel that is attached to the bottom of the upright panel with its open end extending into the interior of the structure. See figure 1.

3.2 Concrete

The door is made of reinforced concrete. The 28 day characteristic strength of the concrete is 60 MPa.

3.3 Reinforcing

The vertical panel is reinforced with 5 layers of Y12 reinforcing bars, with a characteristic tensile strength of 460 MPa. These are spaced at 100 mm in both directions. The total thickness of the reinforcing is thus 60 mm.

The horizontal panel is reinforced top and bottom with Y10 bars spaced at 200mm ctc in both directions. Y10 U bars in both the vertical and horizontal panels connect the two panels together. They are spaced at 200mm. The legs of the U bars should be 600mm long.

3.4 Cover

Minimum cover to the reinforcing shall be 25mm.

3.5 Rails

The sliding door runs on 2 x 20mm SS 304 rails – see section 2 for length. The rails are drilled and tapped every 200mm on their underside to a depth of 12mm, to accommodate M10 threaded bars (see 3.6).

3.6 *Rail assemblies*

There are two types of rail assembly:

The first is for the case where slots are provided in the floor for the rail assemblies, usually at the time the floor is constructed. In this case the rail assemblies consist of the 20mm rails as described in 3.5, J shaped M10 threaded bars, that have a vertical leg that is 125mm long and a horizontal leg that is 75mm long, and a Y12 reinforcing bar that is the same length as the 20mm rails. The long leg of the J shaped M10 threaded bars are inserted into the tapped holes of the rails, while the shorter legs are fastened directly above the Y12 reinforcing bar. It follows that the reinforcing bar runs parallel with the rails at a distance of approximately 125mm beneath.

This assembly is placed into a 140mm deep x 50mm wide groove in the floor slab, and then concreted with a suitably plasticised high strength non-shrink grout.

The second type of rail assembly is used in a retrofit situation, where there is an existing concrete floor. This assembly will consist of straight lengths of M10 x 125 threaded bars that are screwed into the tapped holes of the rails.

The groove in this instance will be cut with an angle grinder such that it is 50mm wide x 30mm deep. Next 130mm deep cored holes are drilled, of diameter 28mm and spaced at 200mm along the centre line of the grooves. The holes may be made using a core drilling machine. Prior to grouting the rail should protrude 10mm above the floor level. The holes and groove may now be grouted with a suitably plasticised high strength non-shrink grout.

It is essential that on completion of the installation that the two rails are perfectly level and parallel.

3.7 *Sliding bar/rack*

A 40mm x 40mm x 1000mm (approx.) steel bar slides up and down behind the vertical panel (on the inside of the structure). This bar is guided by one or more a guide brackets attached to the vertical panel. It has a rack arrangement at its upper end (see fig 1), and small wheel fitted at its lower end.

3.8 *Anchor cup*

Its function is to anchor the sliding bar/rack when it is in the locked position.

It is made from 50 x 50 x 2mm hollow tube of length 100mm. It is closed at one end by a 55 x 55 x 3mm plate, and is open at the other end. The cup is grouted into a 100mm diameter x 120mm deep hole cored into the concrete floor, in the position that the sliding bar/rack will be when the door is in its closed position.

4.0 Installation of door

Once the concrete/grout has gained sufficient strength, the door, with its wheels and wheel brackets attached may be placed on top of the rails, by means of a crane or any other suitable means. Thereafter the sliding bar/rack may be inserted into the guide bracket and on through the hole in the stabilizing panel. When the door is in its closed position the sliding bar/rack will drop into the anchor cup, rendering the door locked.

5.0 The sliding door is now described by way of diagrams

5.1 Figure 1

This shows a perspective of a *door (a)* made from 60MPa reinforced concrete. It has a tall *vertical panel (b),* and a squat *horizontal panel (c)* for stabilizing the door against overturning. The horizontal panel is connected to the vertical panel to form an L shape in section. The dimensions of these panels are given in 2.0.

There is a 200mm long x 44mm x 44mm *vertical hole(d)* through the *second panel* to accommodate the 40mm x 40mm *sliding bar (e),* and above this a short *guide assembly (f)* which has the same function. The guide assembly is fastened to the vertical panel by means of two M12 x 25mm bolts, that go into two M12 x 45mm long ferrules cast into the vertical panel.

Further up, and slightly offset to one side is the *access tube (g)* that is cast into the vertical panel. A removable spline plate covers this access tube, although this plate is not shown in figure 1, but shown in figure 3.

The top section of the sliding bar consists of a 40mm x 40mm x approximately 1000mm long *rack (h),* (which is engaged by the pinion of the opening tool (see figure 2) for a view of the pinion, while figure 3 shows the pinion engaging the rack).

The door is supported by four 100mm diameter *wheels (i)* that run on the *rails (j).* The first pair of *wheels* are attached to the *vertical panel*, while the second pair to the *horizontal panel*. The means of attachment is by *wheel brackets (k). Each bracket is attached by means of four M12 x 30mm bolts* that are bolted to M12 x 45 ferrules cast in the respective panels.

The sliding bar & rack, guide assembly, and wheel brackets are made from mild steel which is hot dip galvanised after assembly. The wheels are electro-plated. The access tube is made from black bar galvanised after machining, and rails are made from 304 stainless steel.

5.2 Figure 2

This shows the opening tool (l) that is used to lock or unlock the door. It consists of a 340mm long x 20mm diameter shaft (m) with a 400mm long x 16mm handle (n) attached at one end and a 10mm thick pinion (o) at the other. The number of teeth on the pinion and their shape are customizable. The pinion is attached to the shaft by means of a M10 x 25mm bolt (p) and 25 OD x 10 ID x 3mm retaining washer (q). The shaft has two 52OD x 20 ID x 15mm thick bearings (r) that serve to centralise the shaft when it is inserted into the access tube. The bearings are held in position by circlips that fit into circlip grooves machined in the shaft.

The shaft, handle, pinion, bolt, washer, circlips are either made from 304 stainless steel or bright mild steel bar that is electroplated.

5.3 Figure 3

This shows the 100mm x 100mm x 10mm spline-plate (s) attached via M12 x 25 mm bolts (t) to the inside face of the vertical panel (b) covering the access tube. The pinion (o), attached to the shaft (m), has moved through the access tube as has engaged the rack (h).

5.4 Closed and Open configurations:

In the closed configuration vertical panel (b) closes off the doorway, overlapping by 100m on the sides and the top. The sliding bar (e) is in its down position, inside the anchor cup.

To open the door, the first step is to insert the pinion (o) of the opening tool (l) into the access tube (g). The pinion then passes through the spline plate (s) situated at the end of the access tube, and then engages the rack (h). The handle (n) of the opening tool may now be turned, and the sliding bar begins to move upwards and out of the anchor cup in the floor.

The handle may now be pushed/pulled to slide the door open. The door, supported by four wheels, slides relatively easily, until an opening is created in the doorway. The opening tool may now be removed, and the door may be pushed/pulled until the doorway is unobstructed.

6.0 Door with three wheels

Figure 4 shows a similar door, but in this case it only has three wheels. The two wheels associated with the vertical panel are identical as in the four wheel version, but the wheel associated with the horizontal panel is located midway along its width and on the side opposite to the vertical panel.

This is a preferred option as the inside rail is shorter, and one less wheel is required.

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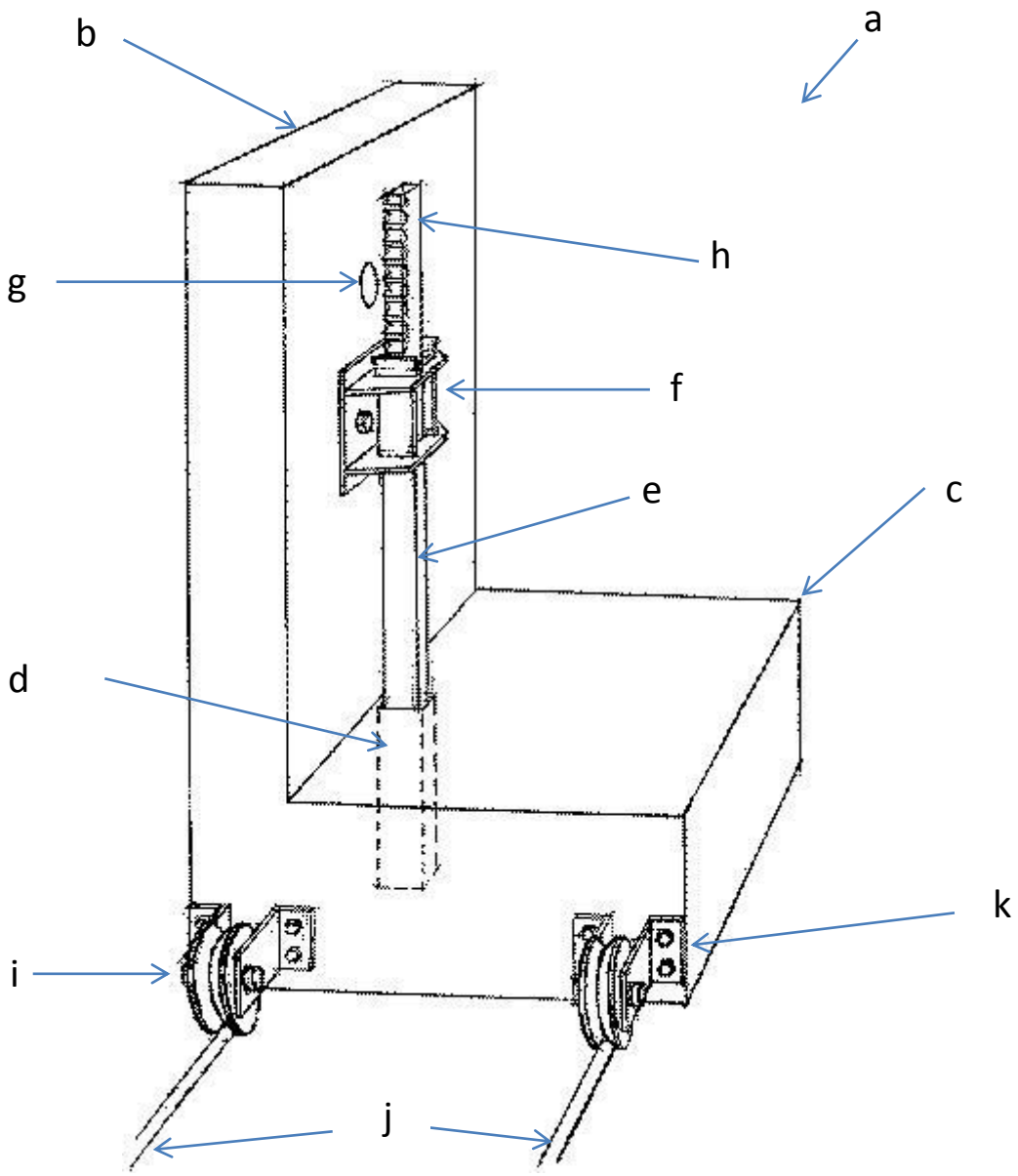

Figure 1 View of L door, with four wheels

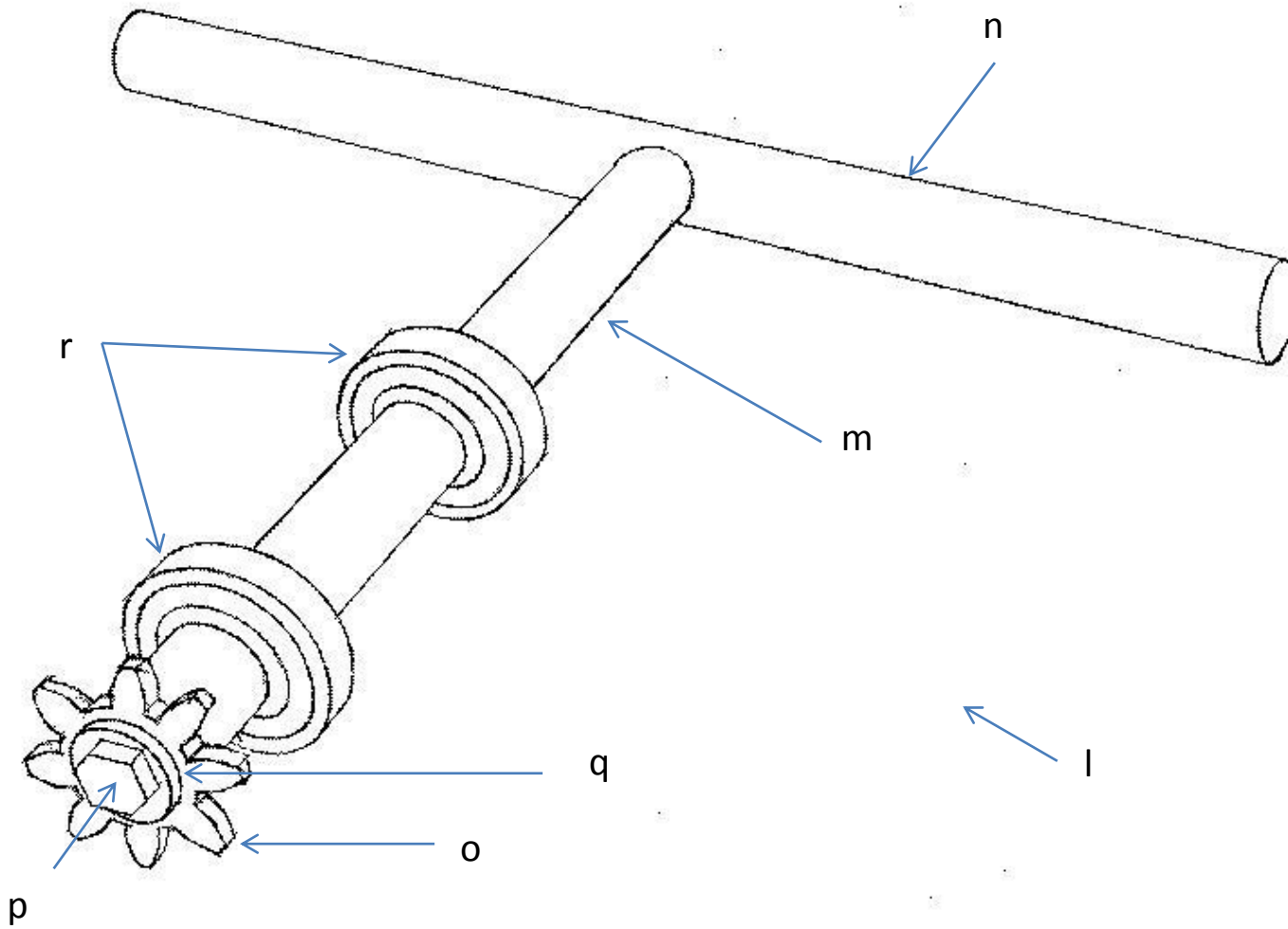

Figure 2 View of Opening Tool

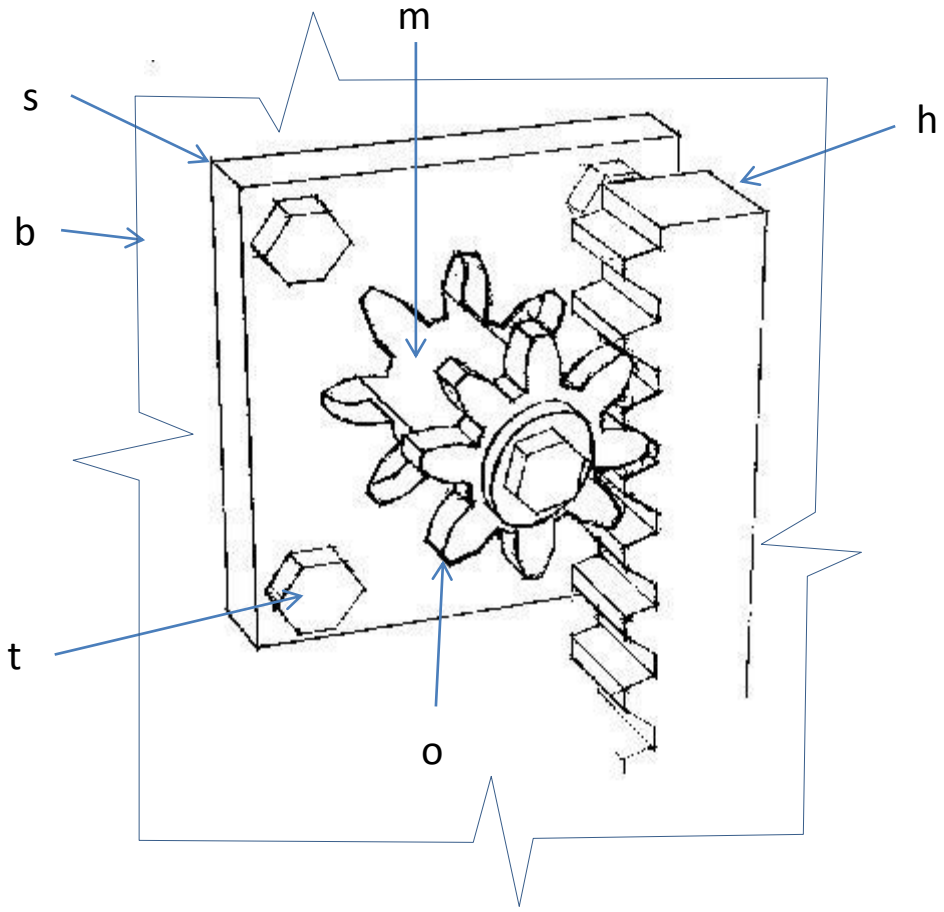

Figure 3 View of spline plate, pinion, and rack

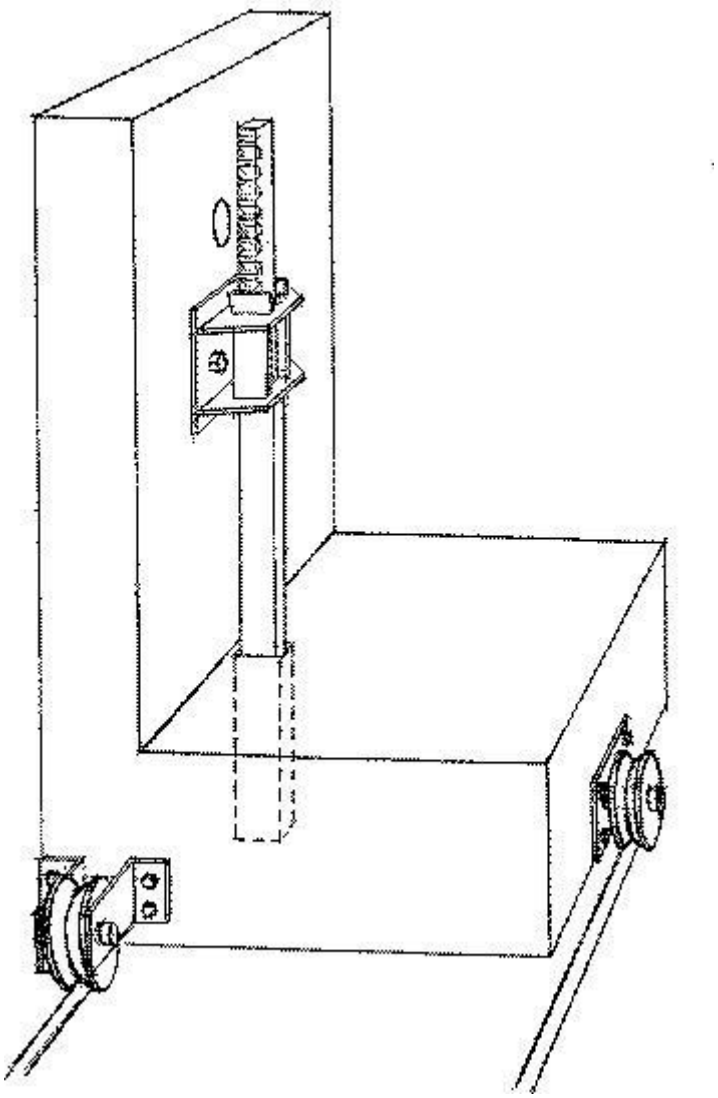

Figure 4 – View of L Door with three wheels