

## **NEW DISCUS CAGE DESIGNS**

### **Introduction**

There is a separate paper concerning new hammer cage designs.

Many existing hammer cages are used also for discus throwing either with a concentric circle or with the discus circle installed behind the hammer circle. The 2004-2005 IAAF Rule 192 proposes that any new separate discus circle be placed in front of the hammer circle. This paper addresses use of these cages for discus throwing also.

### **Calculating Danger Zones**

A concentric circle 1.5m radius is used by me to define the possible points of tangential release of the discus. This is illustrated in Figure 1 for the 2004 recommended stand-alone discus cage. Using this technique on the pre 2004 stand alone discus cage with 5m long sidewings gives a danger sector of 92 degrees compared with the 98 degrees maximum danger sector quoted in the 2002-2003 Handbook. If 98 degrees were considered to be accurate then the release circle radius would be approximately 1.8 metres with consequent larger danger sectors to those calculated here.

### **New Discus Cage Design**

The 2004 stand-alone discus cage has wing extensions to 7m. It should be noted that this cage will not be any more stringent for the discus throwers than was previously experienced by discus throwers, throwing from the rear discus circle in a hammer cage with a separate rear discus circle centred 6.57m from the cage opening into a 40 degree landing sector.

### **Other Discus Cage Designs**

A hammer cage with the discus circle behind the hammer circle as illustrated in the 1998-1999 Handbook has a much smaller danger sector of approximately 73 degrees than for the pre 2004 stand alone discus cage, even if the hammer gates are not used to reduce the danger zone sector, because the circle is further away from the cage opening.

It is pointed out in the hammer cage paper that it would be possible to convert the pre 2004 hammer cage for separate hammer and discus circle into a concentric throwing circle cage located 5.7m from the cage opening with improved safety for hammer throwing. There is also good safety for discus throwing from this cage with a danger sector of 63 degrees if the gates are extended parallel to the centre line of the landing sector but the far side netting would tend to restrict throwers. For that reason it is suggested that the gates be positioned so as to give a gate opening of 6.8m and a resultant danger zone of 68 degrees.

Stand alone discus cages are usually used in the north-eastern corner of conventionally orientated stadia. This makes the back straight very susceptible to a wayward discus thrown by a right-handed thrower that can not be stopped by a standard safety net along the back straight, falling on the track or environs.

When a discus is thrown from a pre 2004 concentric discus circle in a hammer cage the centre of the circle is only 4.2m from the main cage opening. The hammer gates must be located so as to reduce the danger sector. If the 2m long gates are placed parallel to the centre line of the landing sector the danger sector is approximately 77 degrees. If the existing hammer cage has the gates extended to 3.2m then the danger sector is reduced to 66 degrees if the gates are parallel to the centre line of the landing sector. If those gates are positioned so that the gate opening is 6.40m then the danger zone is 68 degrees.

To obtain even smaller danger sectors without inhibiting discus throwers gates would have to be added to the discus cages. Adding 1.5m long gates to the pre 2004 discus cage would reduce the danger sector to approximately 63 degrees. Apart from the added expense, these gates would not be popular with officials and would slow discus throwing competitions. For that reason it is not proposed at this stage.

The danger zones for the various cage designs calculated as stated above are shown in Attachment A.

### **2004 Cage Design Test**

The new cage design with 7.00m long sidewings and a 6m wide gate opening was tested by elite throwers at the Australian Institute of Sport in Canberra in May 2002. It was found that the design gave the much improved safety angle as theoretically calculated above whilst not inhibiting the throwers.

### **Conclusions**

To avoid the need to adjust hammer cage gates for left and right handed throwers when a hammer cage is used for discus throwing the gates can be positioned as suggested in the table of danger zones.

The configuration of the netting behind the circle can be left to individual manufacturers provided that the minimum distance to the netting from the centre of the circle is 3.00m.

### **Recommendation**

Alternative designs be permitted when it is demonstrated that the danger zone is comparable to that provided by the new stand-alone discus cage. In this regard then the following designs would be considered as satisfactory:

- Existing hammer cage with concentric circles with gates extended to 3.2m and positioned so to give a gate opening of 6.4m when being used for discus.
- Existing hammer cage with separate hammer and discus circles modified so that there are concentric circles with centres 5.7m from the gate pivot points with the 2m gates positioned to give a 6.8m gate opening.
- Existing hammer cage with separate hammer circle and discus circle behind with the hammer cage gates pulled aside.
- New hammer cage design with 7m gate pivot opening and 2.45m gates positioned so as to give a 9m gate opening.

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ATTACHMENT A

**ALTERNATIVE DISCUS CAGE DESIGNS**

	C/L to Cage Opening	Cage Opening Width	Wings Length	Approx. Danger Zone Degrees	Comment
Pre 2004 Design	5.00	6.00	5.00	92	
IAAF 2004 Design	7.00	6.00	7.00	69	2004 Discus Cage only Design. The same effect is achieved with the 2004 hammer cage gates 2m long drawn aside
IAAF 2004 Design	6.63	6.00	6.63	72	Discus circle in front of hammer circle in hammer cage with 2m gates extended parallel to the centre of the landing sector
Alternative	5.00	5.20	5.00	86	Existing discus cage sidewings moved to new positions
Alternative Design	7.00	7.00	7.00	75	Hammer Cage 7m opening with 2.45m gates drawn aside
Alternative Design	9.00	7.00	9.45	69	Hammer Cage 7m opening with 2.45m gates positioned 9m apart
Pre 2004 Hammer Cage	6.20	6.00	6.20	77	Pre 2004 Hammer Cage with 2.0m gates extended parallel to the centre line of landing sector
Pre 2004 Hammer Cage	6.14	5.00	6.20	70	Pre 2004 Hammer Cage with 2.0m gates extended closed to give 5m gate opening
Alternative Design	7.40	6.00	7.40	66	Hammer Cage with 3.2m gates extended so that the opening width is 6m
Alternative Design	7.39	6.40	7.40	68	Hammer Cage with 3.2m gates extended to give gate opening 6.4m
Pre 2004 Hammer Cage with separate circles	7.66	6.80	7.70	68	Hammer cage modified to have concentric circles 5.7m from the gate pivot points. When discus is thrown the gates are positioned so as to give a gate opening of 6.8m
Pre 2004 Design	6.57	6.00	4.20	73	Separate Discus Circle behind Hammer Circle with gates drawn aside