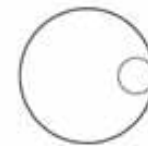
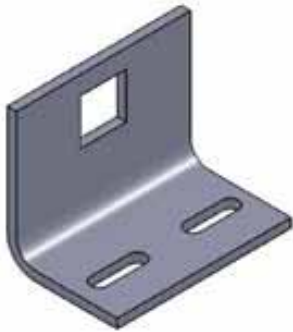


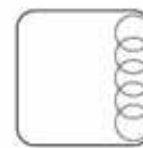
## Plate Washers and oversize holes

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When detailing brackets for attaching precast concrete, tolerance must be built in. The common way of achieving this is by using slotted holes. However, it is sometimes necessary to have tolerance in two directions, in which case an oversize hole can be used. This may be formed in a loose bracket or as part of the supporting structure.



Round hole has  
no vertical tolerance



Square hole has  
vertical tolerance

Although they may be more difficult to form, oversize holes are best if square or rectangular. As may be seen above, a round hole gives no tolerance in a given direction if it is already being used to its full extent in the other direction. A square hole on the other hand, allows full movement in both directions simultaneously.

Whatever the shape of the hole, it is necessary to have an oversize/plate washer to span across the hole as an ordinary washer would simply pass straight through. The material should be the same as the material against which they bear.

Square plates are typically sized so that the tolerance hole is always completely covered, thus the plate is supported on all four edges. Sizing of plate washers has largely been based on experience, although it is possible to carry out a design using Pigeuad's analysis, as a two-way spanning element carrying a central point load.

The tables below give typical sizes of plate washers for stainless steel. They are not definitive and different precasters may use differing sizes. Where square washers cannot be used because of space limitations, for example within a channel section, then rectangular plates are used.

### Square plate washers

Diameter	M12	M16	M20	M24	M30
Clearance hole	14 $\phi$	18 $\phi$	22 $\phi$	26 $\phi$	32 $\phi$
Tolerance hole	50 x 50	60 x 60	60 x 60	60 x 60	75 x 75
Min plate size	100 x 100	110 x 110	120 x 120	120 x 120	120 x 120
Min plate thickness	8	8	10	12	15

### Rectangular plate washers

Diameter	M12	M16	M20	M24	M30
Clearance hole	14 $\phi$	18 $\phi$	22 $\phi$	26 $\phi$	32 $\phi$
Tolerance hole	50 x 50	60 x 60	60 x 60	60 x 60	75 x 75
Min plate size	100 x 50	110 x 50	120 x 60	120 x 75	Do full design
Min plate thickness	10	12	15	20	