

CAPACITY OF MP1001 PLATE BRACKET

Table 1. Maximum Allowable Bracket Capacity (Kips)

| Bracket Type | Pile/Pier Shaft Wall Thickness | Qty. 1/2" Expansion Anchors ¹ | | | | | | Qty. 3/4" Collar Tube Bolts | | | Overturning Moment ² (kip-in) service load x 2" |
|--------------|--------------------------------|--|----|----|----|----|----|-----------------------------|----|----|---|
| | | 8 | 10 | 12 | 14 | 16 | 18 | 1 | 2 | 3 | |
| MP1001 | 0.125 in | 23 | 29 | 35 | 41 | 47 | 52 | 18 | 35 | 53 | |
| | 0.25 in | 23 | 29 | 35 | 41 | 47 | 52 | 10 | 17 | 28 | |

¹Simpson Strong Bolt (ESR-1771), ITW Redhead (ESR-2251), or Hilti KB3 (ESR-1385)

²Applied to foundation as a result of bracket eccentricity

Magnum MP1001-3 and MP1001-4 plate brackets consist flat steel plates with 3.1-inch or 4.6-inch ID collar tubes and 18 qty drill holes for attachment to the side of concrete foundations using anchor bolts. These brackets can be used with either push pier or helical pile products (MP313, MP325, MP425, MP431, MH313, MH325, MH425, MH431). A brief introduction to plate brackets is followed by concrete anchor specifications and discussion of capacity with various anchor patterns and collar tube bolts.

The plate bracket was an original patent of Magnum Piering, Inc. from 1981. For over 25 years, Magnum Piering, Inc. held the exclusive rights to the side mount plate bracket. During that time period, over 400 thousand Magnum patented plate brackets were installed across the United States, Canada, and parts of Europe. It continues to be a popular product in use today.

The plate bracket is advantageous in that it avoids the underside of footings, which are typically pitted and irregular. Plate brackets avoid concrete stress concentrations that can be caused by angle brackets when applied incorrectly. The sides of foundations are generally formed smooth and uniform and make for good connection. Capacity of anchor bolts in shear is easily calculated. The plate bracket is preferred by many.

Despite its simple appearance and lower overall cost, the Magnum MP1001 plate bracket remains one of the highest load tested foundation underpinning brackets by IAS accredited independent laboratory CTL|Thompson, Inc (CTL). A photograph of a load test performed by CTL is shown in Fig. 1 and representative results in Fig. 2. These tests were performed in accordance with ICC-ES AC358 (ICC-Evaluation Services, Inc., 2012) and involved connection of brackets to an unreinforced concrete block using 10 qty 1/2" diameter anchor bolts. Loads were applied eccentrically to a 5-ft unbraced section of pile shaft to simulate buckling effects. In all three tests, the predominant failure mode was direct shear of anchor bolts. Average ultimate capacity was 8 kips per anchor bolt.



Fig. 1 Example IAS MP1001 Bracket Testing

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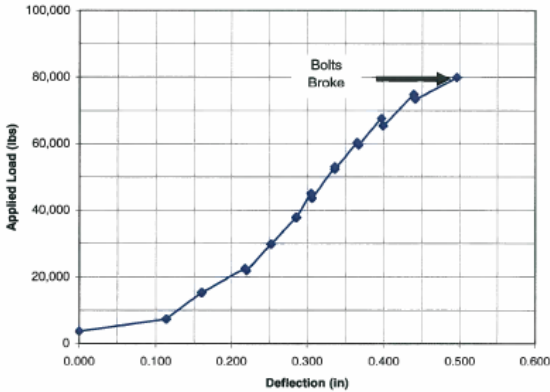


Fig. 2 Representative Bracket Test Results

The recommended maximum allowable capacity of Magnum MP1001 brackets is shown in Table 1 for different anchor bolt combinations. Allowable capacities are based on ACI318 (Building Code Requirements for Structural Concrete (ACI318), 2014) calculations and historic performance experience. Calculations assume sufficient concrete cover and required minimum edge distances. In some cases, concrete breakout of existing foundation sections can govern bracket connection capacity. Concrete shear, concrete breakout, and other factors that can affect bracket connections to structures and a structures ability to span between brackets cannot be accounted for without knowledge of the particular application and should be checked by a registered professional engineer and/or load tested.

The capacity of MP1001 brackets can be limited by the number of 3/4" diameter tube collar connection bolts as shown in Table 1. These connections are made by blind threaded bolts in one-way shear. Per AISC 360 (American Institute of Steel Construction, 2010), these connections must be load tested for capacity

determination. Allowable capacities shown in Table 1 are based on a sequence of structural load tests performed by IAS accredited independent lab CTL. An image of the load tests is shown in Fig. 3. The capacity of this connection depends on the thickness of the pile or pier shaft.

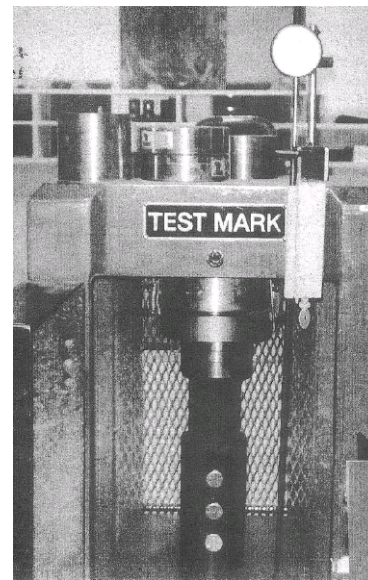


Fig. 2 Common Values of Ambient Vibrations in Buildings (Hannen, 2015)

When underpinning piles are attached to foundations by either angle or side plate brackets, they induce an overturning moment on foundation elements. The magnitude of this applied moment is given in Table 1. The strength of foundations to resist overturning should be checked by a registered design professional as the effect of multiple piles cannot be determined by load test easily.

For more information, copies of test reports, or assistance with underpinning bracket applications, contact Magnum Piering, Inc.



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Works Cited

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