Fastener ID and Design

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A common “hiccup” that occurs with projects is that of fastener identification and design. For Larson Engineering to provide you with an accurate and complete design of a curtain wall system and its connections, we present the following as an insight on our design methods and philosophy.

^ Grade 5 bolt head identification

Fastener Identification

All structural fasteners on shop drawings should be completely identified. The information should include the manufacturer, product name, size and material grade such as Grade 2 or Grade 5 for carbon steel and 300 Series Condition A or 300 Series Condition CW for Stainless Steel Fasteners.

Surrounding Materials

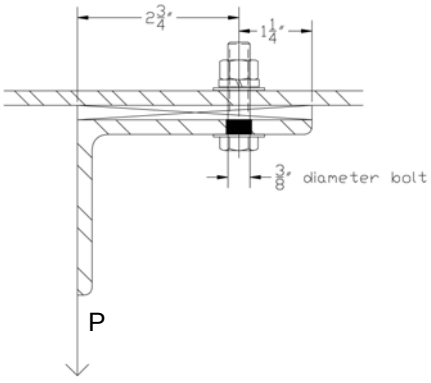
Shop drawings should indicate the surrounding building material into which the fastener grips. This information is key to the tensile capacity design of the fastener.

Connection Geometry

This is primarily related to placement of fasteners in a given connection. Fasteners in aluminum and steel connections should typically be spaced no less than two diameters apart or from any free edge. Fasteners into concrete need to take particular note of the required minimum spacing and edge distances per the manufacturers or code required recommendations.

Prying Tension

All connections with an eccentric loading require the review of an additional tensile load in addition to the directly applied tension. The two primary factors that effect the magnitude of this additional tension are the distance from the load to the fastener and the distance from the fastener to the end of the resisting element. The magnitude of this load is directly related to the ratio of the offset to the resisting element (see detail).



^ Bolt tension = P + (2.75/1.25) P

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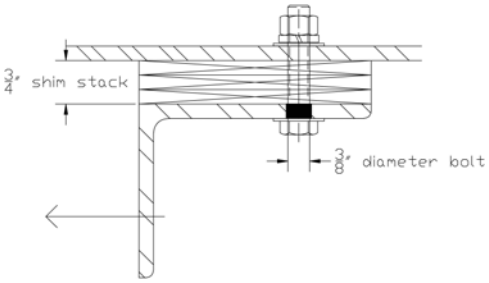
Fastener Bending

In the field, opening dimensions rarely mimic those shown on the details. Adjustments have to be made, typically via the addition of shims. Design of the load transfer across this increased dimension needs to be recognized. Bending greatly decreases the capacity of the fastener.



^ Bending in the fastener

Stacked Shims

Design requires the analysis of bending in the shaft of the fastener. Bending in the fastener is typically reviewed if the shim stack is greater than the diameter of the fastener.

Single Piece Solid Clear Hole Shims

Solid, one piece, clear hole shims are often used to eliminate bending in the fastener. However, an additional tensile load is required in this design method.

Special Inspection

Typically this is a requirement of specific states or cities and applies to concrete fasteners. The allowable design capacity of an inspected fastener can be up to twice the capacity of one that is not inspected. Requirements vary from state to state and city to city. Check with your local code authority for specific requirements.