Bolt-Tightening Requirements

Bolt Tightening and Joint Gaps:
In order for the Strong Frame™ ordinary moment frame to achieve its rated capacity, the connection plates must have firm contact and the bolts must be properly tightened. Bolts shall be tightened in compliance with the Specification for Structural Joints Using ASTM A325 or A490 Bolts, published by the Research Council of Structural Connections (RCSC). The Designer shall specify whether the installation requires snug-tight joints or pretensioned joints.

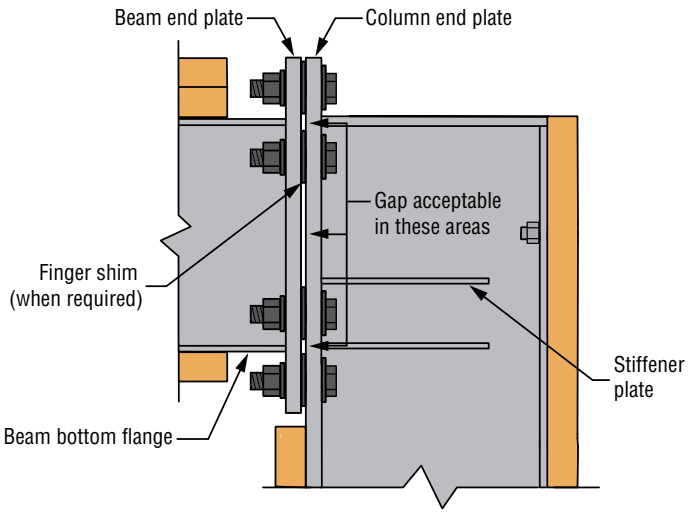
- **Snug-Tight Joints** (recommended for Wind and SDC A, B and C)* Snug-tightened joints call for the tightness that is attained with a few impacts of an impact wrench or the full effort of a worker using an ordinary spud wrench in order to bring the connected plies of steel into firm contact.

- **Pretensioned Joints** (required for SDC D–F)
  In addition to firm contact, pretensioned joints require that the bolts be fully tightened to a specific tension in order to achieve a minimum pretension in the bolt. The effort required to achieve the required pretension force is higher than what would be required for snug-tightened joints. There are 4 accepted methods of verifying bolt pretension: 1) Turn-of-nut, 2) Calibrated wrench, 3) Twist-off-type tension-control bolts, and 4) Direct-tension indicator (DTI) pretensioning. DTI washers are provided in the Strong Frame™ moment frame installation kit.

* Per IBC 1613.1, pretension is not required on detached one and two-family dwellings if they are located in SDC A, B or C or if they are located where mapped short-period, spectral response acceleration (Ss) is less than 0.4g.

Connection Plate Gaps During Installation
Shims must be installed at locations where the gap between the column and beam connection plates, under the bolt heads, is greater than or equal to ⅛" during installation. If the gap is less than ⅛", draw the end plates together by tightening the bolts.

Finger Shims: When They Are Required
Tighten bolts until beam and column end plates are in firm contact. Gaps that are not under bolt heads are not a concern. If the column and beam connection plates cannot be drawn together sufficiently through bolt tightening, then additional shims are required. Total thickness of shims under each bolt head shall be less than ¼".



Connection Plate detail with Finger Shims

Strong-Frame™ Finger Shims
In order to facilitate correct installation in the event that the above gap requirements cannot be met, 16 finger shims are included with each Strong Frame ordinary moment frame. These 16-gauge steel shims are designed to fit around the bolts to fill any gaps that might exist under the bolt heads.

To install the shims, loosen the ⅞" high-strength bolts in the connection plates. Then slide the shims around the bolts on both sides of the connection, making sure they are flush with the outside of the connection plates. Then re-tighten bolts.

Direct Tension Indicator (DTI) "Squirting" Washers

Strong Frame™ moment frame installation kits include easy-to-use Direct-Tension-Indicator (DTI) washers to verify proper bolt pretensioning. Follow these steps when bolting the beam-to-column connection:

1. Install a DTI washer under bolt head. Slide the bolt through connection holes. Install the hardened washer and nut on opposite side.

2. Tighten all bolts to the snug-tight condition described above.

3. Once all bolts are snug-tight, further tighten each bolt until the DTI protrusions are compressed and the orange silicon markers squirt out of the washer indicating proper installation pretension.

NOTE: If, at any time following installation, the orange silicone markers are no longer visible, proper pretensioning can be checked by verifying the gap between the bolt head and the DTI is no more than 0.015". A feeler gauge is included in the connection kit.