

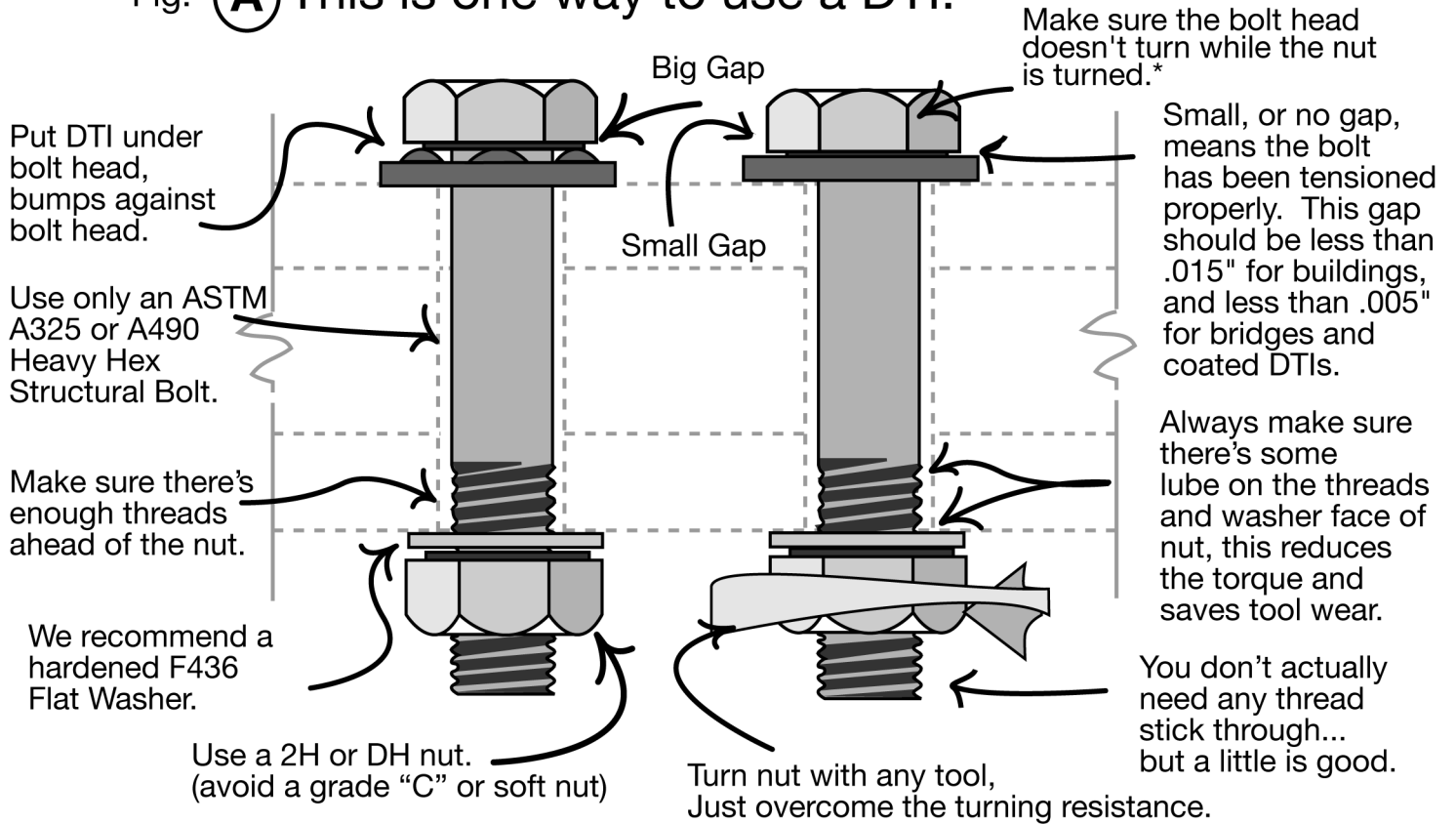
# DTI INSTALLATION



Here's what you do:

1. snug the plies,
2. compress the DTI.
3. go home!

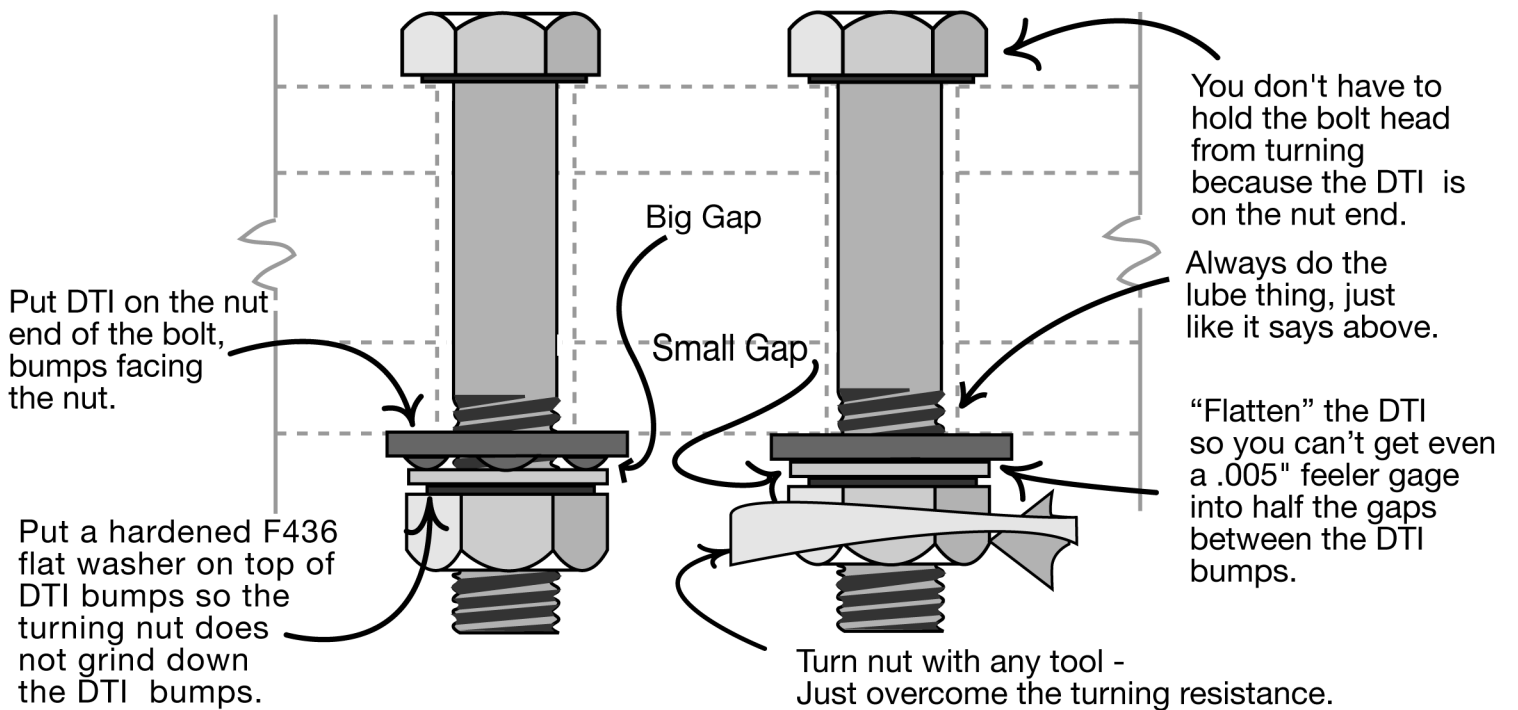
Fig. **(A)** This is one way to use a DTI:



\*Access issues? Put the DTI under the nut, turn the head.

Fig. **(B)** This way is often preferred by steel erectors:

(In the past, this used to be the last resort. Not any more. Our DTIs are designed to be put here. So, go ahead, put it on the nut side!)



Now that you have read the instructions, watch the videos. Scan with smartphone.

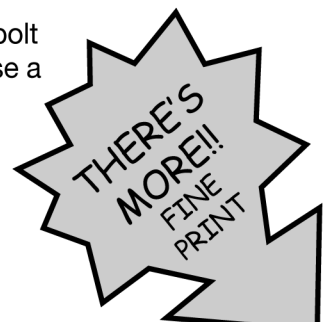


You can use DTIs on the head end of a bolt when the head is turned, you can also use a DTI with a twist-off bolt. Call for special instructions.

If you have any other questions about DTIs, in any application, please call:

Applied Bolting Technology Products Inc. **1-800-552-1999**

Visit our website @ [www.appliedbolting.com](http://www.appliedbolting.com)



## DTI INSTALLATION AND INSPECTION

### FOR IRONWORKERS AND OTHER BOLT INSTALLERS

1. You can locate the DTI on either end of the bolt. Just make sure the DTI bumps bear against the underside of the bolt head Or against a hardened flat washer, never directly against the nut or the steel plates.
2. Never never never grind the DTI bumps down by turning either the bolt head or the nut directly against the DTI - put a hardened flat washer in between.
3. ALWAYS snug an array of bolts before final tightening, just as you would when DTIs are not used. Make sure you don't fully compress the DTI on the snug (first) pass. On the final pass, compress the DTIs in the same sequence as you would if there were none present - that is, from the most rigid point outward.
4. If impact wrenches are used, final DTI compression should take less than 10 seconds, or perhaps 20 seconds for larger A490 bolts. Choose a wrench with sufficient muscle (size, air pressure, condition) to do this. Other types of wrenches are also acceptable, such as electric or hydraulic, but if they're non-impacting, ignore the "10 second rule".
5. Don't try to use a feeler gage very much. Judge the DTI gap closure mainly by eye. Remember, a "completely flattened" DTI is acceptable. Some DOTs like to see at least one visible gap. Check with the inspector, or call us for guidance.
6. You're not supposed to take more bolts out of their kegs than can be stuffed, snugged, and tightened in one shift (oh, sure!). But just in case keep some lubricant handy if the bolts and nuts are getting too rusty to tighten efficiently.
7. Remember, DTIs don't change the torque resistance of the bolt, and they don't change the (flat) washer requirements either. (Regular thickness F436 washers over short slots or oversized holes, but extra thick 5/16" F436 washers if the bolts are A490 larger than 1" dia.) Over a standard size hole, the DTI can replace one flat washer if the design called for a flat washer under both the bolt head and the nut. If you have Squirters® on oversized or slotted holes, call and we can make sure all the washers are in the right spot.
8. As with any approved bolt tensioning method, don't forget to do the RCSC's Pre-Installation Verification to make sure the bolt assembly, the bolt installer, and the wrench all work together to get the right bolt tension. If there's a Skidmore around, you might try this first on it and check the results. Show the inspector - they will be impressed.

### FOR INSPECTORS

1. Check all bolt, nut, flat washer, and DTI certifications for conformance with the project specifications, especially the rotational capacity (RC) tests, if applicable, for nut lubrication. (Remember, when DTI's are used, every bolt gets an "in situ" RC test, because, no matter how much the bolt/nut friction factor has deteriorated, if the DTI has been sufficiently compressed and the bolt has not broken, the rotational capacity of the assembly must be ok.)
2. Check the calibration of the Skidmore (if any) on the site, and use it to spot check the bolts and DTIs. (see #4 below ) That is, on the Skidmore, see how much compression of the DTI is indicative of correct bolt tension\*.
3. Have some .015" and/or some .005" feeler gages available which will fit into the openings of the DTI between the DTI bumps. These are available free issue from Applied Bolting in every keg.
4. Put a DTI on a bolt into the Skidmore and tighten it to a bolt tension 5 percent higher than the required minimum using a manual or non-impacting wrench. Record the number of refusals of a feeler gage to determine the job inspection gap (which is one more than the average number of refusals), or you can make sure the feeler gage is refused half way around or more. Please refer to your jobsite spec's for guidance.
5. Make sure that the bolt installers snug all the bolts in the connection before final tensioning. Listen for or otherwise time the final tensioning operation. If impact wrenches are used the rule of thumb is 10 seconds or less but let them go as long as 20 seconds for large A490 bolts. If they're not able to tighten the bolts this quickly, tell them to do better. It's impor-tant for the health of the bolts. If non-impacting tools are used, the "10 or 20 second rule" can be ignored.
6. Check for too much thread stickout "above" the nuts - if it is more than half the bolt diameter, there MAY be insufficient threads ahead of the nut for proper bolt ductility, and thread runout may prohibit proper compression of the DTIs and be the cause of bolts breaking. "Zero" stickout (bolt shank flush with top of nut) is ok.
7. With the bolts in place, check a sample of compressed DTIs using the proper thickness feeler gage. Make sure the feeler gage is refused half way around the DTI (our DTIs are marked only at openings to help you judge where to try to insert the feeler gage) or in accordance with the Job Inspection Gap. Your jobsite spec's will rule the roost. If the feeler gage is refused the correct number of times or more, THE BOLT IS OK. If you CAN insert it all the way into the bolt shank more than the minimum, THE BOLT IS NOT TIGHT ENOUGH. In the latter case, ask the bolt installer to tighten the bolt a little more. If the DTI is almost compressed enough, it's probably OK. (Remember the Skidmore test in 4 above) Don't over inspect the bolts, and don't use a torque wrench.
8. Remember, a "completely flattened" DTI is NOT cause for rejection except by special edict of the -engineer-of-record. It's possible and safe to "completely flatten" DTIs. In if doubt, try flattening the DTI on a bolt in a Skidmore, and see how much bolt tension it produces. Then disassemble the bolt after this test and run the nut down the threads of the bolt to where it was during installation. If some stretch has occurred in the bolt, the nut probably will not run more or less freely to the root of the thread.

For a complete treatise on bolt, nut, washer and DTI selection and installation, consult the Research Council on Structural Connections Specification. If you would like to have your own copy of this, call us and we'll send it. You'll be the smartest kid on the block.



# Pre-Installation Verification Test Report using Direct Tension Indicators

Date: \_\_\_\_\_

Wrench Model: \_\_\_\_\_

Skidmore No.: \_\_\_\_\_ Skidmore Calibration Date: \_\_\_\_\_

Bolt Grade:  ASTM A325  ASTM A490

Bolt Size: \_\_\_\_\_  BLACK  GALVANIZED  DACROMET

Lot No.: \_\_\_\_\_

DTI Lot & config.: \_\_\_\_\_  DTI ON NUT SIDE  DTI ON HEAD SIDE

Nut lot number: \_\_\_\_\_

F436 FW: \_\_\_\_\_

F436 Wide FW: \_\_\_\_\_

Required Tension: \_\_\_\_\_

(5% over minimum tension)

(7/8" Minimum = 39 kips, 5% over = 41 kips)

Sample #1  
Bolt Tension \_\_\_\_\_

.005"  
 .015"

**ASSEMBLY  
ACCEPTABLE**

Refusals	Yes	No

Sample #2  
Bolt Tension \_\_\_\_\_

**ASSEMBLY  
ACCEPTABLE**

Refusals	Yes	No

Sample #3  
Bolt Tension \_\_\_\_\_

**ASSEMBLY  
ACCEPTABLE**

Refusals	Yes	No

Inspector: \_\_\_\_\_

Date: \_\_\_\_\_