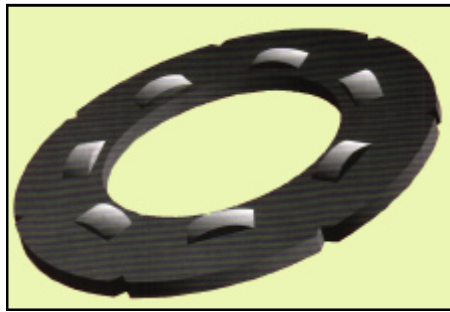


DIRECT TENSION INDICATOR



INSTRUCTION MANUAL

Keep For Your Records



Figure 1

Direct Tension Indicators measure clamping force (bolt load)

The Director Tension Indicator (DTI) is a specially hardened washer with protrusions on one face (see *Figure 1*). The DTI is placed under the bolt head or nut, and the protrusions create a gap. As the gap is tensioned, the clamping force flattens the protrusions, reducing the gap (see *Figure 2*).

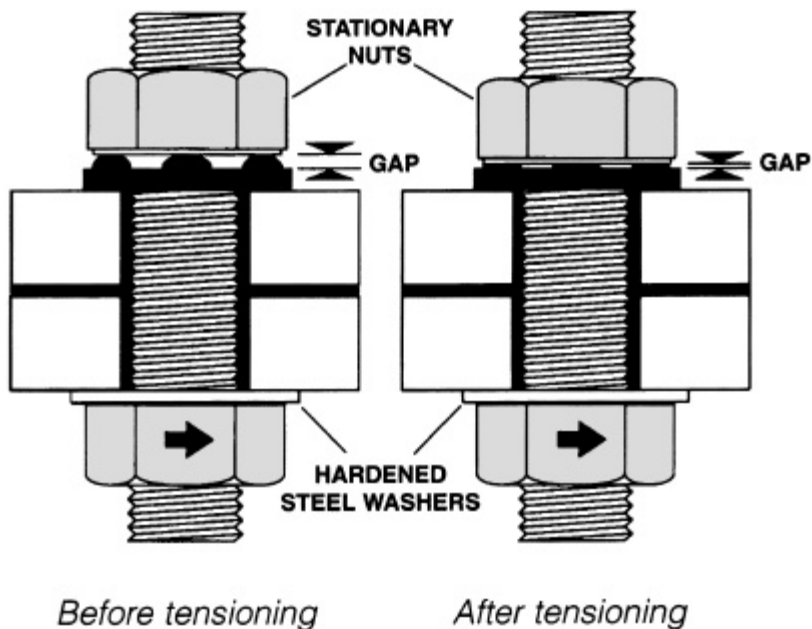


Figure 2

BOLT TIGHTENING USING DTIs

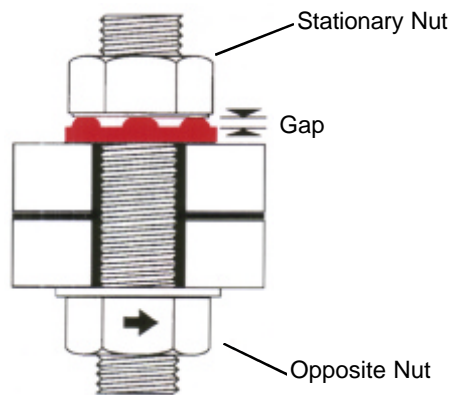
METHOD #1 (Preferred Method) - PLAIN FINISH DTIs

DTI Under the Stationary Nut - Turn the Opposite Nut to Tighten

This method should be used whenever possible. Other methods are acceptable, but should only be used when this one cannot be.

ASSEMBLY

Put the DTI under the stationary nut with the bumps facing the underside of the nut (see figure below).



TIGHTENING

PART 1: Turning the nut opposite the stationary nut, apply torque to all bolts in the pattern using a criss-cross sequence. When turning the opposite nut, prevent the stationary nut from turning with a hand wrench. Turning can wear down the bumps. This criss-cross sequence should be performed using a series of passes at a torque value that is a fraction of the target torque and increases for each pass. For example: if the target torque is 300 ft-lbs, the first pass might be 30% of the target torque, which would be 90 ft-lbs, the second pass might be 70% or 210 ft-lbs, and so on. The number of passes performed in this manner will be dictated by the application. A final criss-cross sequence will be performed using the following procedure.

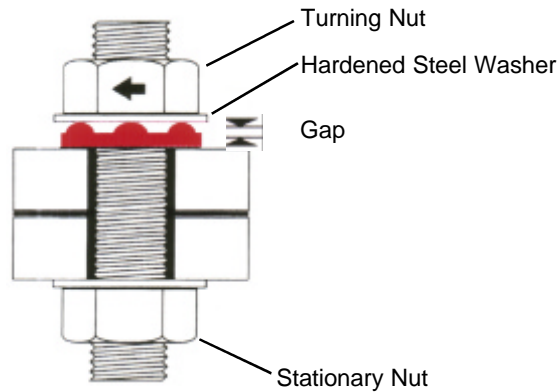
PART 2: Tighten bolt number 1 by slowly applying torque until the desired gap is achieved in half or more of the entry spaces (SEE INSPECTION). Repeat this process for bolts 2 through 4. As each of the first four bolts is brought up to the desired load, record the amount of torque required for each bolt and compute an average torque value. Use the average torque value to tighten the remaining bolts in the flange using the criss-cross sequence. Make a final circular pass using the average torque value. Continue the circular pass until the nut on the next bolt refuses to turn when torque is applied. Next, check the gap for each bolt in the circular pattern using the procedure described in the INSPECTION section of this manual. If the No-Go gauge is not refused in half or more of the entry spaces, apply a greater amount of torque to the nut until the No-Go gauge is refused in half or more of the entry spaces. In the rare instance that the No-Go gauge is refused and the Go gauge is also refused, the target bolt load has been exceeded and the DTI must be replaced.

Remove the bolt and reinstall it with a new DTI. Retighten the bolt while monitoring the gap between the DTI and the nut to ensure that the target load is not exceeded again.

METHOD #2 (Alternate Method) - PLAIN FINISH DTIs

DTI Under the Nut to be Turned - Turn the Same Nut to Tighten

This method should be used only when the preferred method cannot be used. It is usually limited to an installation where the bolt must be installed in such a way that the device for applying torque can only be placed on the same end as the DTI and the DTI cannot be inspected from the other end.



ASSEMBLY

Place the DTI under the nut to be turned with the bumps facing the underside of the nut. Place a hardened 1/4" thick flat washer between the DTI and the nut.

TIGHTENING

Follow instructions in Parts 1 & 2 of TIGHTENING in METHOD #1 applying torque to the nut on the same end of the bolt as the DTI.

INSPECTION

Each DTI is marked with a lot number. A test certificate is provided with the DTIs, which relates bolt load to the gap obtained for each size and lot number tested. Refer to the test certificate to determine the appropriate size feeler gauge to use. For example, the test certificate for DTIs used with a 5/8" diameter, B7 stud from lot number 58BAI indicates a mean gap of .033" when the bolt load is at 50% of minimum yield strength of the stud. When a feeler gauge (No-Go gauge) of .033" is refused by a majority of the entry spaces (2 out of 3 in this particular case), the bolt load is a 50% of minimum yield strength. To determine whether or not the bolt is within acceptable upper limits, select a feeler gauge (Go gauge), which is .003" THINNER than the No-Go gauge (in this case, a .030" feeler gauge). The feeler gauge should be a majority of the entry spaces. Using this process will ensure the upper and lower limits.

PROBLEMS COMMONLY ENCOUNTERED WHEN TIGHTENING BOLTS

Dry or Rusty Threads: Usually caused by poor storage conditions, dry or rusty bolts and nuts should not be permitted. Ideally - nuts, bolts, washers and DTIs should be kept in dry storage and their containers not opened until immediately before use. Rust significantly increases the amount of torque required to tension a bolt. When assembling bolts, always use a lubricant. A molybdenum disulfide based lubricant with approximately 70% solids is recommended for most applications. Such lubricants are available at Fastorq Bolting Systems. When applying lubricant, make sure to lubricate the underside of the nut that will be turning as well as the washer surface upon which the nut will be turning. **Do not lubricate either surface of the DTI or the side of the washer making contact with the DTI.**

Damaged Threads: Usually caused by forcing the bolt through misaligned holes - this will cause the nut to freeze.

Trapped Bolts: Usually caused by slippage in the joint as a result of flanges slipping out of alignment after the bolts have been installed. Trapped bolts cannot develop tension along their entire length. Securing the flanges by partially loading four or more bolts after careful alignment should prevent this problem.

Hardened Washers Under the Turned Element: The use of hardened washers under the turned element significantly reduces the torque required to tension a bolt and is recommended by FASTORQ when using DTIs.

Hardened Washers Under the DTI: When the surface of the flange making contact with the DTI is rough or uneven, place a hardened 1/4" thick washer under the DTI. This will ensure accurate measurement of the gap between the DTI and the nut.