Pre-installation verification testing must be performed in compliance with all of the following: (1) At the site of installation; (2) Prior to the placement of bolting assemblies of verified lots in the work; (3) On a sample of no fewer than 3 complete bolting assemblies; (4) Using bolting assemblies that are representative of the condition of those that will be pretensioned in the work (5) In accordance with the test procedure enumerated below.

|  |  |  |  |
| --- | --- | --- | --- |
|       |       |       |       |
| State Project Number | Structure Number | Job Number | Test Date |
| [ ]  120/A325 [ ]  150/A490 |       |       |       |
| Bolt Group/Grade | Bolt Diameter (D) | Bolt Length (L) | Bolt Manufacturer & Lot number |
|        |        |       |
| Bolt Type | Bolt Finish | Assigned Fastener Assembly (Bolt-Nut-Washer) Lot Number |
|       |       |       |
| Washer Grade & Finish | Washer Manufacturer & Lot Number | Calibrated Tension Measuring Device - Brand (e.g., Skidmore), Serial Number  |
|       |       |       |
| Nut Grade & Finish | Nut Manufacturer & Lot Number | Calibrated Tension Measuring Device - Calibration Due Date  |

**Instructions:**

**Step-1** Enter the project, fastener assembly (bolt, nut & washer) lot, and calibrated tension measuring device information on the table above.

**Step-2** Use Table 1 to determine the full rotation needed for the fastener assembly.

**Step-3** Install the bolt, number and type of washers required for the work and any required spacers, in the calibrated tension measuring device so that the bolt stick-out is flush with the nut, up to a max of 3 to 5 threads of stick-out.

**Step-4** Snug tighten the fastener assembly. Do not exceed 50% of the tension in Table 2 during this step. *To snug tighten the fastener assembly, the plies must be brought into firm contact and each bolting assembly must have at least the tightness attained with either a few impacts of an impact wrench, or the full effort of an ironworker using and ordinary spud wrench.*

**Step-5** Match mark the bolt, nut, and faceplate of the calibrator.

**Step-6** Turn the nut the required rotation from Step-2.

**Step-7** Verify that the reading is at or above the required tension in Table 2. If the reading is not at the minimum required tension in Table 2, turn the nut up to an additional 60 degrees, stopping once the minimum tension in Table 2 is achieved; note the additional rotation in Table A. Record the tension and torque, at the completion of rotation, in Table A.

**Step-8** Complete Table B and determine the acceptability of the PIV.

**Table 1 – Required Rotation for Turn-of-the-nut Method (Step-2)**

|  |  |  |
| --- | --- | --- |
| **Bolt Length (L) Relative to Bolt Diameter (D)** | **Rotation** | L / D = \_\_\_\_\_\_\_\_\_\_\_\_\_\_**Required (Total) Rotation** = \_\_\_\_\_\_\_\_\_\_\_\_\_ |
|  L/D ≤ 4 | 1/3 Turn or 120° |
| 4 < L/D ≤ 8 | 1/2 Turn or 180° |
| 8 < L/D ≤ 12 | 2/3 Turn or 240° |

**Table 2 – Minimum Installation Tension, kips**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Bolt Dia.** | **1/2”** | **5/8”** | **3/4"** | **7/8”** | **1”** | **1 1/8”** | **1 1/4"** | **1 3/8”** | **1 1/2"** |
| **120/A325** | 13 | 20 | 29 | 41 | 54 | 67 | 85 | 102 | 124 |
| **150/A490** | 16 | 25 | 37 | 51 | 67 | 84 | 107 | 127 | 155 |

**Table A – Recorded Installation Tension and Torque (Step-7)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Sample Assembly-1** | **Sample Assembly-2** | **Sample Assembly-3** | **Average Torque** |
| **Measured Tension, kips** |  |  |  | ------------ |
| **Measured Torque, ft-lbs**  |  |  |  |  |
| **Additional Rotation\*\*** |  |  |  |  |

\*\* Amount of rotation, past the required rotation calculated in Step-2, needed to reach the minimum tension.

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Sample Assembly-1** | **Sample Assembly-2** | **Sample Assembly-3** |
| **Is the measured installation tension less than that specified in Table 3?****Table B – PIV Acceptance Criteria (Step-8)** | **[ ]  YES [ ]  NO** | **[ ]  YES [ ]  NO** | **[ ]  YES [ ]  NO** |

If *YES* was selected for any of the sample fastener assemblies, the cause(s) must be determined and resolved before any fastener assemblies are used in the work. Cleaning, lubrication and retesting of these bolt assemblies is permitted provided that ALL assemblies for the work are treated in the same manner. Repeat the PIV using a new DT2114 form for the new fastener assembly condition. If *NO* is selected for all sample fastener assemblies, the installation method and fastener assembly condition is suitable for the work. If additional rotation was needed, include this rotation for final installation.

**Inspection Torque**  Apply the average measured torque to 10% of the bolting assemblies, but no fewer than two bolting assemblies, selected at random in each joint. If no nut or bolt head is turned relative to its mating component by the application of the torque, the joint shall be accepted as properly pretensioned.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Quality Control Witness** |  | Signature |  | Date |
| **Quality Assurance Witness** |  | Signature |  | Date |