|  |  |  |  |
| --- | --- | --- | --- |
|  |  |  |  |
| 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:**

**This test shall conform to ASTM F3125 Annex 2A. This form is valid for 2 samples of the same fastener assembly lot number. Use a separate form to test another fastener assembly lot.** Equipment needed: Calibrated bolt tension measuring device appropriate for the bolts to be tested, calibrated torque wrench and spud wrenches, appropriate bushings, and spacers.

Step-1: Enter the project, fastener assembly (bolt, nut & washer) lot information, 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 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: Using a calibrated torque wrench, tighten the fastener assembly to at least the tension listed in Table 2.

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

Step-6: Tighten the fastener assembly to at least the minimum installation tension in Table 3. Record both the tension and torque in Table A.

*Use Table 4 to find the maximum allowable torque for the measured tension. Check that the measured torque does not exceed this maximum value.*

Step-7: Continue to tighten the nut to total rotation. *Rotation is measured from the initial marking in step 5.*

*Assemblies that strip or fracture prior to this rotation fail the test.*

Step-8: Record the tension, at the completion of the total rotation, in Table B.

Step-9: Repeat steps 3 thru 8 for the second sample.

Step-10: Completely fill out Table C. Sign and date form.

**Table 1 – Required Rotation for Turn-of-the-nut Method**

|  |  |  |  |
| --- | --- | --- | --- |
| **Bolt Length (L) relative to**  **Bolt Diameter (D)** | **Rotation** | | L / D = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  Required (Total) Rotation = \_\_\_\_\_\_\_\_\_\_\_\_\_ |
| **120/A325** | **150/A490** |
| L/D ≤ 4 | 2/3 Turn or 240° | 2/3 Turn or 240° |
| 4 < L/D ≤ 8 | 1 Turn or 360° | 5/6 Turn or 300° |
| 8 < L/D ≤ 12 | 1 1/6 Turn or 420° | 1 Turn or 360° |

**Table 2 – Minimum Initial Tension, kips -0/+2 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** | 1 | 2 | 3 | 4 | 5 | 7 | 9 | 10 | 12 |
| **150/A490** | 2 | 3 | 4 | 5 | 7 | 9 | 11 | 14 | 17 |

**Table 3 – 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** | 12 | 19 | 28 | 39 | 51 | 64 | 81 | 97 | 118 |
| **150/A490** | 15 | 24 | 35 | 49 | 64 | 80 | 102 | 121 | 148 |

**Table 4 – Maximum Torque\*\*, ft-lb, at Minimum Installation Tension, kips**

\*\* For tensions exceeding those listed, use the following formula to calculate the maximum torque: Torque (ft-lbs) = Tension (kips) x Bolt Diameter (inches) x 20.8333

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **120/A325** | | | | | | | | | |
| **Bolt Dia.** | **1/2”** | **5/8”** | **3/4"** | **7/8”** | **1”** | **1 1/8”** | **1 1/4"** | **1 3/8”** | **1 1/2"** |
| **Tension** | 12 | 19 | 28 | 39 | 51 | 64 | 81 | 97 | 118 |
| **TorqueMAX** | 125 | 247 | 437 | 710 | 1062 | 1502 | 2120 | 2779 | 3688 |

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **150/A490** | | | | | | | | | |
| **Bolt Dia.** | **1/2”** | **5/8”** | **3/4"** | **7/8”** | **1”** | **1 1/8”** | **1 1/4"** | **1 3/8”** | **1 1/2"** |
| **Tension** | 15 | 24 | 35 | 49 | 64 | 80 | 102 | 121 | 148 |
| **TorqueMAX** | 156 | 312 | 546 | 893 | 1333 | 1875 | 2656 | 3466 | 4625 |

**Table 5** – **Minimum Tension at Total Rotation ( = 1.15 x Table 3 ), 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** | 15 | 23 | 32 | 45 | 59 | 74 | 93 | 112 | 136 |
| **150/A490** | 20 | 31 | 40 | 56 | 74 | 92 | 117 | 139 | 170 |

**Table A – Recorded Pre-Installation Tension & Torque Values (Step-6)**

|  |  |  |
| --- | --- | --- |
|  | **Assembly-1** | **Assembly-2** |
| **Measured Minimum**  **Installation Tension** |  |  |
| **Measured Torque** |  |  |

\*Measure torque while nut is turning.

**Table B – Recorded Tension at Full Rotation (Step-8)**

|  |  |  |
| --- | --- | --- |
| **Measured Tension**  **at Full Rotation** | **Assembly-1** | **Assembly-2** |
|  |  |

**Table C – Rotational Capacity Test Acceptance Criteria (Step-10)**

|  |  |  |
| --- | --- | --- |
| **Acceptance Criteria**  The assembly fails if any of the questions below are answered *Yes (Fail)* | **Assembly-1** | **Assembly-2** |
| Did the torque recorded in Table A exceed the maximum torque in Table 4? | **Yes (Fail)**  **No (Pass)** | **Yes (Fail)  No (Pass)** |
| Did the assembly strip or fracture before reaching full rotation? | **Yes (Fail)  No (Pass)** | **Yes (Fail)  No (Pass)** |
| Did the tension recorded in Table B exceed the value in Table 5? | **Yes (Pass)  No (Fail)** | **Yes (Pass)  No (Fail)** |
| Was the nut not able to be turned, by hand, on the bolt threads to its starting position? | **Yes (Fail)  No (Pass)** | **Yes (Fail)  No (Pass)** |
| After removing the nut, were there any signs of thread shear failure, stripping or torsional failure? | **Yes (Fail)  No (Pass)** | **Yes (Fail)  No (Pass)** |
| Did the bolt break? | **Yes (Fail)  No (Pass)** | **Yes (Fail)  No (Pass)** |

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