Chapter 11 - Bolting

- **Certification Requirements**
- **Testing Requirements**
- **Bolt Placement and Connection**
- **Inspection**

Certification Requirements

Certification.

(a) A-325 and A-490 High-Strength Bolt Assemblies used on steel girder or truss bridges.
A certified copy of the mill test report.

(b) All other bolt assemblies [A-307 excluding Guardrail Bolts, Eye Bolts, Ribbed and Unfinished, A-449, F-1554 and A-325/A-490 materials not covered by the provisions in (a) above].
A certified copy of the mill test report.

Certified Mill Test Report Requirements

Table 11.1 - ~Certified Mill Test Report Requirements

Test	A325	A449	A307	A687	Others
Chemical Analysis	X	X	X	X	X
Hardness Test	X	X	X		X
Tensile Strength (* by Wedge Test Method)	X	X	X	X	X
#Proof Load Test	X	X	X	X	X
@Rotational Capacity Test	X				
Charpy V-Notch				X	X

*Certified Mill Test Report shall state that Wedge Test Method was used (For ASTM A307 and A449 bolts the Wedge Test Method is required only for square and hexagon head bolts. Wedge Test Method not required for ASTM A687. See appropriate specifications).

#Proof Load Test and/or Yield Test as allowed or specified by the applicable ASTM Specification.

@Rotational Capacity Test required for Zinc Coating (Galvanized) bolts only. This test shall be conducted using the actual nuts that are used on the project.

~The requirements set forth in this table are to alert the Contractor to the requirements for testing and certification as specified in the applicable ASTM Specifications and are not intended to alter the requirements of the specification.

LOT #:	032655	pg.1 of 1

TEST REPORT

SLSB, LLC dba St. Louis Screw & Bolt
2000 Access Blvd.
PO Box 260
Madison, IL 62060
PH: 800-237-7859
FAX: 314-389-7510

PRODUCTION INFORMATION:

PART#:	SIZE:	LOT#:	DESCRIPTION:	ASTM SPEC:	MFG DATE:	FINISH:
AAA075200	3/4(10)UNC2AX2	032655	HHS	A325-1 10	5/02/11	PLAIN

CHEMISTRY FROM RAW MATERIAL SUPPLIER:

GRADE :	HEAT NO:	ASTM SPEC:	STEEL MILL SUPPLIER:
1045	20102490	A-29	BETA

CHEMICAL CONTENTS

C	MN	P	S	Si	Ni	Cr	Mo	Cu	Sn	Al	N
0.46	0.70	0.0100	0.0070	0.20	0.05	0.20	0.010	0.11		0.0050	

MECHANICAL PROPERTIES:

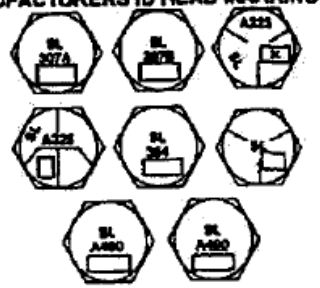
PRODUCTION QTY	PCS SAMPLED	ISSUE DATE	SAMPLED BY	TESTED BY	H.T. PO#	TEST METHODS	VISUAL INSPECTION PER ASTM F788	PCS SAMPLED	LOT PASSED
59,820	8	5/13/11	RC	RC	1022780-01	ASTM F606	100	8	PASSED

TENSILE STRENGTH	PROOF LOAD TEST	HARDNESS	
WEDGE	LBS.	LBS.	SURFACE	CORE
6 DEGREE	40,100	28,400	31.	N/A

	SAMPLES								
	1	2	3	4	5	6	7	8	AVG.
TENSILE LOAD	47,900	47,500	48,000	47,900	47,100	47,400	47,900	47,100	47,600
PROOF LOAD ELONGATION	.0000	.0000	.0002	.0000	.0001	.0000	.0000	.0001	.0000
HRC- SURF	30.7	30.7	30.9	31.5	30.6	31.0	31.7	30.8	31.
HRC-CORE									

The SLSB LLC Laboratory has been accredited by the American Association for Laboratory Accreditation in the field of mechanical and fastener testing for the tests listed above, certificate# 0698-01. The sampling plan meets or exceeds F1470 Sample Size C or applicable specification. The steel was made and melted in the USA, and the product was tested by SLSB LLC, St. Louis, MO, USA, free of mercury contamination. We certify that the samples tested conform to the ASTM specification listed above, and the data is a true representation of the information provided by the material supplier and our testing laboratory. This test certificate relates only to the items tested on this document and may not be reported or distributed except in full. Thread fit and dimensional requirements are compliant to ANSI B18.2.6 specification.

MANUFACTURERS ID HEAD MARKING: SL



OTHER

Signed: _____ Date: 5/13/11

AMENDED ☐ **
DATE: INITIAL:

*Heats of steel used have not had not had the following materials intentionally added: bismuth, selenium, tellurium, or lead.

** Indicates the amended item, when and by whom.

Rotational Capacity Test Certificate

LeJEUNE BOLT COMPANY
3500 WEST HIGHWAY 13
BURNSVILLE, MN 55337-17995
PH: 952-890-7700
FAX: 952-890-3544

Rotational Capacity Lot Number	Test Method	Test Date
DHG60666	FHWA	8/16/2010

Test Equipment	Serial Number	Calibration Date
Model MS Skidmore	10668	6/1/2010
Model#3726134 Torque Wrench	LBT01	11/12/2009

Component Size and Description		Lot#
3/4-10 x 2 1/4	ASTM A325-1 Hex Bolt Mech Galv	270686AZ
3/4-10	ASTM A563 DH Nut Mech Galv	PM871
3/4	ASTM F436-1 Washer Mech Galv	C2656M

Test Data - Minimum Installation Tension

Sample	Fastener Tension (lbs.)	Torque (ft. lbs.)	Maximum Allowable Torque (ft.lbs.)	Pass / Fail
1	28,000	230	437	Pass
2	28,000	200	437	Pass

Test Data - Full Rotation

Sample	Degrees of Rotation	Fastener Tension (lbs.)	Minimum Required Tension (lbs.)	Pass / Fail
1	240	36,000	32,000	Pass
2	240	38,000	32,000	Pass

We certify: The product furnished by LeJeune Bolt Company was manufactured, sampled, tested, and inspected in accordance with the standards and specifications listed above in effect as of the date of manufacture. The above data accurately represents values provided by LeJeune Bolt Company's suppliers and/or values generated in LeJeune Bolt Company's laboratory. This certified material test report relates only to the items listed on this document and may not be reproduced except in full.

Chief of Quality Assurance

011-006-03

Testing Requirements

Two classes of bolts:

Acceptance.

(a) A-325 and A-490 High-Strength Bolt Assemblies used on steel girder or truss bridges.

Documented measurements and visual inspection.

I. Rotational Capacity.

II. Direct Tension Indicator (DTI).

(b) All other bolt assemblies

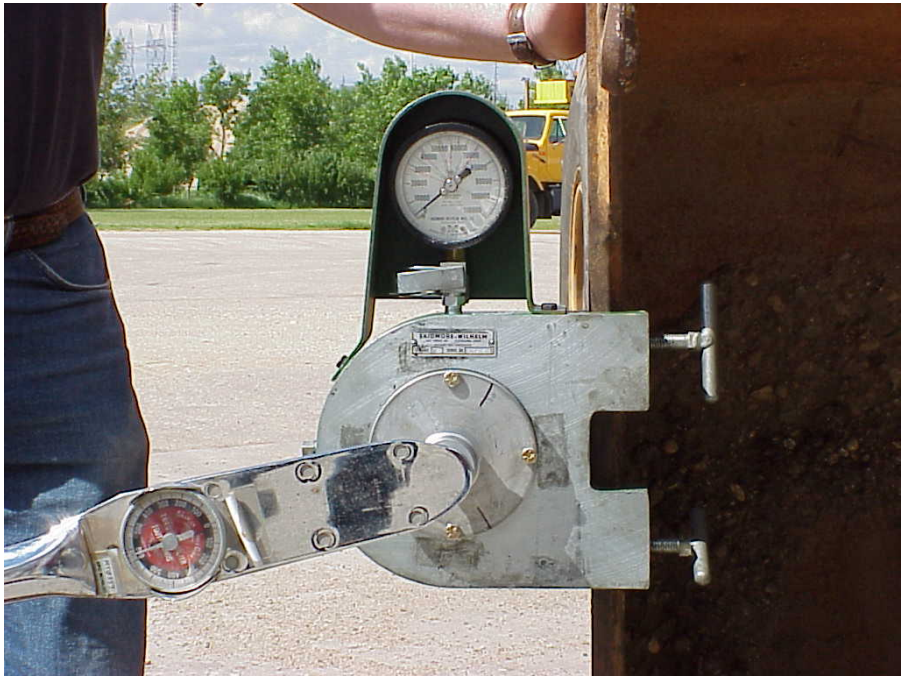
Documented measurements and visual inspection.

High Strength Bolt Assemblies
A325 or A490 Bolts

- Used in friction type connections
- Bolts are tightened to a high tension, producing clamping forces which enable the steel surfaces to carry loads by friction

High Strength Bolt Assemblies
A325 or A490 Bolts

- Rotational Capacity Test
  - Checks lubrication of nut and threads of bolt for proper tension
  - 3 each - bolt/nut/washer



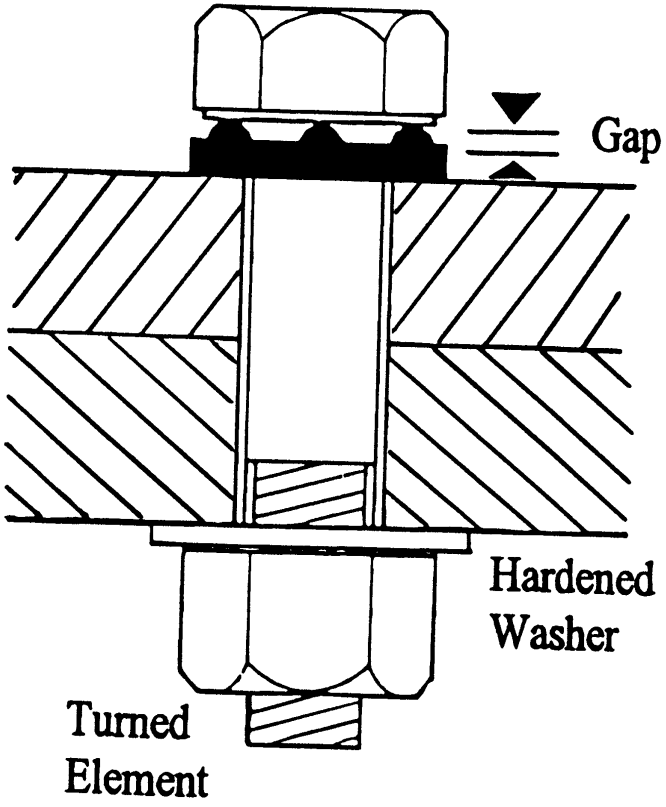
High Strength Bolt Assemblies
A325 or A490 Bolts

- Direct Tension Indicator (DTI) Test
  - Verifies the DTI
    - Dimples on DTI must be squished within a specified range of tension

  - 3 each - bolt/nut/washer/DTI (if bolt length is 4” or larger)
  - 6 each - bolt/nut/washer/DTI (if bolt length is less than 4”)
    - The additional 3 bolts are 4” or longer

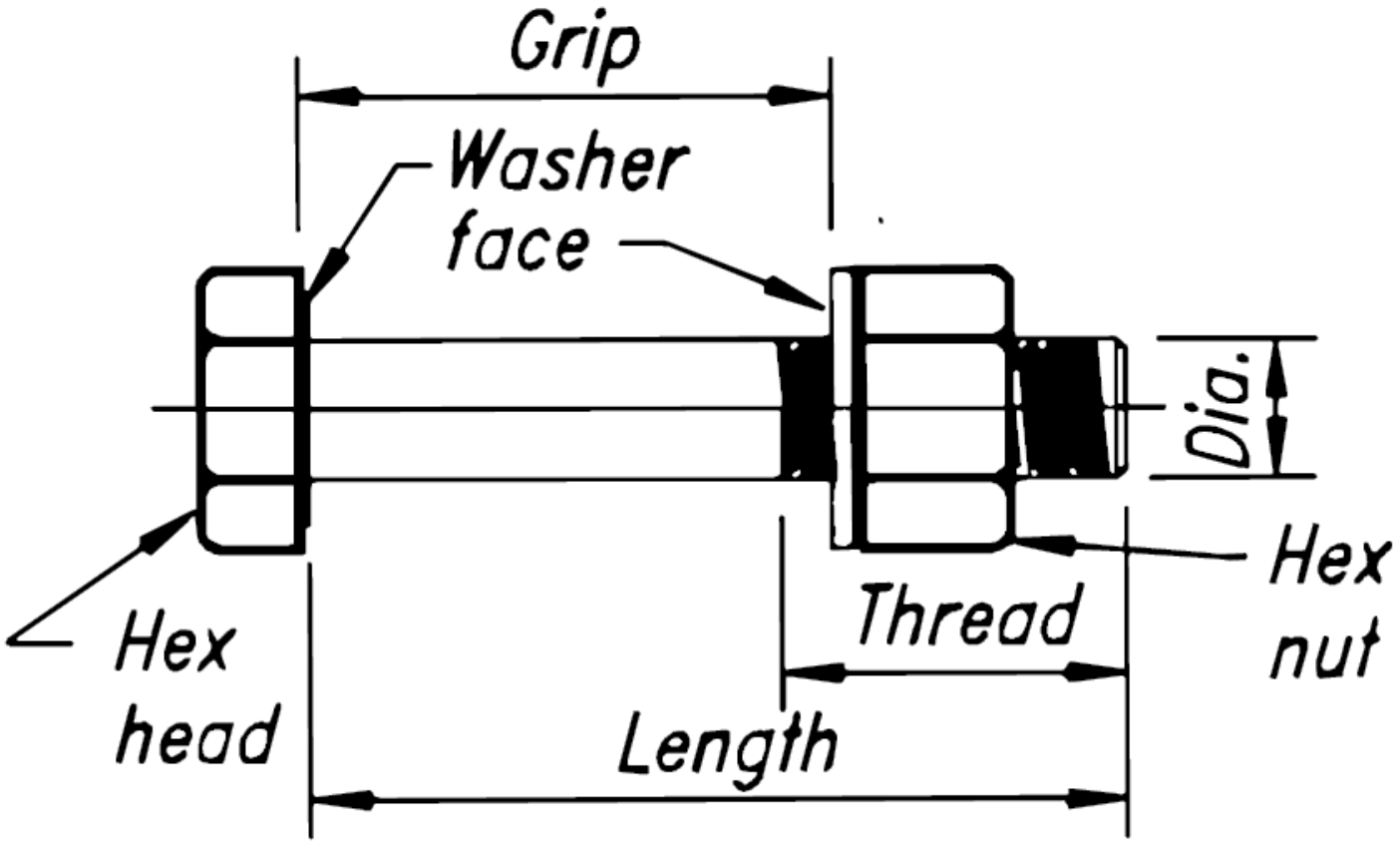
Direct Tension Indicators

- Hardened washer with protrusions
- Placed under the bolt head
- Protrusions are flattened when bolt is tightened
- Marked for use with A325 or A490 bolts



Bolt Placement and Connection

Bolt Length



Bolt Placement and Connection

Bolt Length

Bolt Length = Connection plate thickness (grip)
+ thickness of nut (same as bolt diameter)
+ thread projection (1/4”)
+ thickness of washer(s)
+ thickness of DTI

Example: Two ½” plates connected using a a ¾” bolt diameter with washer and DTI

= (½” + ½”) + (¾” + ¼”) + 3/16” + 1/8” = 2 5/16” or 2 ½”

grip nut & thread washer DTI round up to nearest ¼”

Bolt Placement and Connection

Bolt Length

Figure 11.3 Bolt Length

Bolt Diameter Size	*Length to Add
5/8"	7/8"
3/4"	1"
7/8"	1 1/8"
1"	1 1/4"
*Add to the grip to determine total bolt length required.	

Figure 11.4 Thickness of Washers

Washer Type	*Thickness
Flat Washer	3/16"
Beveled Washer	5/16"
Direct Tension Indicator (DTI)	1/8"
*Add to the grip to determine total bolt length required.	

Bolt Placement and Connection

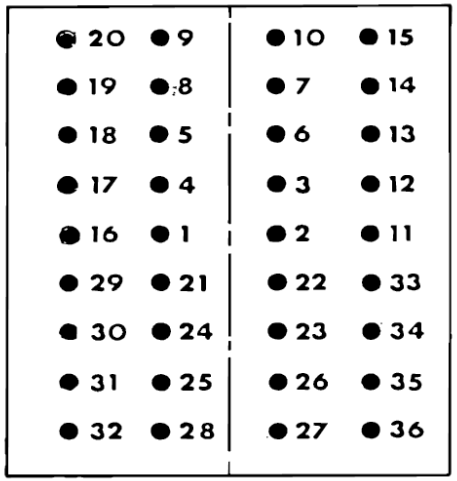
Connected Plates

- Clean and Free of any materials that could compromise the connection
  - Dirt
  - Burrs
  - Oil
  - Paint (except shop applied primer)
  - galvanizing

Bolt Placement and Connection

- Bolt heads are showing in conspicuous or visible locations
  - Flange Splice - Bolts placed with head down
  - Web Splice - Bolts placed with head to exterior face of girders

- Bolt tightening shall progress from the inside of the connection to the outside



Turn-of-Nut Installation Method

- Hardened washers are not required
- The nut shall first be snug tightened
- The nut shall then be rotated to amount given in the table, depending on bolt length

Turn-of-Nut Installation Method

Nut Rotation from Snugged Condition (a,b)			
	Geometry of Outer Faces of Bolted Parts		
Bolt Length Measured From Underside of Head to End of Bolt	Both Faces Normal to Bolt Axis	One Face Normal to Bolt Axis and Other Face Sloped Not More Than 1:20, Bevel Washer Not Used	Both Faces Sloped Not More Than 1:20 From Normal to Bolt Axis, Bevel Washers Not Used
Up to and including 4 diameters	1/3 turn	1/2 turn	2/3 turn
Over 4 diameters but not exceeding 8 diameters	1/2 turn	2/3 turn	5/6 turn
Over 8 diameters but not exceeding 12 diameters (c)	2/3 turn	5/6 turn	1 turn

a Nut rotation is relative to bolt, regardless of the element (nut or bolt) being turned. For bolts installed by 1/2 turn and less, the tolerance should be plus or minus 30 degrees; for bolts installed by 2/3 turn and more, the tolerance should be plus or minus 45 degrees.

b Applicable only to connections in which all material within grip of the bolt is steel.

c No research work has been performed by the Research Council Riveted and Bolted Structural Joints to establish the turn-of-nut procedure when bolt lengths exceed 12 diameters. Therefore, the required rotation must be determined by actual tests in a suitable tension device simulating the actual conditions.

Inspection
DTIs

- Use a 0.005” feeler gage.
- Contractor shall check sufficient number of bolts in each joint to insure proper tension.
- SDDOT inspector shall Check a minimum of 20% of bolts in each joint, with a minimum of 4 in each joint.
- Half of the gaps must be refused with the feeler gage to be ok, but still must have at least one visible gap left.

Inspection
Other Items to consider

- Use new bolt each time
  - Once bolt is at full tension it can not be reused again
  - If it needs to be loosened the bolt should be discarded
- Make sure washer does not turn
- Tighten bolts within 10 second if using an impact wrench
- Anchor bolts require rolled threads (not cut threads)