

# UNYTITE INC.

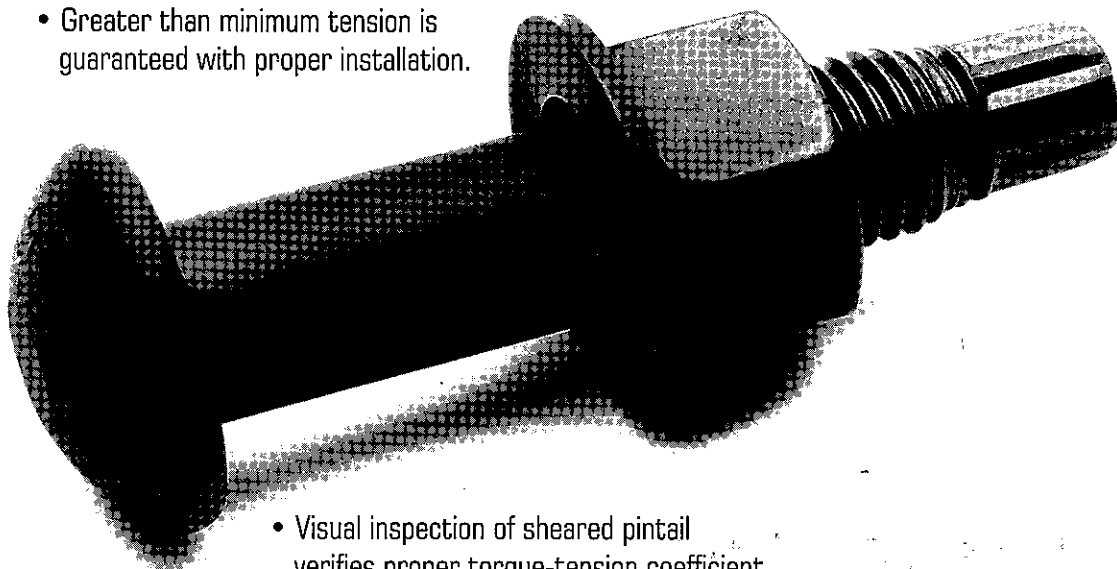
QS 9000/ISO 9002 REGISTERED

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## TENSION CONTROL FASTENING SYSTEM

### COST SAVING FEATURES:

- Pre-assembled fasteners providing consistent, reliable tension and faster assembly time.
- Single source for bolt, nut and washer.
- Greater than minimum tension is guaranteed with proper installation.



- Visual inspection of sheared pintail verifies proper torque-tension coefficient.
- Dependable, repeatable results. Consistent tension is not dependent on tools or operator skill.
- Lightweight electric installation tool. Less operator fatigue.
- One operator installation reduces installation time and manpower costs.



MANUFACTURERS  
OF  
DOMESTIC HIGH STRENGTH STRUCTURAL FASTENERS

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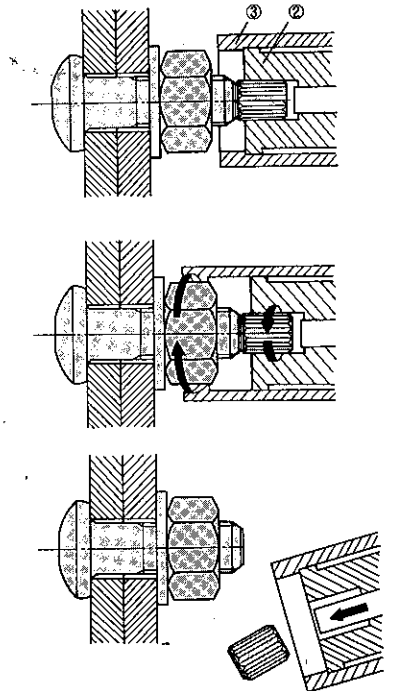
# Structural Steel Fastening System

Unytite Inc., a QS 9000/ISO 9002 registered facility located in Peru, Illinois, is a manufacturer of "Structural Fastening Systems" for the Heavy Construction (High Rise, Bridge, Road, and Industrial Building applications), Petro Chemical (Refinery, Pipeline, and Chemical Industries), Heavy Equipment, Rail Car, and Tractor-Trailer O.E.M.'s.

The unique Tension Control Fastening System is a 3 piece fastening assembly comprised of a button head design bolt with a 12 point pintail, a high strength heavy hex nut, and a hardened flat washer. When installed with a dual socket electric shear wrench, the outer socket applies the turning force to the nut, while the inner socket holds the bolt in place by gripping the 12 point spline tip. When the forces reach or exceed the designed torque-tension coefficient, the 12 point spline tip will shear off, leaving the bolt and nut securing the application at the proper tension.

## Installation Procedure

1. *Fit the inner socket of the shear wrench over the spline on the bolt and push forward until the outer socket engages completely with the nut.*
2. *Pull the larger trigger on the wrench. The inner socket will hold the bolt in place, while the outer socket tightens the nut. The spline will shear off when proper tension is reached.*
3. *Remove the wrench from the nut and pull the ejection trigger. This will eject the spline from the inner socket of the wrench. The installation is now complete, and may be verified visually.*



## Handling – Storage – Installation

1. All structural fasteners should be protected from dirt and moisture at the job site. No more than the amount of bolts to be used that day should be removed from the container, or protected storage. Remaining bolts at the end of the day should be returned to the correct container. Dirty or rusted bolts should not be used.
2. Place all the bolts into the connection, with a washer under the nut in standard and short slotted holes. For long slotted and oversize holes, a washer should be placed under the head of the bolt and under the nut. Washer and nut identification markings should always face the opposite direction of the connection.
3. Bring all the fasteners in the connection to a snug tight condition, starting with the most rigid part of the connection.

(The above recommendations by AISC apply to all A325 and A490 fasteners regardless of installation methods)

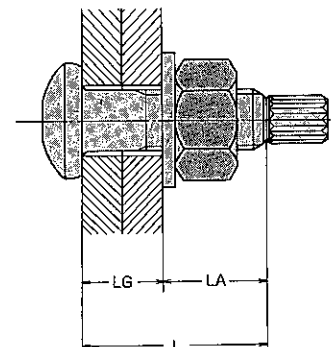
## Determining Proper Bolt Length

To determine the proper length of fastener that is needed, refer to the chart at right for the proper length to add to the grip. The bolt length should be adjusted to the next 1/4 inch for washer thickness.

(NOTE: 3-5 bolt threads should be within the structural member to avoid thread run out)

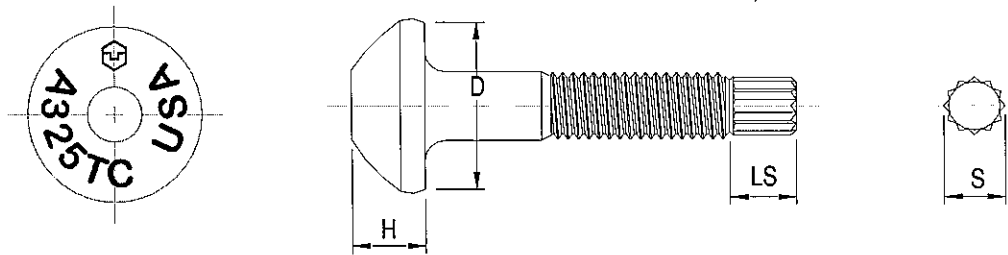
NOMINAL BOLT SIZE	LENGTH ADDED TO GRIP
5/8"	7/8"
3/4"	1"
7/8"	1-1/8"
1"	1-1/4"
1-1/8"	1-1/2"

L = Bolt Length  
 LG = Grip Length  
 LA = Length Added to Grip



**UNYTITE, INC.** tension control bolts are designed, manufactured and tested to conform to ASTM (American Society for Testing and Materials) F-1852, A-325 and A-490, AISC (American Institute of Steel Construction), FHWA\* (Federal Highway Administration) and the most demanding customer specifications.

\*Production to meet FHWA on customer request.



**ASTM F-1852 Dimensions for Twist Off Structural Bolt**

Normal Size or Basic Product Diameter	H		D	LS	S
	Height		Bearing Surface Diameter	Length of Spline	Width Across Flats
	Max	Min	Min	Ref.	Ref.
5/8" 0.625	0.403	0.378	1.102	0.60	0.43
3/4" 0.750	0.483	0.455	1.338	0.65	0.53
7/8" 0.875	0.563	0.531	1.535	0.72	0.61
1" 1.000	0.627	0.591	1.771	0.80	0.70
1-1/8" 1.125	0.718	0.658	1.991	0.90	0.80
				A	A

A - The spline length (LS) and across the flat (S) dimensions are used for reference only. The grooved spline design may vary in size and shape.

**ASTM A325 (F1852) Mechanical Properties**

	Bolt				Nut		Washer
	ASTM A325 Type 1				A563 DH		F436
	Proof Load	Tensile Strength	Hardness		Proof Load	Hardness	Hardness
			Brinell	Rockwell			
5/8"-11	19,200	27,100	253 ~	HRC	39,550	HRC	HRC
3/4"-10	28,400	40,100			58,450		
7/8"-9	39,250	55,450	319	25~34	80,850	24~38	38~45
1"-8	51,500	72,700			106,050		
1-1/8"-7	56,450	80,100	223~286	19~30	133,525		

**A325 (F1852) Fastener Tension**

Nominal Diameter	1	2	3
	AISC Table 4 Design Tension	AISC Installed Fastener Tension	UNYTITE Fastener Tension
	Min lbf	Min lbf	Min lbf
5/8"-11	19,000	19,950	23,000
3/4"-10	28,000	29,400	33,000
7/8"-9	39,000	40,950	44,000
1"-8	51,000	53,550	57,000
1-1/8"-7	56,000	58,800	65,000

**ASTM A490 Mechanical Properties**

	Bolt				Nut		Washer
	ASTM A490 Type 1				A563 DH		F436
	Proof Load	Tensile Strength		Hardness	Proof Load	Hardness	Hardness
		Max	Min				
3/4"-10	40,100	56,800	50,100	HRC	58,450	HRC	HRC
7/8"-9	55,450	78,550	69,300		80,850		
1"-8	72,700	103,000	90,900	33~38	106,050	24~38	38~45
1-1/8"-7	91,550	129,700	114,450		133,525		

**A490 Fastener Tension**

Nominal Diameter	1	2	3
	AISC Table 4 Design Tension	AISC Installed Fastener Tension	UNYTITE Fastener Tension
	Min lbf	Min lbf	Min lbf
3/4"-10	35,000	36,750	39,900
7/8"-9	49,000	51,450	55,200
1"-8	64,000	67,200	74,000
1-1/8"-7	80,000	84,000	95,400

- 1 - AISC minimum design specification
  - 2 - AISC 8 (d) (3) minimum installed tension for alternate design fastener
  - 3 - UNYTITE Tension Control Bolt Designed Fastener Tension
- (Average Fastener Tension of 5 samples per each assembly lot)

# Inspection Certificate

**A. Set Lot Number** — All UNYTITE Bolts, Nuts and Washers are manufactured and processed in accordance with our lot identification quality assurance plan. Each production lot is assigned an identification number, which follows the product throughout its manufacturing process. Each lot is tested individually, and as a set with other production lots, and assigned a set lot number, which is labeled clearly on each shipping drum.

**B. Fastener Tension** — In each set lot, 5 fastener sets are tested for fastener tension. None of the five sets is lower than the minimum fastener tension. The average tension is reported on the certificate, along with the standard deviation.

**C. Other Information** — All UNYTITE certificates include mechanical properties, chemical composition, and heat numbers of raw materials.

SET LOT NO. 6781A		INSPECTION CERTIFICATE		UNYTITE, INC. One Unytite Drive Peru, Illinois 61354 815-234-2221 - FAX # 815-234-3434	
Specification	Size	Quantity			
ASTM F1552 Type 1 - 00		35,200 sets			
ASTM A563 Grade DHS - 00					
ASTM F435 Type 1 - 00	3/4-10 UNC X 2				
Mechanical properties used in accordance with ASTM F667/668, ASTM A328, ASTM A118					
BOLT LOT NO. 67461		Date: Dec, 09, '02			
Mechanical Property of Full Size Bolts			Heat Treatment IDENTIFICATION		
Tensile Strength	Proof Load	Hardness	Quench	Temp.	
Min. 124,000 lb	20400 lb	HRC			
Max. 124,000 lb	20400 lb	HRC			
Spec. 24-36	HEB 89	50-55			
Average 50.52	HEB 89	51.9			
NUT LOT NO. 08270			Heat Treatment IDENTIFICATION		
Hardness	Proof Load	Hardness	Quench	Temp.	
Min. 124,000 lb	20400 lb	HRC			
Max. 124,000 lb	20400 lb	HRC			
Spec. 24-36	HEB 89	50-55			
Average 50.52	HEB 89	51.9			
WASHER LOT NO. 3222			Fastener Tension		
Hardness	IDENTIFICATION	Chemical Composition %			Fastener Tension
Min. 124,000 lb		C	Si	Mn	Min.
Max. 124,000 lb		P	S	Cu	Max.
Spec. 18-45		Ni	Cr		Mean / 3 sets
Average 42.7					Standard Deviation
					2186

## Case Study: HEX vs T.C. COST ADVANTAGES

SITUATION... Steel Usage: 1,500 ton Bolt Usage: 30,000 sets Erection Period: 2 months

UNYTITE A325 HEX HEAD BOLT	UNYTITE A325 TENSION CONTROL BOLT
<b>EQUIPMENT AND TOOLS:</b> 1) Impact Wrench - 3 sets (Weight-Ingersoll model #5340 = 33 lbs + Socket Weight) 2) Tension Calibrator - 1 set 3) Torque Wrench - 1 set 4) Air Compressor (30 HP) - set	<b>EQUIPMENT AND TOOLS:</b> 1) Electric Wrench - 3 sets (Weight-TONE 60EZ 13 lbs - 2 sets TONE 90EZ 19 lbs - set) 2) Tension Calibrator - 1 set 3) Generator - 1 set
<b>LABOR DAYS:</b> 1) 5 man group 2) 1,200 bolts per group per day 3) 30,000 bolts / 1,200 = 25 days erection time 4) 5 men x 25 days = 125 labor days	<b>LABOR DAYS:</b> 1) 3 man each group 2) 2,400 bolts per group per day 3) 30,000 bolts / 2,400 = 13 days erection time 4) 3 men x 13 days = 39 labor days
<b>INSPECTION:</b> 1) Torque check for 5% of bolts installed 2) 250 bolts / 2 inspectors / per day 3) 30,000 x 0.05 / 250 = 6 days 4) 2 inspectors x 6 days = 12 labor days	<b>INSPECTION:</b> 1) Visual inspection
<b>DIRECT LABOR COST:</b> 1) Assembly = \$4,800.00 (30,000 bolts / 250 x \$40.00) 2) Bolt Fastening Labor Cost = \$40,000.00 (\$40.00 x 8 hours x 125 labor days) 3) Inspection Cost = \$5,760.00 (\$60.00 x 8 hours x 12 labor days) <b>Total Labor Costs = \$50,560.00</b>  3/4 x 2 1/4 22,000 sets 7/8 x 2 1/2 8,000 sets = \$17,726.00  <b>TOTAL COST: = \$68,286.00</b>	<b>DIRECT LABOR COST:</b> 1) Assembly = \$0.00 2) Bolt Fastening Labor Cost = \$12,480.00 (\$40.00 x 8 hours x 39 labor days) 3) Inspection Cost = \$0.00 <b>Total Labor Costs = \$12,480.00</b>  <b>T.C. BOLT NUT WASHER ASSEMBLY COST</b>  3/4 x 2 1/4 22,000 sets 7/8 x 2 1/2 8,000 sets = \$22,117.00  <b>TOTAL COST: = \$34,597.00</b>
<b>SUMMARY: \$68,286 - \$34,597 = \$33,689 Estimated Savings (Approximately 50%) 25-13=12 Fewer Erection Days</b> (Cost reductions increase proportionately as project size and labor duration increase. Figures do not reflect savings due to fewer rental days of equipment)	

## Tension Control Assemblies Comparison: Button Head Vs. Hex Head

Ninety nine percent of all T.C. bolts are manufactured or produced with a button head design which incorporates a larger bearing surface than the hex head design. In structural applications the hardened, flat, bearing surface under the bolt head is in contact with a softer steel beam surface which is generally rough with mill scale, blast cleaned, or primer coated. These surfaces will have a higher friction coefficient than the hardened surfaces of the bolt, thus preventing rotation. Therefore, with the Unytite button head, which has 40% more bearing surface than the subject hex head, there is less chance of rotation because there is 40% more resistance and clamping force being distributed between the bolt head and the structural member.

The lower friction coefficient inherent in the hex head design has a greater chance for rotation in installations, thus resulting in decreased torque and causing the tip to shear before minimum tension is achieved. This could mean having to remove the assembly and reinstalling a new assembly.