



**CASCADE  
NUT & BOLT, Inc.**

PO BOX 12787 SALEM, OR 97309  
(503) 375-6445 • FAX (503) 587-8025  
1 888 511-1005  
[www.cascadenutandbolt.com](http://www.cascadenutandbolt.com)

**TECHNICAL DATA SHEETS  
FOR THE NEW  
INF3013 COATING  
SYSTEM**

## CORROSION-RESISTANT COATINGS FOR STRUCTURAL BOLTS



Coating System	Hot Dip Galvanized	Mechanical Galvanized	Zinc Flake Coating (INF3013)	Electrodeposited Zinc	Electrodeposited Cadmium
Designation	ASTM F2329	ASTM B695	ASTM F3393	ASTM B633	ASTM B766
Salt Spray Hours	400 hrs (approx. coating thickness control)	400 hrs (approx. coating thickness control)	240-1000 hrs	48 hrs	200 hrs
Nut	Over tapped	Over tapped	Slightly over tapped	As tapped	As tapped
Applications	Steel and aluminum structures	Steel and aluminum structures	Steel and aluminum structures	Interior steel mezzanines	Potash mining
Benefits	Very good corrosion resistance, fair torque tension	Very good corrosion resistance, fair torque tension, better thread fit and surface uniformity compared to HDG	Exceptional corrosion resistance (tailored), dual corrosion protection, exceptional torque tension, friction range can be targeted, colour flexibility, paintable, cost equivalent to HDG, rack spin, dip spin, spray process, only system permitted for A490/A490M	Low cost, uniform finish, good torque tension, top coats and sealers can be added to improve corrosion resistance and torque tension	Good torque tension, very good chemical corrosion resistance, exceptional abrasion resistance
Detriments	Sacrificial coating system requiring important coating densities (thickness vs. Weight), lower proof due to overtapping of nut	Expensive, sacrificial coating system requiring important coating densities (thickness vs. weight), lower proof due to overtapping of nut	No obvious detriments	Poor corrosion resistance (A325 only)	Expensive coating, high level of toxicity particularly when vaporized, used exclusively in potash mining (A325 only)

# TECHNICAL REVIEW

# TENSION CONTROL BOLTS COATED WITH INF3013™

February 14, 2023

## OVERVIEW

This technical review is intended to streamline and clarify the requirements of the specifications and to provide test data indicating compliance to the requirements of these specs. This review is not intended as a deep dive into all areas of the specification(s) but more to provide key information specific to the functionality of coated Tension Control (TC) bolts.

Since TC bolts have a unique method of tightening the critical factors affecting installation are different from a more conventionally installed fastener. TC bolts use a shear wrench for tightening. The wrench has an inner socket which retains the tip of the bolt from rotation while the outer socket rotates the nut. Once the correct tension (torque) has been achieved the tip shears from the bolt.

In effect the bolts are calibrated to shear the tip at a targeted tension. Critical factors to control the targeted tension are in order of priority; friction, shear tip groove diameter, and hardness/chemistry.

These three factors are what will be the focus of this technical review.



## SPECIFICATIONS

The bolt specification for structural fasteners is ASTM F3125 (22) (Figure 1). This spec was created in 2015 and has had several revisions with the latest and current revision occurring in 2022. This specification is the “recipe” for manufacturing and testing structural fasteners. The F3125 spec also includes several other ASTM specifications (Figure 2) that detail exactly how to test these fasteners for several different factors such as hardness, coating thickness, and details the applicable plating specification. With the latest release of F3125 (22) the permitted zinc flake coating specification changed from F1136/F1136M (Geomet), F2833 (Magni), and F3019/F3019M (Doerken) to ASTM F3393 (20) (Figure 3). With this change the spec went from a “Brand” to more of a performance specification. The above-named Brands are the only coatings approved to the specification.



**Designation: F3125/F3125M – 22**

**Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi and 150 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength<sup>1</sup>**

Figure 1

## 2. Referenced Documents

### 2.1 ASTM Standards:<sup>2</sup>

[A194/A194M Specification for Carbon Steel, Alloy Steel, and Stainless Steel Nuts for Bolts for High Pressure or High Temperature Service, or Both](#)

[A354 Specification for Quenched and Tempered Alloy Steel Bolts, Studs, and Other Externally Threaded Fasteners](#)

[A449 Specification for Hex Cap Screws, Bolts and Studs, Steel, Heat Treated, 120/105/90 ksi Minimum Tensile Strength, General Use](#)

[A563/A563M Specification for Carbon and Alloy Steel Nuts \(Inch and Metric\)](#)

Figure 2

# TECHNICAL REVIEW

# TENSION CONTROL BOLTS COATED WITH INF3013™

F3125/F3125M-22  
TABLE A1.1 Permitted Coatings

120 ksi & 830 MPa Bolt Assemblies <sup>A</sup>			150 ksi & 1040 MPa Bolt Assemblies <sup>A</sup>		Classification Codes	
Commonly Applied Coatings	Grade or Class		Qualified Coatings	Corrosion	Appearance	Coefficient of Friction
F2329	Hot Dip Galvanized / 50 µm		F3393	D	1	R <sub>B</sub>
B695	Class 55		...	...	...	...
	Classification Codes		...	...	...	...
Other Coatings	Corrosion	Appearance	...	...	...	...
		Coefficient of Friction	...	...	...	...
F3393	D	1	...	...	...	...

<sup>A</sup> Coatings for Twist-off style bolt assemblies shall be agreed upon between the producer, supplier and user, and are not permitted except when applied under the Direction of the manufacturer. The coefficient of friction classification code does not apply to Twist-off style bolt assemblies.

<sup>B</sup> Specification F3393 is a consolidation and replacement of three ASTM standards which included qualified coatings F1136/F1136M Bolt & Washer Grade 3, Nut Grade 5, F2833 Grade 1, and F3019/F3019M Grade 4.

Figure 3

## SPECIFICATION CONTROLS VERSUS INFASCO DATA

With a coated TC bolt, you are looking for two primary characteristics: long corrosion resistance and repeatable shear of the tip providing a consistent targeted tension. The plating spec and the general bolt spec have controls in place to ensure these characteristics are met. The Material Test Reports (MTR) detail the values achieved against the specification requirements.

## ASSEMBLY TENSION TEST

Test conducted in a hydraulic load cell device (Skidmore tester) per ASTM F3125-22 (Figure 4).

### 11. Requirements Specific to Twist-Off style bolts

11.1 Assembly Tension Test (Fastener Tension):

11.1.1 The assembly lot tension test shall be performed on twist-off style fastener assemblies to determine the ability of the assembly to provide the required minimum tension.

11.1.2 Twist-Off style bolt assembly lots shall be tested by the manufacturer or responsible party to verify conformance to installation tension requirements.

11.1.3 The test assemblies shall consist of one tension control bolt, one nut and at least one washer.

11.1.4 Test assemblies shall develop a bolt tension to

the minimum requirements in **Table 8** when the spline end is separated from the bolt.

TABLE 8 Twist-Off Style Assembly Installation Tension Test (Minimum Tension, lbf)

Bolt Diameter, in.	F1852	F2280
1/2-13 UNC	12550	15650
5/8-11 UNC	19900	24900
3/4-10 UNC	29450	36800
7/8-9 UNC	40750	50950
1-8 UNC	53450	66800
1 1/8-7 UNC	67350	84100
1 1/4-7 UNC	85500	106850

Figure 4

# TECHNICAL REVIEW

# TENSION CONTROL BOLTS COATED WITH INF3013™

The Infasco test values for Assembly Tension are recorded in the MTR (Appendix 1) and are the mean value of 3 individual tension tests (Figure 5).

ASSEMBLY TENSION (F1052) MINIMUM	29,000 lbf
MEAN VALUE	35,000

INFASCO  
A division of Ifestgroupe LP      700 Ouellette, Mariville (Quebec) J3M 1P6  
A Heico Company      Tel.: (450) 858-8741 Fax: (450) 460-5496  
03-LAB-010 Rev. 01

Figure 5

## COATING REQUIREMENTS AND VALUES

The selected coating requirements provide three significant contributions to the effectiveness of this bolting system: corrosion resistance, frictional properties (for repeatable tension), and reduction in variation from environmental changes.

Per coating specification ASTM 3393-20 the correct coating code would be D1N.

D for the corrosion resistance level and minimum coating thickness to achieve 720 hours minimum. (Figure 6). The 1 in D1N represents the color of the coating, in this case grey. And the N represents the friction requirement of the coating which is total coefficient of friction of 0.12+/-0.03. Per the spec this is not relevant for twist off style bolts (TC) as the more prominent factor is the Tension Test results. However, using this value ensures that the coating supplier understands and can provide a consistent friction.

TABLE 1 Minimum Corrosion Resistance, Minimum Coating Thickness, or Minimum Coating Weight

Classification Code	Minimum Corrosion Resistance	Minimum Coating Thickness	Minimum Coating Weight
A	240h	0.00016 in. - 4µm	0.0430oz/ft <sup>2</sup> - 13g/m <sup>2</sup>
B	480h	0.00020 in. - 5µm	0.0524oz/ft <sup>2</sup> - 16g/m <sup>2</sup>
C	600h	0.00025 in. - 6µm	0.0688oz/ft <sup>2</sup> - 21g/m <sup>2</sup>
D	720h	0.00030 in. - 8µm	0.0754oz/ft <sup>2</sup> - 23g/m <sup>2</sup>
E	960h	0.00050 in. - 12µm	0.0800oz/ft <sup>2</sup> - 24g/m <sup>2</sup>
F	1200h	0.00060 in. - 15µm	0.1180oz/ft <sup>2</sup> - 36g/m <sup>2</sup>
G	As Agreed Upon	As Agreed Upon	As Agreed Upon

Figure 6

Since this is a very extended salt spray test (30 days) it is not practical to use salt spray testing as an ongoing conformance test. Instead, we use salt spray testing as an audit method and use coating thickness testing as the ongoing quality test. Our plating thickness measuring device outputs a value that must have a multiplier factor assigned to compare to the thickness allowable by the spec. As above the minimum thickness for D is 0.0003. Our outputs are multiplied by a factor of 0.001. For example, 0.53 times 0.001 equals 0.00053 exceeding the minimum required above. The converted spec value for our device is 0.30.

The Infasco test values (Figure 7) for the coating thickness are shown in the MTR (Appendix 2).

Figure 7

ASTM E376
COATING THICKNESS
(0.001 in)
0.30
0.53
0.55
0.33
0.38
0.33
0.38
0.44
0.41
0.45
0.49
0.47
0.50
0.33
0.62
0.47

## TECHNICAL REVIEW

# TENSION CONTROL BOLTS COATED WITH INF3013™

---

A recent audit for salt spray hours has produced a test result that at time of this report has exceeded 6000 hours. (Figure 8). For comparison purposes only salt spray testing on samples coated with Mechanical Galv failed at 433 hours due to red corrosion and high levels of white corrosion (Figure 9).



Figure 8



Figure 9

Although the full MTR package from Infasco will cover other aspects of the fastener's compliance to the specification the purpose of this report makes that information irrelevant and was therefore not included in this review. Full MTR package is available upon request.

Rick Brown

Technical Services and  
Structural Product Manager  
647-922-1469 | [rbrown@infasco.com](mailto:rbrown@infasco.com)

[infasco.com](http://infasco.com)

# TECHNICAL REVIEW

# TENSION CONTROL BOLTS COATED WITH INF3013™

## MTR PAGE 1 Appendix 1



ISO 9001, IATF 16949  
ISO / IEC 17025  
ISO 14001

SET NO.: 2022-40284

### FASTENER TEST REPORT

(THIS DOCUMENT MAY ONLY BE REPRODUCED IN ITS ENTIRETY, WITH PRIOR WRITTEN APPROVAL BY THE INFASCO LABORATORY)  
(THE INFASCO LABORATORY IS ACCREDITED BY THE CCN FOR THE TESTS LISTED AT [WWW.CCN.CA](http://WWW.CCN.CA))  
COMPLIES WITH EN10204:2004 INSPECTION CERTIFICATE 3.1

DATE: 2022-12-16

DESCRIPTION	A F1852-1TC+A563-DH NA+F436-1 UNC N 3/4-10 X 2 1/2
-------------	---

#### BOLT F1852-1TC ROUND HD BOLT UNC N ZAFINF3013 MARKING : HOLLOW TRIANGLE & "A325TC"

LOT NO. 2207-59741 1313D	MANUFACTURED BY INFASCO			HARDNESS (ROCKWELL) HRC 25.0 - HRC 34.0		PROOF LOAD (LB) MIN: 28,400	TENSILE STRENGTH (LB) MIN: 40,100
MEAN VALUE				30.9		PASS	49,363
HEAT NO.	C %	Mn %	P %	S %	SI %	B %	
A57540	0.34	0.79	0.011	0.004	0.21	0.002	

#### NUT HVY HEX NUT A563-DH FNA UNC N ZAFINF3013 MARKING : TRIANGLE & "DH"

LOT NO. 2202-51584 5950D	MANUFACTURED BY INFASCO			HARDNESS (ROCKWELL) HRC 24.0 - HRC 38.0		PROOF LOAD (LB) MIN: 58,450	
MEAN VALUE				33.6		PASS	
HEAT NO.	C %	Mn %	P %	S %	SI %	Cu %	Ni %
C148283	0.44	0.78	0.004	0.013	0.20	0.04	0.02

#### WASHER F436-1 STRUCTURAL WASHER FNA STD ZAFINF3013 MARKING : MANUFACTURER'S ID & "F436"

LOT NO. 08-20560 7494D	MANUFACTURED BY TECHNICAL STAMPING INC USA			HARDNESS (ROCKWELL) HRC 38.0 - HRC 45.0			
MEAN VALUE				38.7			
HEAT NO.	C %	Mn %	P %	S %	SI %		
12012250	0.35	0.87	0.009	0.001	0.19		

HEAT CHEMICAL ANALYSIS PROVIDED BY STEEL SUPPLIER.

ASSEMBLY TENSION (F1852) MINIMUM	29,000 lbf
MEAN VALUE	35,000

INFASCO

A division of Ifastgroupe LP 700 Ouellette, Marieville (Quebec) J3M 1P6  
A Helco Company Tel: (450) 658-8741 Fax: (450) 460-5496

  
Christian Raymond  
Quality Assurance Supervisor

03-LAB-010 Rev. 01

Revision date of test report: 2022-12-16

Page 1 of 1



# TECHNICAL REVIEW

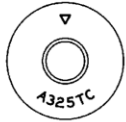
# TENSION CONTROL BOLTS COATED WITH INF3013™

MTR PAGE 2 Appendix 2



ISO 9001, IATF 16949  
ISO / IEC 17025  
ISO 14001

LOT NO.: 2207-59741  
1313D



## FASTENER TEST REPORT

(THIS DOCUMENT MAY ONLY BE REPRODUCED IN ITS ENTIRETY, WITH PRIOR WRITTEN APPROVAL BY THE INFASCO LABORATORY)  
(THE INFASCO LABORATORY IS ACCREDITED BY THE CCN FOR THE TESTS LISTED AT [WWW.CCN.CA](http://WWW.CCN.CA))  
COMPLIES WITH EN10204:2004 INSPECTION CERTIFICATE 3.1

DATE 2022-11-19

DESCRIPTION AND MARKING	F1852-1TC ROUND HD BOLT UNC N ZAFINF3013 HOLLOW TRIANGLE & "A325TC"	
SIZE	3/4-10 X 2 1/2	GRADE 10B35M
QUANTITY	56,756	

### HEAT CHEMICAL ANALYSIS (provided by steel supplier)

HEAT NO.	C %	Mn %	P %	S %	Si %	B %
A57540	0.34	0.79	0.011	0.004	0.21	0.002

METHOD	ASTM F606 PROOF LOAD (psi)	ASTM F606 WEDGE TENSILE STRENGTH (psi)	SHEAR STRENGTH	SURFACE HARDNESS (HR 30N)	ASTM F606 CORE HARDNESS (ROCKWELL) HRC 25.0 HRC 34.0	MICRO HARDNESS	ASTM E376 COATING THICKNESS (0.001 in)
SPEC. MIN:	85,000	120,000					0.30
SPEC. MAX:							
S NO. 1	PASS	149,000			HRC 31.2		0.53
A NO. 2	PASS	148,000			30.4		0.55
M NO. 3	PASS	147,000			30.4		0.33
P NO. 4					31.6		0.38
L NO. 5					30.7		0.33
E NO. 6							0.38
							0.44
							0.41
							0.45
							0.49
							0.47
							0.50
							0.33
							0.62
							0.47

THE ABOVE TESTED SAMPLES HAVE BEEN INSPECTED FOR VISUAL DISCONTINUITIES AND FOUND ACCEPTABLE. THEY COMPLY IN ALL RESPECTS WITH THE LATEST EDITION OF THE FOLLOWING SPECS:  
ASTM F3125 GRADE 1852 TYPE 1, ASME B18.2.6, THREADS PER ASME B1.1 CLASS 2A UNLESS OTHERWISE SPECIFIED. NO BISMUTH, SELENIUM, TELLURIUM, LEAD HAVE BEEN INTENTIONALLY ADDED COATING AS PER F3393 D1N.

MANUFACTURED IN: CANADA  
The steel was melted and rolled  
in North America and is mercury and asbestos-free.

Gabriel Landry, eng.  
Senior Metallurgical Engineer

INFASCO  
A division of Ifastgroupe LP 700 Quéllette, Marieville (Quebec) J3M 1P6  
A Helco Company Tel.: (450) 658-8741 Fax: (450) 460-5496

03-LAB-009 Rev. 10

Revision date of test report: 2023-02-13

Page 1 of 1

