



Test Report

# Company X Torque- Angle to Failure Testing

Conducted by: Peak innovations Engineering

David Archer  
8/4/2015

**Equipment and Test Summary**  
**All tests**

Equipment				
Description	Manufacturer and Model	Capacity	Equip. ID	Joints
Transient Recorder and Ultrasonic System	Micro Controls MC 900 portable 4 channel	N/A	CO-03	All
DC Controller	Stanley 21A114303	N/A	CD-06	All
DC Nut-Runners	Stanley E33LA18-46	46 N-m	TA-24	All
Torque-Angle Transducer	RS Tech 032930-00021	20 in-lb	ST-49	A1,A2,A3,A4,A5,A6,A7,A8,B1,B2,B3,B4,C1
Torque-Angle Transducer	GSE 038526-G0101	100 in-lb	ST-48	A9,A10,B5,B6

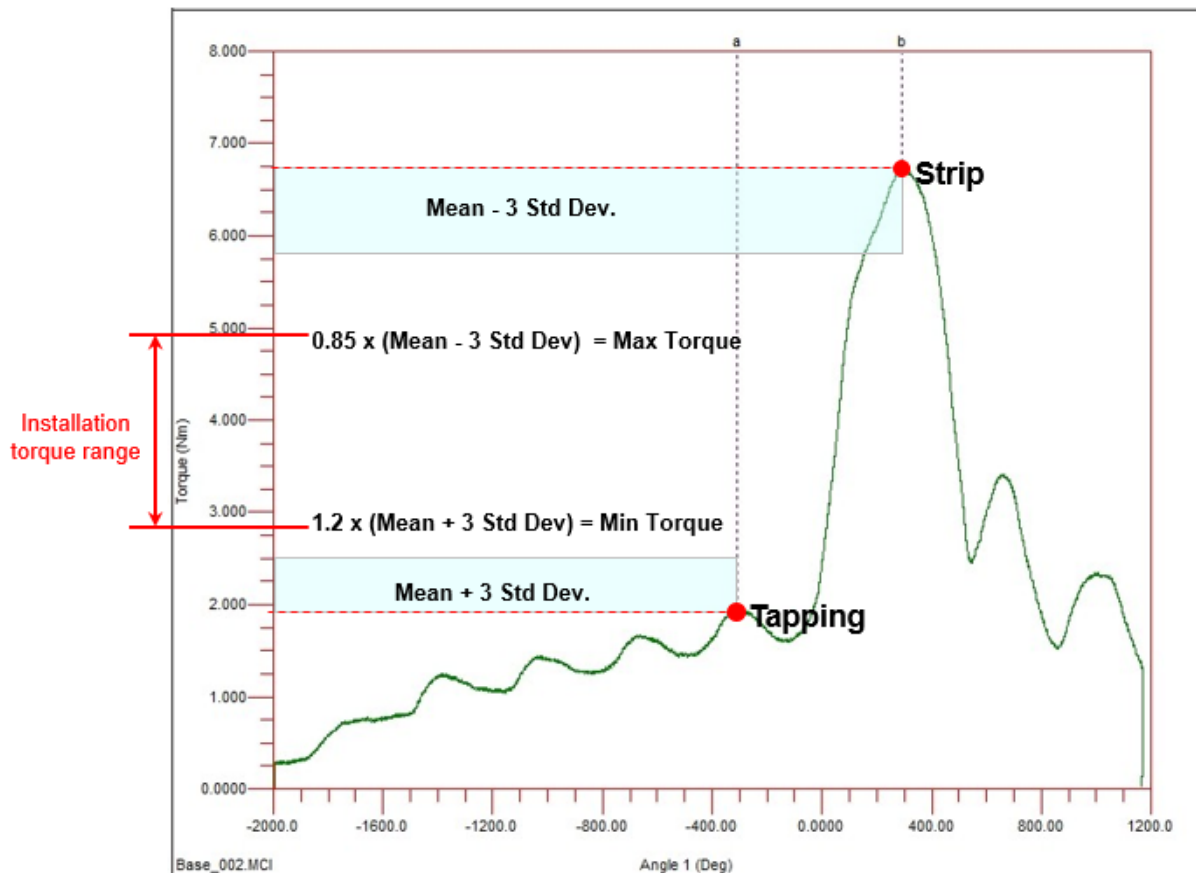
Test Parameter	
Parameter	Description
Test Specification	DVM-0084-EX
Requestor	XXXXXXXXXXXX
Test Date(s)	7/24/2015 thru 7/29/2015
Temperature/Humidity	21.6°C - 21.3°C, 33%-38% RH
Tightening Strategy	Less than 6mm: 400 RPM to Failure 6mm: 200 RPM to Failure
Test Technicians	Dave Archer, Eric Hannula

# Torque-Angle to Failure Introduction

## Calculation of Min/Max torque per DVM-0084-EX

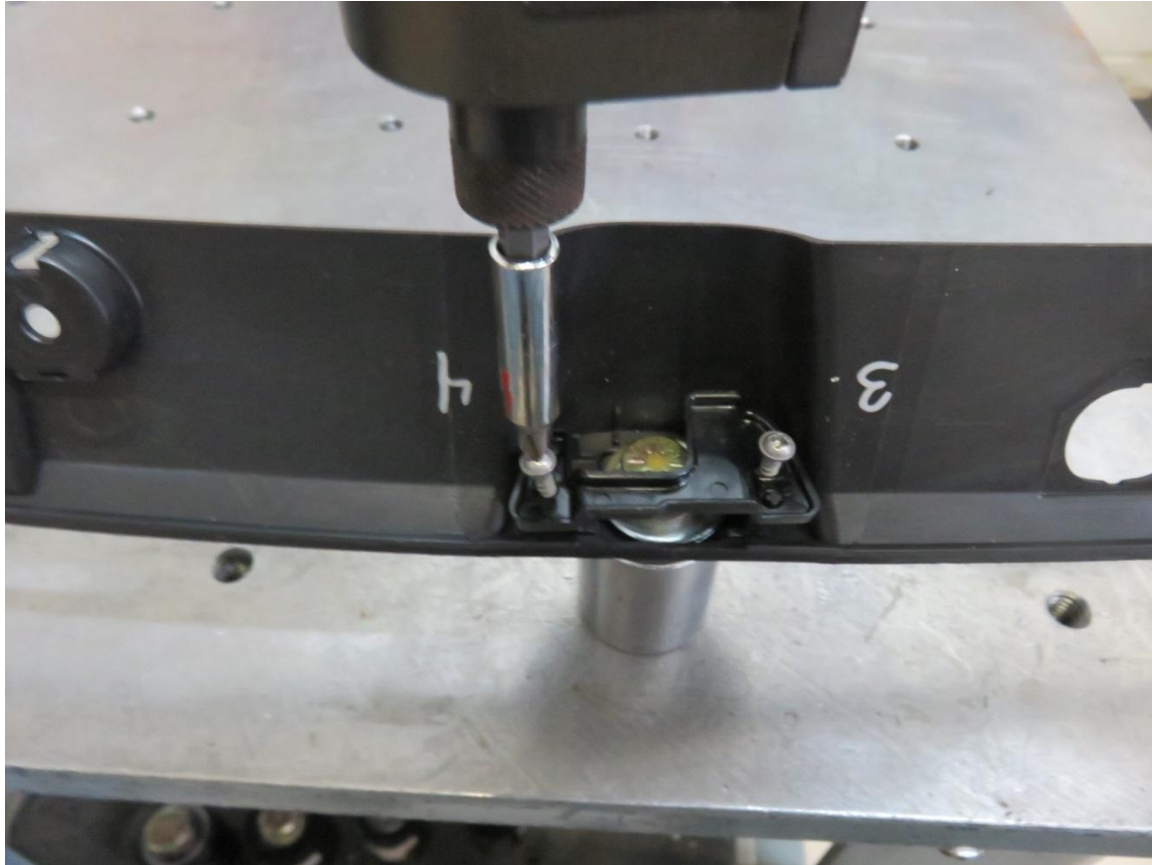
The results that follow report two values picked from each rundown. The Tapping and Strip torque represent the peak torque prior to screw seating and the ultimate torque at failure, respectively. Typically installation torque is established to be between these values. While the mean of each is usually used as a starting point, their variability should be taken into account when establishing installation torque. The results data includes mean +/- 3 standard deviation values for this purpose.

It should be noted that the torque-angle trace is not a foolproof indication of joint stiffness, as friction variation during the rundown can also cause changes in the slope of a torque-angle trace.



**Illustrative Torque-Angle To Failure Trace  
(with selection of tapping and strip points)**

## Test Setup



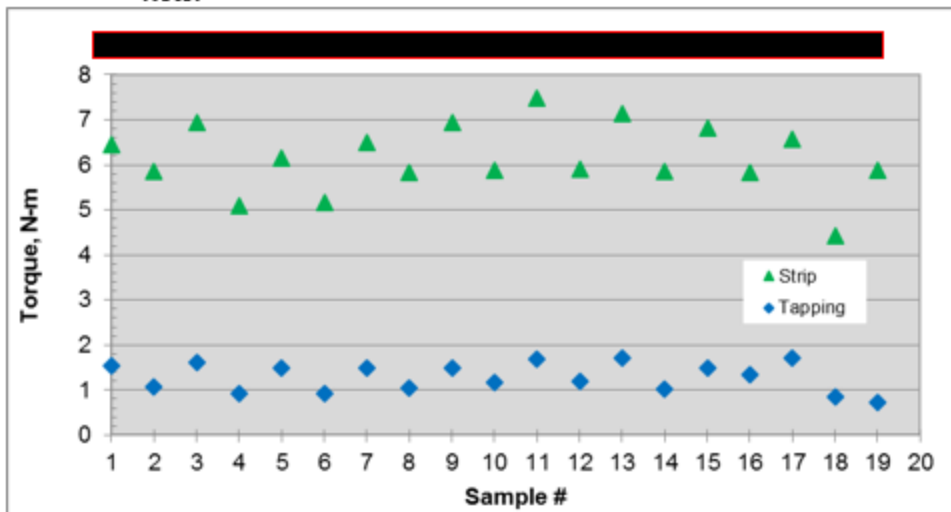
## Test Results

The results of picking the points of interest described previously are shown below.

Sample #	Torque, N-m		Strip/Tap
	Tapping	Strip	
1	1.54	6.44	4.19
2	1.07	5.84	5.46
3	1.62	6.95	4.29
4	0.92	5.08	5.53
5	1.49	6.15	4.13
6	0.92	5.16	5.58
7	1.49	6.50	4.36
8	1.04	5.82	5.61
9	1.50	6.95	4.63
10	1.18	5.88	5.00
11	1.68	7.49	4.45
12	1.18	5.91	4.99
13	1.71	7.15	4.18
14	1.03	5.85	5.69
15	1.48	6.82	4.61
16	1.33	5.83	4.37
17	1.70	6.56	3.86
18	0.84	4.41	5.25
19	0.72	5.87	8.14
N	19	19	19
MEAN	1.29	6.14	4.96
STD DEV	0.32	0.77	0.97
X -3STD	0.33	3.84	2.06
X +3STD	2.24	8.44	7.87
MIN	0.72	4.41	3.86
MAX	1.71	7.49	8.14

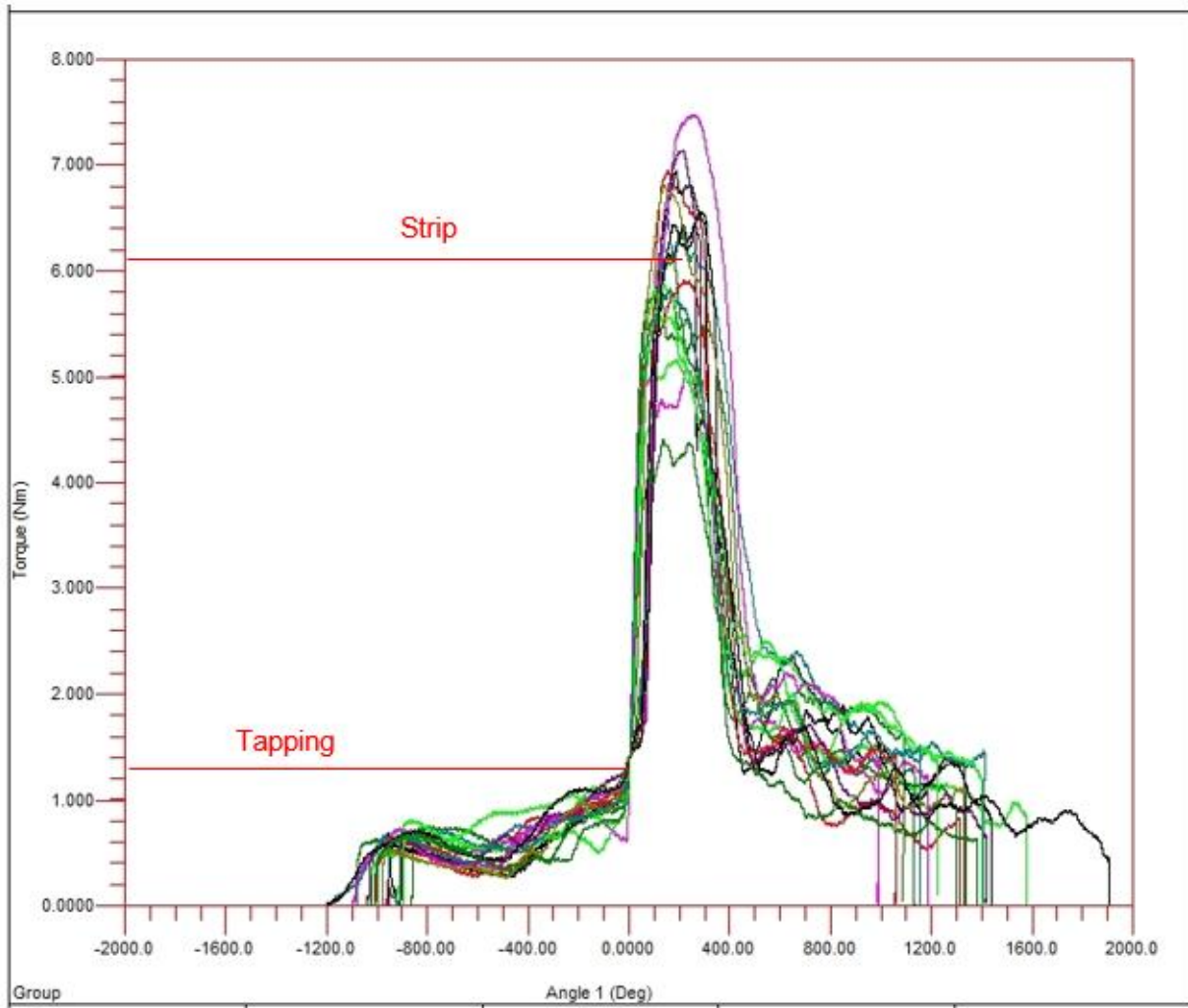
Failure Mode: Nut member strip

Note:



## Test Traces

Torque-Angle traces from which reported data was taken are shown below. Mean values are annotated.



**Traces aligned to zero degrees at 1.25 N-m**

## Post Test Photos

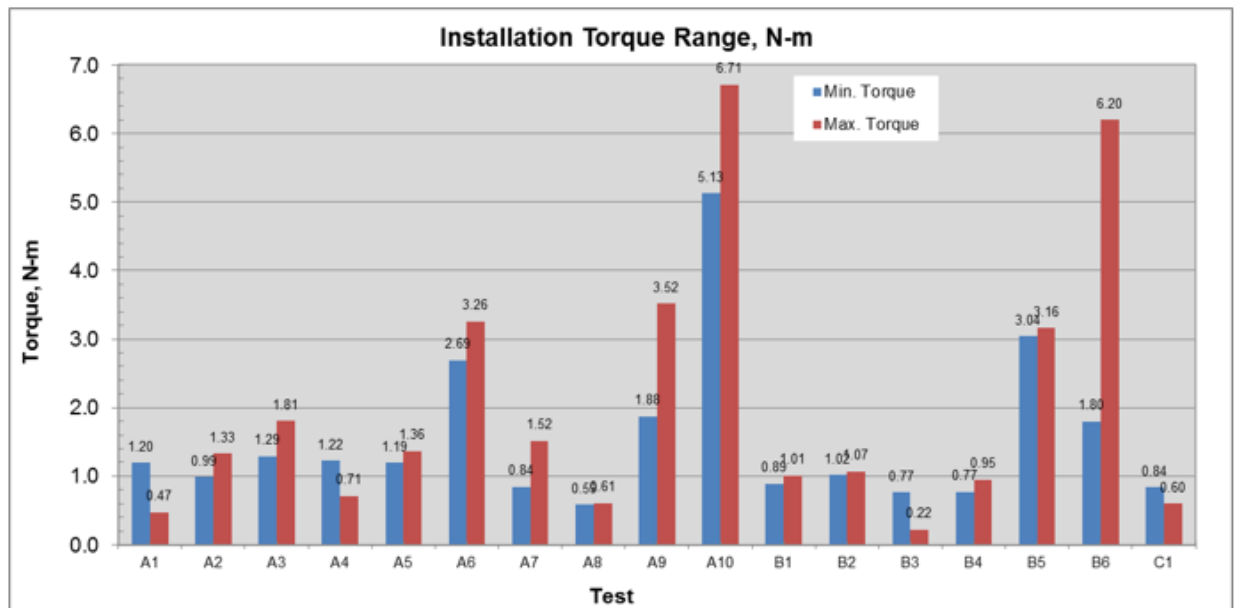


Typical Surfaces

# Test Summary

The recommended dynamic installation torque range as calculated per spec DVM-0084-EX is summarized below. (See page 4) Rows in red have no acceptable range, as the minimum torque is greater than the maximum.

TEST Matrix				Installation Torque, N-m	
Function	Joint #	Description	Fastener	Min. Torque	Max. Torque
Applique	A1			1.20	0.47
	A2			0.99	1.33
	A3			1.29	1.81
	A4			1.22	0.71
	A5			1.19	1.36
	A6			2.69	3.26
	A7			0.84	1.52
	A8			0.59	0.61
	A9			1.88	3.52
	A10			5.13	6.71
Bodyside	B1			0.89	1.01
	B2			1.02	1.07
	B3			0.77	0.22
	B4			0.77	0.95
	B5			3.04	3.16
	B6			1.80	6.20
CHMSL	C1			0.84	0.60





## Test Summary

Following are observations on joint behavior that likely influenced test results.

Function	Joint #	Description	Fastener	Comments
XXXXX	A1	[REDACTED]	[REDACTED]	• Even number holes aren't as deep as odd number holes. Screws appear to bottom out in even number holes.
	A2			•
	A3			•
	A4			•
	A5			•
	A6			•
	A7			•
	A8			•
	A9			• Screws 1,4,5,8,9,12,13,16,17,20 fractured - outside holes of groups of 4
	A10			• #12 stud drive feature fractured
XXXX	B1	[REDACTED]	[REDACTED]	•
	B2			
	B3			• Hole size diff odd/even. Odd # holes – upper screws as positioned in vehicle are larger, screw starts deeper in hole.
	B4			•
	B5			•
	B6			• Studs #6,8,9,10,12,14,20 drive feature fractured
XXX	C1	[REDACTED]	[REDACTED]	• #5 screw head hit PCB

The results and comments contained in this report should be considered valid only for the specific components tested.