Applications Laboratory Testing Report

CD533 Altracs Plus® 30 x 12

Drive Strip Testing

Project Number: 16007

Submitted To:

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Date: 6/8/16

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Introduction

The ATF, Inc. Applications Lab, on behalf of -------, initiated project number 16007. The objective was to evaluate the performance of the Altracs Plus® 30 x 12 Fastener in the CD533 headlight reflector. The reflector assembly and screws were provided to ATF by -------. Drive and strip torque tests were conducted to determine tightening torques. The testing procedure, results, and recommendations from ATF are described in this document.

Parts Tested

Altracs Plus® 30 x 12

- **Size**: 3 mm diameter, 12 mm length
- **Head Style**: Torx® Pan Head
- **Head Diameter**: 6.00 mm
- **Drive Style**: 10IP
- **Finish**: A3K ISO 4042 + WAX

Figure 1: Altracs Plus® 30 x 12 Torx® Pan Head

Application

Head Light Reflector

Reflector (Boss): Aluminum
Reflector Cover (Capture): Plastic
ATF Screw: Altracs Plus® 30 x 12 Torx® Pan Head

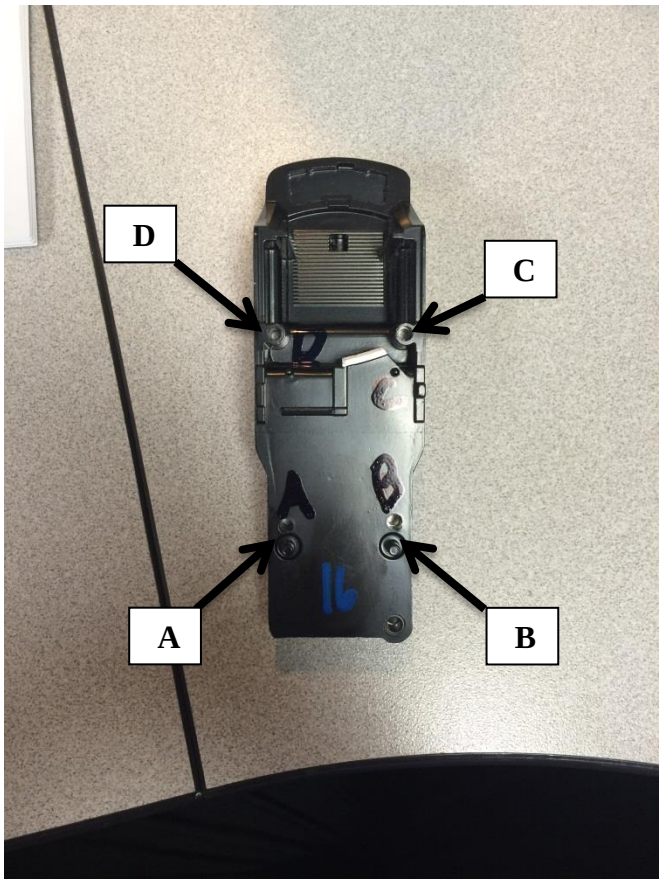

Figure 2: Reflector

Test Preparation

Drive & Strip Torque

Driving torque and stripping torque are important in determining a joint's safety of assembly. Drive and strip torque testing is conducted by driving the fasteners into the pilot holes of each boss with an Atlas Copco electric driver, turning at a free speed of 500 rpm, until the joint fails. The torque is measured continuously throughout the driving process. The measuring apparatus consists of an Atlas Copco Tensor S4/S7 running ToolsTalk PF3000 for data acquisition. The software then collects and translates signals from the transducer into a torque vs. rotation graph. This graph is interpreted to determine the precise maximum driving and stripping torque.

Tightening Torque

The tightening torque is the torque at which it is recommended the application be assembled. The tightening torque should be sufficiently high so as to fully drive the screw and generate clamp load, yet low enough to avoid stripping and long term boss damage. An adequate safety factor to compensate for the repeat accuracy of the driver system must also be considered.

Drive and Strip Torque Explanation

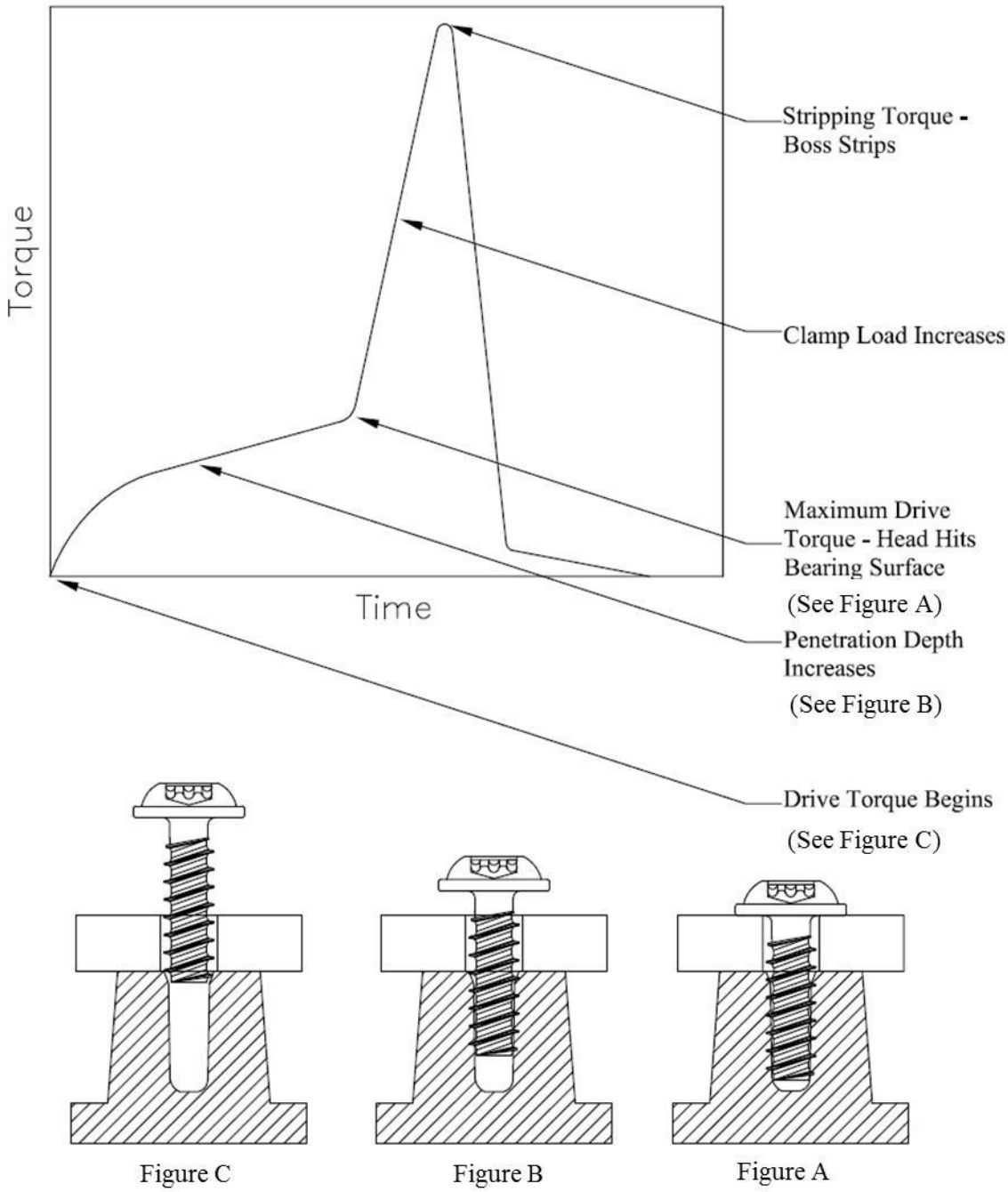

Figure 3: Drive and Strip Torque Explanation

Test Results

Boss Dimensions

Table 1: Boss Dimensions

Item Number	Hole Diameter - Bottom (mm)	Hole Depth (mm)	Counter-Bore Diameter (mm)	Counter-Bore Depth (mm)
1A	2.74	9.40	3.32	3.63
3A	2.70	9.41	3.34	3.66
4A	2.74	9.47	3.32	3.49
5A	2.74	9.41	3.30	3.38
6A	2.68	9.37	3.34	3.48
7A	2.74	9.41	3.34	3.59
8A	2.74	9.43	3.34	3.50
9A	2.72	9.46	3.30	3.53
10A	2.72	9.38	3.32	3.41
11A	2.74	9.44	3.32	3.43
12A	2.72	9.45	3.32	3.47
13A	2.74	9.44	3.30	3.42
14A	2.70	9.44	3.32	3.53
15A	2.72	9.46	3.34	3.53
16A	2.74	9.46	3.32	3.47
17A	2.74	9.44	3.32	3.46
18A	2.74	9.46	3.34	3.46
19A	2.72	9.46	3.34	3.37
20A	2.74	9.43	3.32	3.49
21A	2.72	9.48	3.32	3.48
22A	2.74	9.44	3.34	3.36
23A	2.72	9.45	3.32	3.54
1B	2.74	9.44	3.36	3.76
3B	2.72	9.49	3.32	3.63
4B	2.74	9.44	3.32	3.48
5B	2.74	9.39	3.34	3.56
6B	2.74	9.39	3.32	3.59
7B	2.74	9.38	3.32	3.42
8B	2.74	9.42	3.36	3.43
9B	2.74	9.45	3.34	3.45
10B	2.74	9.33	3.34	3.39
11B	2.74	9.37	3.34	3.37
12B	2.74	9.43	3.34	3.49
13B	2.74	9.44	3.32	3.44

14B	2.72	9.38	3.36	3.43
15B	2.74	9.43	3.32	3.49
16B	2.74	9.40	3.34	3.42
17B	2.74	9.41	3.34	3.46
18B	2.74	9.42	3.34	3.46
19B	2.74	9.41	3.34	3.41
20B	2.74	9.40	3.34	3.48
21B	2.74	9.47	3.34	3.48
22B	2.74	9.38	3.32	3.38
23B	2.74	9.45	3.32	3.44
1C	2.72	9.37	3.34	3.52
3C	2.68	9.49	3.30	3.68
4C	2.80	9.33	3.32	3.42
5C	2.72	9.32	3.32	3.43
6C	2.72	9.35	3.34	3.40
7C	2.72	9.33	3.32	3.46
8C	2.72	9.33	3.30	3.40
9C	2.72	9.40	3.32	3.48
10C	2.72	9.37	3.34	3.45
11C	2.72	9.36	3.34	3.46
12C	2.72	9.38	3.34	3.41
13C	2.70	9.39	3.32	3.44
14C	2.70	9.30	3.34	3.43
15C	2.72	9.39	3.30	3.40
16C	2.74	9.46	3.32	3.40
17C	2.72	9.37	3.30	3.44
18C	2.72	9.38	3.32	3.45
19C	2.72	9.37	3.32	3.39
20C	2.74	9.35	3.34	3.49
21C	2.68	9.33	3.30	3.38
22C	2.70	9.32	3.30	3.38
23C	2.72	9.35	3.30	3.42
1D	2.74	9.41	3.30	3.60
3D	2.72	9.38	3.32	3.70
4D	2.72	9.43	3.32	3.49
5D	2.70	9.29	3.30	3.47
6D	2.70	9.33	3.32	3.46
7D	2.74	9.40	3.32	3.40
8D	2.74	9.42	3.34	3.47
9D	2.72	9.39	3.32	3.50
10D	2.72	9.39	3.32	3.53

11D	2.72	9.42	3.32	3.46
12D	2.70	9.38	3.32	3.46
13D	2.74	9.42	3.32	3.43
14D	2.68	9.55	3.32	3.54
15D	2.74	9.43	3.32	3.52
16D	2.72	9.47	3.32	3.42
17D	2.74	9.42	3.32	3.40
18D	2.72	9.41	3.32	3.48
19D	2.74	9.44	3.34	3.42
20D	2.68	9.38	3.22	3.52
21D	2.68	9.41	3.32	3.46
22D	2.72	9.40	3.34	3.43
23D	2.74	9.41	3.32	3.45
Average	2.73	9.41	3.32	3.47
3s Upper Control Limit	2.78	9.55	3.38	3.70
3s Lower Control Limit	2.67	9.26	3.27	3.24
Standard Deviation	0.02	0.05	0.02	0.08

Drive and Strip Torque

Results For Altracs Plus® 30 x 12

Table 2: Drive Strip Torque Values

Trial #	Driving Torque (N-m)	Stripping Torque (N-m)	Driving Torque (in-lbs)	Stripping Torque (in-lbs)
14A	0.44	1.33	0.44	1.33
15A	0.22	1.72	0.22	1.72
18A	0.34	2.04	0.34	2.04
22A	0.40	2.22	0.40	2.22
14B	0.46	1.65	0.46	1.65
15B	0.32	1.80	0.32	1.80
18B	0.38	1.94	0.38	1.94
22B	0.38	2.08	0.38	2.08
14C	0.48	1.79	0.48	1.79
15C	0.40	1.42	0.40	1.42
18C	0.37	2.34	0.37	2.34
22C	0.32	1.52	0.32	1.52
14D	0.58	1.79	0.58	1.79
15D	0.51	1.50	0.51	1.50
18D	0.36	2.37	0.36	2.37
22D	0.48	1.52	0.48	1.52
Average	0.40	1.8	0.40	1.81
3s Upper Control Limit	0.66	2.79	0.66	2.79
3s Lower Control Limit	0.14	0.84	0.14	0.84
Standard Deviation	0.087	0.325	0.087	0.325

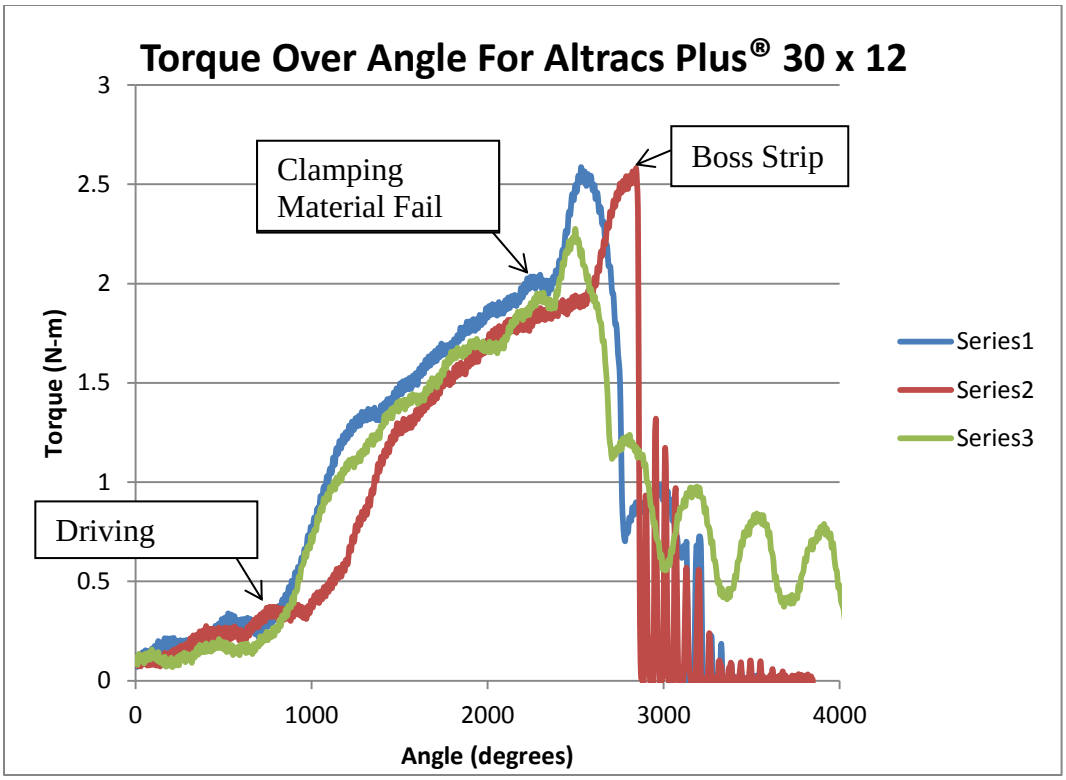

Figure 4 Torque Over Angle for Altracs Plus® 30 x 12

Conclusions

The objective for this series of testing was to evaluate the performance of the Altracs Plus® 30 x 12 Fastener in the CD533 headlight reflector. The results of the drive and strip test indicate the circuit/clamping material failing before the boss strips. The recommended tightening torque shown below is significantly below both the stripping torque and the clamp material failing.

Based on the performance of the screws, the ATF Applications Lab feels that optimal performance will be achieved if the recommendations stated in the next section are met.

Recommendations

Upon completion of all testing and analysis the ATF, Inc. Applications Lab has made the following recommendations:

Table 3: Two Stage Tightening Torque Recommendation
Recommended Tightening Torque: 1.00 N-m
1st Stage: 500 RPM to 0.70 N-m
2nd Stage: 150 RPM to 1.00 N-m
Necessary driver repeat accuracy: ± 10.0%