REVISION HISTORY		
REV	BY	DATE
P2	DPP	4/23/14

Glenair Band-Master ATS Micro Tool Endurance Test

By: Drew Price	Date: 4/23/2014	
Checked: Preston Clover	Date: 4/23/2014	
Enter text	Enter text	

Glendale, California

1.0 PURPOSE

1.1 This document records the correlation between the clamping performance of EMI shield termination bands installed with a Glenair Band-Master tool and the number of bands that tool has installed. This report shows the changes in clamping performance over 1,680 band terminations.

1.2 All terminations were performed with a brand new tool, which received no adjustment, alteration, or parts replacement for the duration of the test.

1.3 “Maximum Clamp”, “Retained Force”, and “Loop Tensile” measurements were recorded and plotted as a function of how many bands were installed using the test tool.

2.0 ITEMS TESTED

2.1 Glenair Band-Master ATS ‘Micro’ tool P/N 601-101 and/or 600-061, serial number 35097. (Band-It Tie-Dex-2 P/N A30199).

2.2 1,680 Glenair Micro bands P/N 601-065, 14” long, pre-coiled, passivated 304SS. The bands adhere to M85049/128-7.

3.0 TOOLS USED

3.1 MTS Q/Test-5 tensile testing machine.

3.2 Glenair Band-Master “Loop Tensile Testing Kit” using 0.875” mandrel.

4.0 RESPONSIBILITY

4.1 Tool (601-101 S/N 35097) provided by Glenair.

4.2 Bands (601-065) provided by Glenair.

4.3 “Loop Tensile Testing Kit” provided by Glenair.

4.4 All testing and documentation performed by Drew Price and Preston Clover.

4.5 Testing took place from 03/13/2014 to 04/03/2014.

5.0 TEST PROCEDURE

5.1 See Table 1.

6.0 RESULTS

6.1 Complete results, see Table 2.

6.2 BREAK-IN

6.3 DURATION

6.4 WEAR

TABLE 1 – MAX CLAMP, RETAINED FORCE, LOOP TENSILE

OUTLINE	DETAILS
1.0 EQUIPMENT	**1.1** MTS Q/Test-5 tensile tester with fixture to hold Glenair Loop Tensile Testing Kit 0.875" mandrel. **1.2** The Loop Tensile Testing Kit uses a split mandrel with a button load cell inside to measure the compressive force delivered by the band.
2.0 TEST SCHEDULE	**2.1** Three bands were terminated onto the split mandrel and their Max Clamp, Retained Force, and Loop Tensile force were recorded. **2.2** 25 bands were then terminated on a ~0.800" diameter wooden dowel rod. **2.3** Steps 2.1 and 2.2 were repeated for a total of 60 times (1,500 bands terminated on dowel rods in groups of 25, with 3 test bands terminated onto the load cell after each group, for a total of 1,680 bands).
3.0 TEST PROCEDURE	**3.1** All bands were terminated according to the instructions listed in Glenair publication *Shield Termination Assembly Process,* found in Band-Master ATS product literature. **3.2** The Max Clamp measurement is taken when the band is tensioned as tightly as possible over the centerline of the split mandrel, and the internal locking mechanism in the Band-Master tool has "clicked." The tool is held with the tensioning handle compressed, and the force reading is recorded. See ***Figure 1***. **3.3** The Retained Force measurement is taken after the tail of the band used in measuring Max Clamp from 3.2 is cut off. The band is now considered "terminated." The force reading is recorded. See ***Figure 2***. **3.4** The Loop Tensile measurement is taken by placing the split mandrel into the supplied holding fixture on the tensile test machine. The fixture allows the split mandrel to "explode" or grow. Eventually, the expansion of the mandrel causes the locking lip on the band to fail. The tensile tester records the peak force required to break the terminated band. The tensile test machine is set to extend at 1.00 inch/minute. See ***Figure 3***. **3.5** At the end of testing, after all the terminations were complete, the cutting faces of the tool were visually inspected for wear. **3.6** All bands terminated on dowel rods were saved for later visual inspection to explain termination behavior after test completion. These samples give a chronological history of locking lip formation over time. See ***Figures 4 and 5***.

TABLE 1 – MAX CLAMP, RETAINED FORCE, LOOP TENSILE	
OUTLINE	**DETAILS**
4.0 FIGURES	 **Figure 1**  **Figure 2**

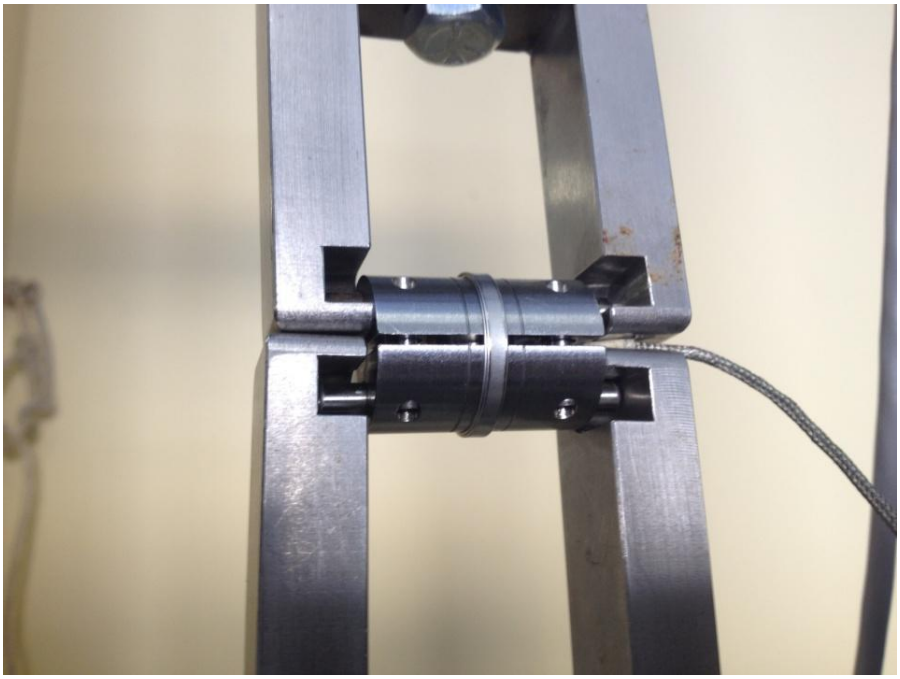
TABLE 1 – MAX CLAMP, RETAINED FORCE, LOOP TENSILE	
OUTLINE	**DETAILS**
4.0 FIGURES	 **Figure 3**  **Figure 4**

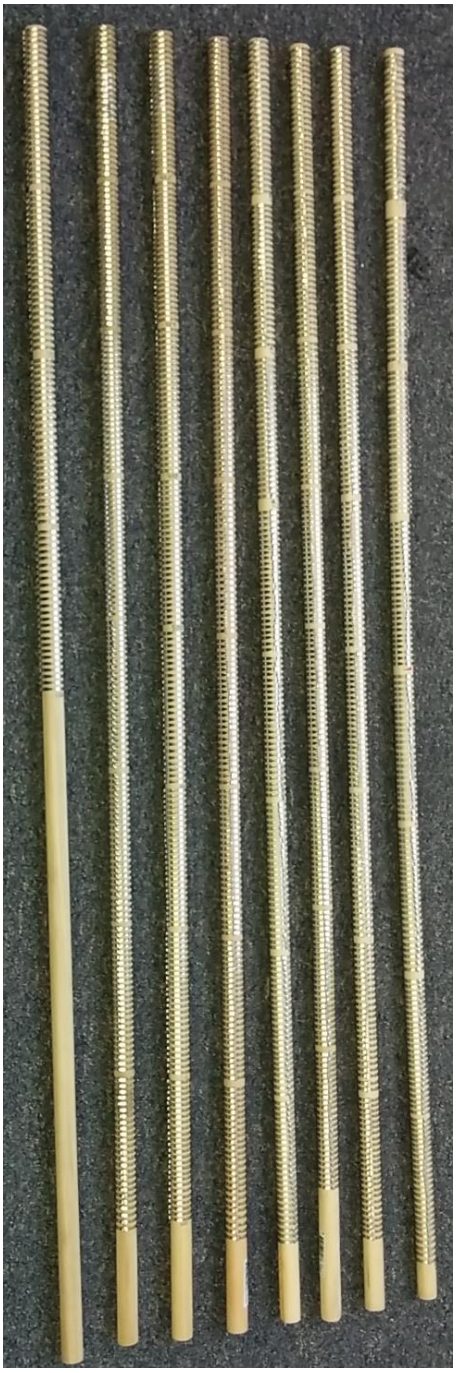
TABLE 1 – MAX CLAMP, RETAINED FORCE, LOOP TENSILE	
OUTLINE	**DETAILS**
4.0 FIGURES	 **Figure 5**

TABLE 2 – RESULTS

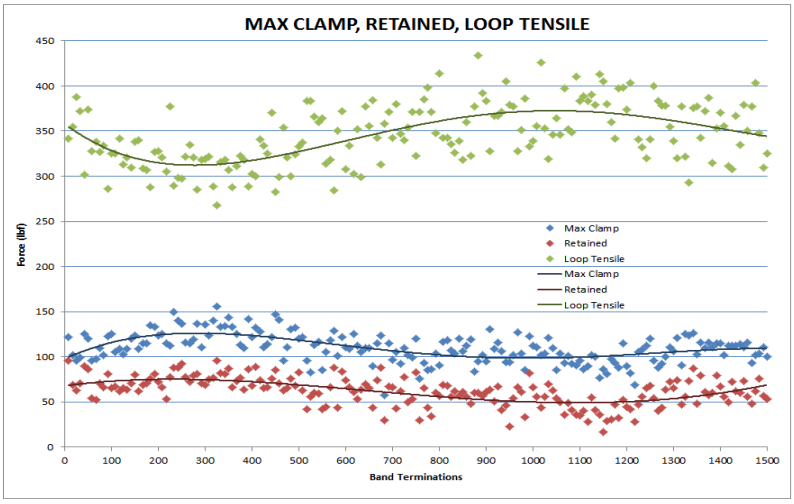
OUTLINE	DETAILS
1.0 CLAMPING FORCE	**1.1** The load cell data for Max Clamp, Retained Force, and Loop Tensile is shown below. A full-size copy of the chart is shown on ***Sheet 12***. 1.1.1 The trend lines are fitted to a 4th order polynomial. 1.1.2 All data points were recorded after allowing the reading to settle. **1.2** The Max Clamp and Retained Force (blue and red on the chart, respectively) follow roughly the same trend lines through the duration of the test. 1.2.1 Max Clamp and Retained Force initially increase and then peak at 300 band terminations. Values then drop slightly up to 900 band terminations, then increase slightly and level off by 1,200 band terminations. 1.2.2 By 500 band terminations (the recommended change interval for the cutting edges of the tool, the blade and knife) the forces have started to drop off, but have not deviated significantly from their initial values at the beginning of the test. **1.3** Loop Tensile (green on the chart) appears to mirror both Max Clamp and Retained Force. 1.3.1 Loop Tensile initially decreases to a low point at about 300 band terminations, then increases fairly steadily until peaking at around 1,000 terminations, before dropping back off again. 1.3.2 The roughly inverse relationship between Loop Tensile and Max Clamp and Retained Force has been noted before in other data sets on the performance of the EMI shield termination bands and their tools. 

TABLE 2 – RESULTS

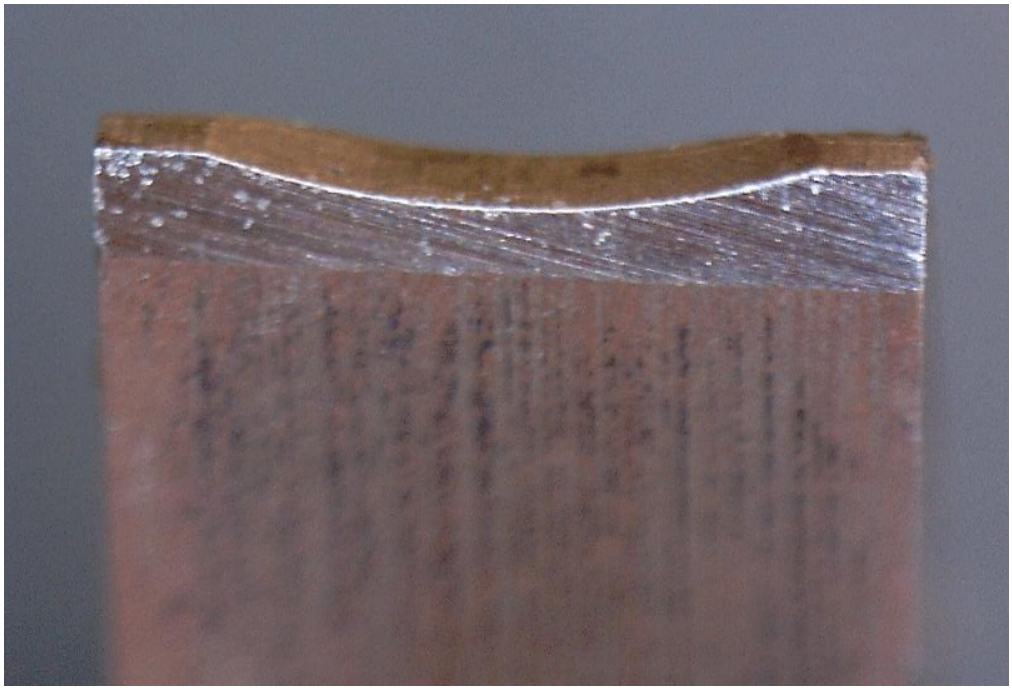
OUTLINE	DETAILS
2.0 VISUAL INSPECTION AND COMMENTS	**2.1** No parts of the tool failed or broke during the duration of the test. **2.2** The tool was not disassembled or adjusted in any way until the test was concluded. **2.3** The tool was verified to have a setting of 80lbs +/- 5 lbs. **2.4** The tool tension was re-verified to be 80 lbs +/- 5 lbs after the completion of the test. **2.5** Some slight wear of the cutting edge of the tool blade is visible under magnification after completion of the test. Red arrows denote areas of wear. 2.5.1 The bottom edge of the blade has been dulled at the corners of the nose relief radius. See ***Figures 6, 7*** *&* ***8.*** This is the area of the blade where the cutting action is initiated.  **Figure 6 – New blade, underside**

TABLE 2 – RESULTS

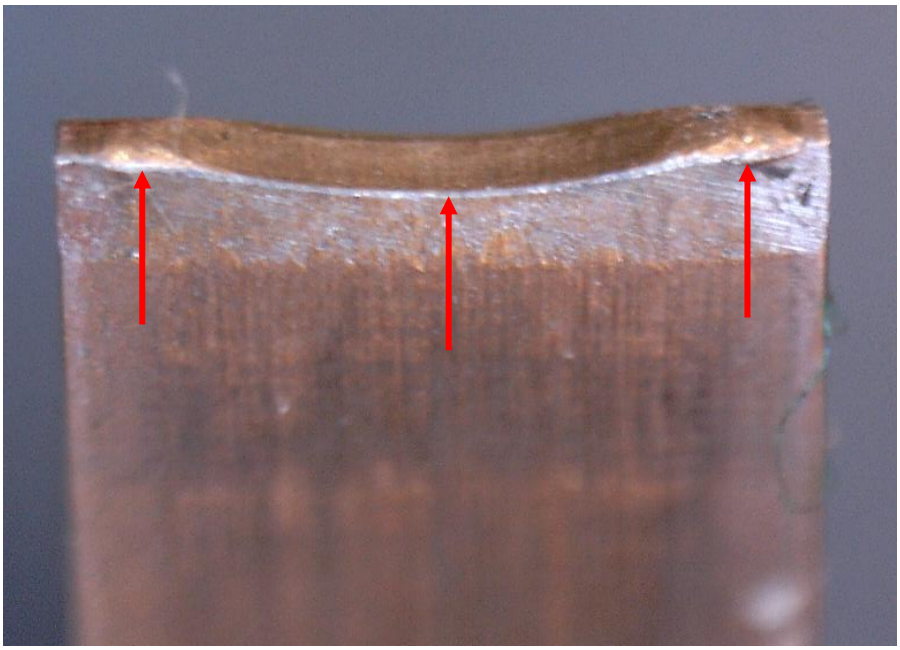
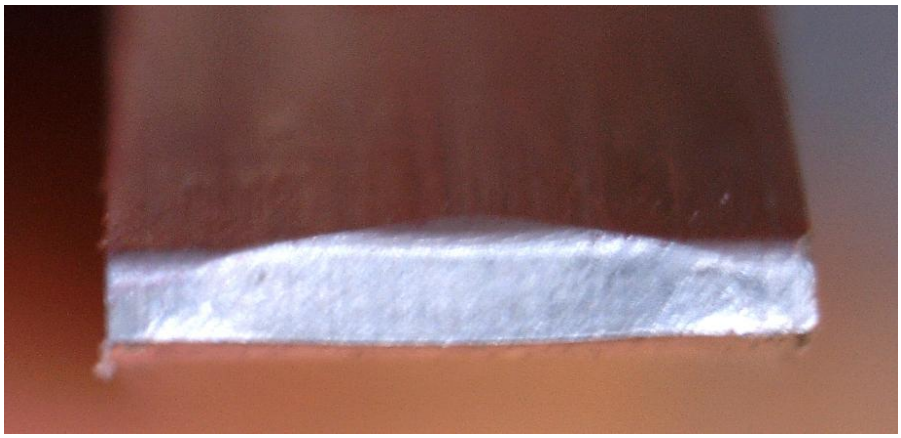
OUTLINE	DETAILS
2.0 VISUAL INSPECTION AND COMMENTS	 **Figure 7 – Used blade, underside, ~1,700 terminations**  **Figure 8 – Used blade, edge-on, ~1,700 terminations**

TABLE 2 – RESULTS

OUTLINE	DETAILS
2.0 VISUAL INSPECTION AND COMMENTS	**2.6** Some slight visible wear of the tool knife is visible under magnification. 2.6.1 The sharp corners of the knife have been dulled at the outer edges of the cutting edge. Red arrows denote areas of wear. See ***Figures 9*** *&* ***10.*** 2.6.2 The relief around the cutting edge was observed to be filled with filings from terminated bands, but not to the point of clogging the relief. See ***Figure 10*****.**

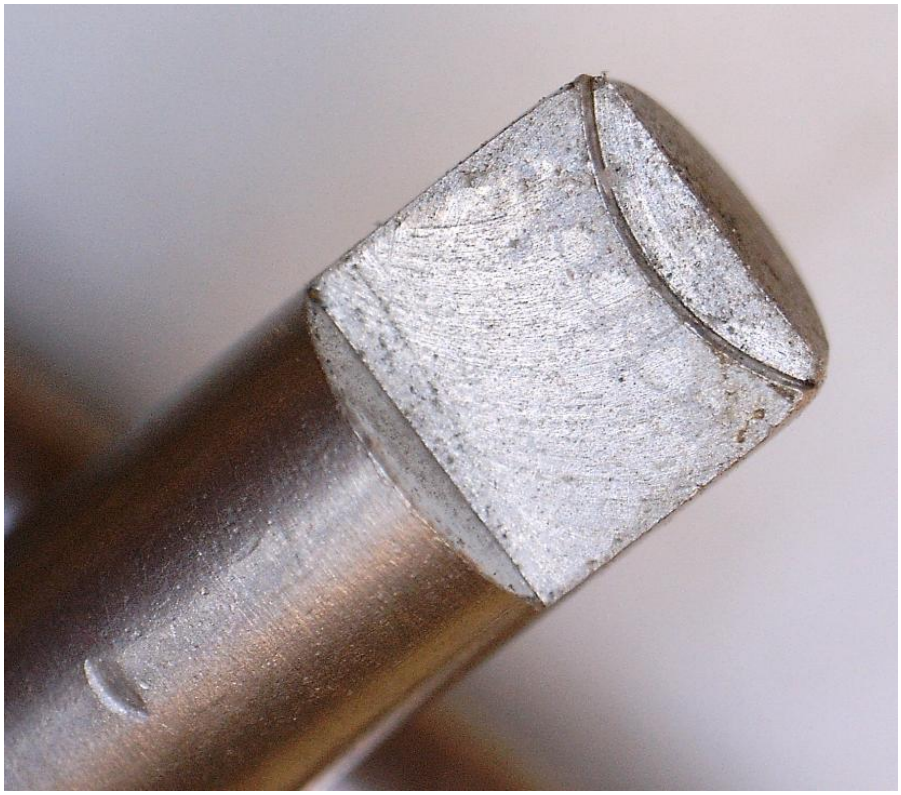
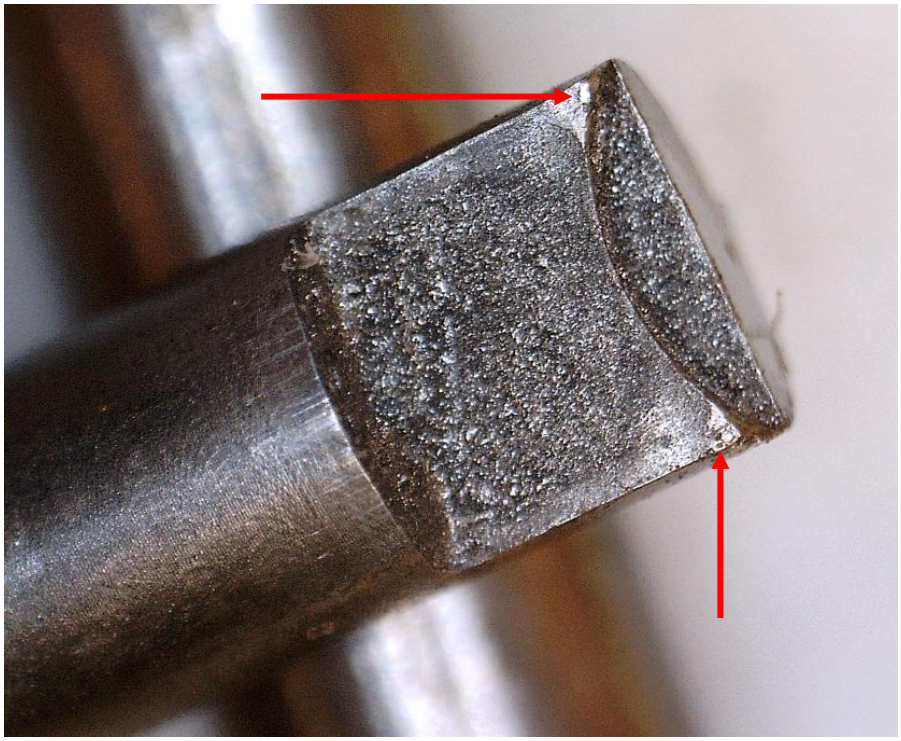
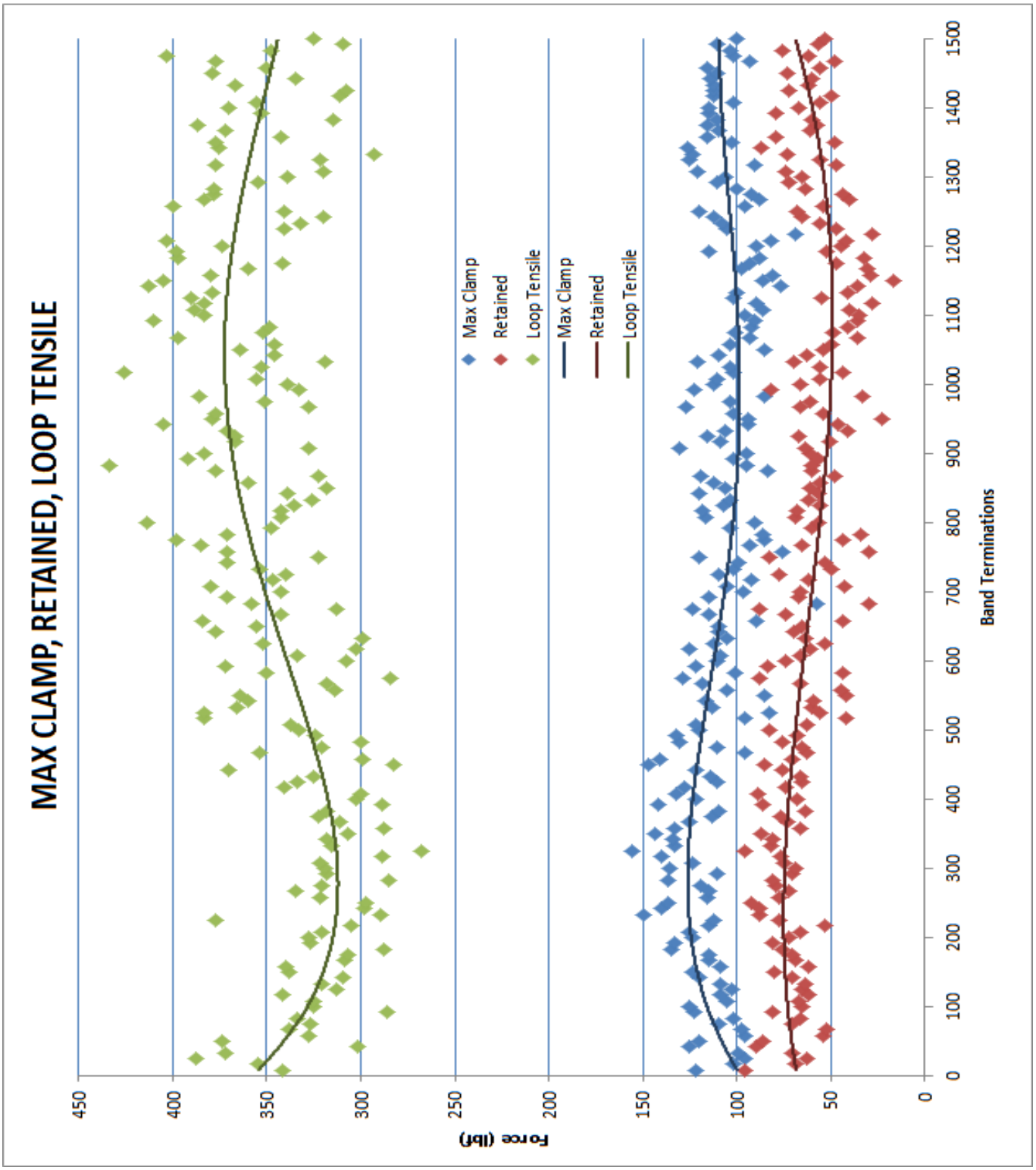


Figure 9 – Knife, new

TABLE 2 – RESULTS	
OUTLINE	**DETAILS**
2.0 VISUAL INSPECTION AND COMMENTS	 **Figure 10 – Knife, ~1,700 terminations**



Title: Glenair Band-Master ATS Micro Tool Endurance Test	Document Number: GT-14-33	Revision: P2
	Sheet 12 of 13	

SUMMARY

- After ~1,700 terminations, there was no failure or excessive wear of any components of the Band-Master ATS micro tool.
- Some increase in clamping force as measured by the Max Clamp, Retained Force and Loop Tensile methods is evident for about the first 300 terminations after new cutoff blades and knives are fitted to the tool.
- Some decrease in clamping force as measured by the Max Clamp, Retained Force, and Loop Tensile is evident after about 600 terminations.
- The deviation of values from one band to the next as measured by Max Clamp, Retained Force, and Loop Tensile methods matches the behavior seen in previous tests.