



Toolmarks Examination

Test No. 26-5281 Summary Report

Each participant received a sample pack containing tool(s) and material(s) with questioned toolmarks, which they were asked to examine. Data were returned from 89 participants and are compiled into the following tables:

	<u>Page</u>
<u>Manufacturer's Information</u>	<u>2</u>
<u>Summary Comments</u>	<u>3</u>
<u>Table 1: Examination Results</u>	<u>4</u>
<u>Table 2: Conclusions</u>	<u>6</u>
<u>Table 3: Additional Comments</u>	<u>17</u>
<u>Appendix: Data Sheet</u>	

This report contains the data received from the participants in this test. Since these participants are located in many countries around the world, and it is their option how the samples are to be used (e.g., training exercise, known or blind proficiency testing, research and development of new techniques, etc.), the results compiled in the Summary Report are not intended to be an overview of the quality of work performed in the profession and cannot be interpreted as such. The Summary Comments are included for the benefit of participants to assist with maintaining or enhancing the quality of their results. These comments are not intended to reflect the general state of the art within the profession.

Participant results are reported using a randomly assigned "WebCode". This code maintains participant's anonymity, provides linking of the various report sections, and will change with every report.

Manufacturer's Information

Each sample pack contained tool(s) and material(s) with questioned toolmarks. Participants were asked to determine if any of the questioned toolmarks were made by the submitted tool(s).

SAMPLE PREPARATION: To assist examiners, each questioned piece of material was marked with paint to identify it to its item number. Before use, each provided tool was inspected for defects and then "broken in" to remove any manufacturing residue.

ELIMINATION ITEMS: Each questioned piece of material was cut with its own separate tool, both different from the provided tool and from each other; neither was provided for examination.

SAMPLE PACK ASSEMBLY: The elimination items were placed into their respective pre-labeled envelopes and sealed. The provided tools were labeled, packaged in bubble wrap, and placed directly into the same pre-labeled sample pack box. Additional pieces of unmarked exemplar material were placed into pre-labeled envelopes and were intended for testing purposes.

VERIFICATION: Predistribution results were consistent with each other and the manufacturer's preparation information. In addition, ten randomly selected sample packs were verified by a qualified toolmark examiner who confirmed the manufacturer's preparation information.

Item	Known/ Questioned	Identification/ Elimination	Tool	Material Description
1	Known	--	Pittsburgh® 12" Bolt Cutter	--
2	Questioned	Elimination	Kobalt® 18" Bolt Cutter	8-G Copper Grounding Wire (with blue paint)
3	Questioned	Elimination	Pro-Grade 8" Bolt Cutter	8-G Copper Grounding Wire (with red paint)

Summary Comments

This test was designed to allow participants to assess their proficiency at a toolmark examination involving striated, impression marks. Participants were supplied with one tool (Item 1) and two pieces of material with questioned toolmarks (Items 2 and 3). Each questioned piece of material (Items 2 and 3) was cut with its own separate tool, both different from the provided tool (Item 1). Refer to the Manufacturer's Information for preparation details.

Among the 89 responding participants, 77 (87%) eliminated the toolmarks on Item 2 and either eliminated the toolmarks on Item 3 or reported them as inconclusive with respect to having been created by the Item 1 tool. Eleven participants eliminated the toolmarks on Item 2 but identified the toolmarks on Item 3 as having been created by Item 1. The remaining participant eliminated the toolmarks on Item 3 and reported the toolmarks on Item 2 as inconclusive with respect to having been created by Item 1.

Examination Results

Were the questioned toolmarks on either of the pieces of copper wire (Item 2 and Item 3) produced by the suspect's bolt cutter?

TABLE 1

WebCode	Item 2	Item 3	WebCode	Item 2	Item 3
26WYBJ	No	No	G9PYAF	No	Inc
2L6QDN	No	Inc	GBQ3XU	No	No
34JPXC	No	Yes	GCPCQC	No	No
34ZJYL	No	No	GK32R7	No	Inc
3N4N7U	No	Inc	GQ4DN3	No	Inc
3WHD3E	No	No	GXNGV6	No	No
3ZGNXE	No	Yes	H4AT8C	No	Inc
4NLXQF	No	Inc	HPNGV3	No	Inc
4V6ZXH	No	Inc	HPRXU2	No	Inc
6AGXFN	No	Inc	J78RVB	No	Inc
7WPQXD	No	No	JMJ94X	No	Inc
7WQN9A	No	Inc	K2U9DT	No	No
8E2ZCJ	No	No	K3NYJ8	No	No
8MU9WB	No	Inc	K6UGH4	No	No
8MXRKD	No	Inc	K7QXUZ	No	No
8WKU39	No	Yes	K9TTHC	No	Inc
9BG9ZG	No	Inc	LPYEGP	No	No
9NKT37	No	No	LQT6M6	No	Inc
ABFUWM	No	No	LURJ89	No	No
AEDB69	No	Inc	LWUGH2	No	Inc
AFARG7	No	Inc	MZ9CYY	No	Inc
ANNDQA	No	Inc	N86TNV	No	Inc
AR4978	No	Yes	NGVC8C	No	No
AWYWWM	No	Yes	NRDVMZ	No	No
CH8RU8	No	Inc	NX2JG6	No	Inc
CL8ZYH	No	Inc	P3PHBQ	No	Yes
DJHBWJ	No	Inc	PAQU8N	No	Yes
DUZVB8	No	Inc	PBKKD3	No	Inc
EHMVED	No	No	PEJ2ND	No	Yes
EK4EZ8	No	Inc	PYQ4N2	No	Inc
FA2GRX	No	Yes	Q9AXEN	No	Inc
FZZUY2	No	Yes	QBEQ72	No	Inc

TABLE 1

WebCode	Item 2	Item 3	WebCode	Item 2	Item 3
QCUPQQ	No	Inc			
QQQ4NY	No	Inc			
QQVLLX	No	Inc			
RGKJ2X	No	Inc			
RMBTBV	No	Yes			
T3JAU3	No	Inc			
UDVWJU	No	No			
UDYG7W	No	Inc			
UGU8EU	No	Inc			
UGYR3W	No	No			
V44ZUX	No	Inc			
VNB4VN	No	Inc			
W2V344	No	Inc			
WLGWPG	No	No			
WMBMVW	No	Inc			
WXVQ84	No	No			
XJA2JJ	No	No			
XQRA8F	No	Inc			
XRLZDV	No	Inc			
XYMCAR	No	Inc			
YADK8K	No	Inc			
YJPK2V	Inc	No			
YTURGV	No	No			
YU77BW	No	No			
ZU27PM	No	No			

Response Summary			Total Participants: 89
<i>Were the questioned toolmarks on either of the pieces of copper wire (Item 2 and Item 3) produced by the suspect's bolt cutter?</i>			
	<u>ITEM 2</u>	<u>ITEM 3</u>	
Yes	0 (0.0%)	11 (12.4%)	
No	88 (98.9%)	28 (31.5%)	
Inc	1 (1.1%)	50 (56.2%)	

Conclusions

TABLE 2

WebCode	Conclusions
26WYBJ	Based on microscopic comparisons, the toolmarks on item 1-3-1 (copper wire) were eliminated as having been made by item 1-1 (bolt cutters), in the opinion of the laboratory. Based on differences in class characteristics, the toolmarks on item 1-2-1 (copper wire) were eliminated as having been made by item 1-1 (bolt cutters).
2L6QDN	Examinations showed tool marks on item 2 were not created by Item 1. Examinations showed tool marks on Items 2 and 3 were not created by the same unknown tool. Examinations to determine if Item 1 created the toolmarks on Item 3 were inconclusive due to insufficient individual characteristics.
34JPXC	following microscopic comparisons analysis, item 2 was excluded due to significant differences between its toolmarks and test cut made by submitted bolt cutter. conversely, the toolmarks on item3 matched test cut of submitted bolt cutter, indicating that bolt cutter was used to cut item3.
34ZJYL	Item 2 was microscopically compared with test specimens produced by the Item 1 tool, revealing class characteristic and significant individual distinguishing characteristic differences (impressed striated detail of differing coarseness, intervals of repetitive pattern, and direction). It was concluded that the evidentiary cut in Item 2 was not made by the Item 1 tool. Item 3 was microscopically compared with test specimens produced by the Item 1 tool, revealing class characteristic and significant individual distinguishing characteristic differences (impressed striated detail of differing coarseness, intervals of repetitive pattern, and direction). It was concluded that the evidentiary cut in Item Item 3 was not made by the Item 1 tool.
3N4N7U	1. Examination of Exhibit 1 revealed one (1) Pittsburgh brand bolt cutter Model 60677 designed to be used as an opposed jaw pinching type tool. a. Casts were created of the working surface, sub-exhibited as Exhibit 1.1 and will be retained in the laboratory for future microscopic comparison. b. Exhibit 1 was used to create Exhibit 1.2 test standards. 2. Examination of Exhibits 2 and 3 each revealed one (1) non-ferromagnetic copper wire displaying damage consistent with that caused by an opposed jaw center cut pinching type tool such as bolt cutters and diagonal cutters. Both Exhibits are suitable for microscopic comparison. 3. Exhibit 1.1 (test standards) and Exhibits 2 and 3 (unknowns) were microscopically examined and compared to each other. a. It could not be determined if the damage of Exhibit 3 was or was not caused by Exhibit 1 due to insufficient agreement/disagreement of individual characteristics. b. The damage on Exhibit 2 was not caused by Exhibit 1 due to sufficient disagreement of individual characteristics. c. The damage on Exhibits 2 and 3 was not caused by the same tool due to sufficient disagreement of individual characteristics. 4. See photos for markings and measurements. 5. All measurements are approximate. TECHNICAL NOTES Class characteristics are defined as measurable features of a firearm/tool which indicate a restricted group source. They result from design features and are determined prior to manufacture of the firearm/tool. Individual characteristics are defined as marks produced by the random imperfections or irregularities of firearm/tool surfaces. These random imperfections or irregularities are produced incidental to manufacture and/or caused by use, corrosion, or damage, and are unique to that specific tool. Any conclusions indicating that a toolmark was made by a specific firearm/tool are not to the absolute exclusion of all other firearms/tools because it is not feasible to examine all possible firearms/tools. However, observing this amount of agreement from a different source is considered extremely remote.
3WHD3E	1. The tool marks present on the cut pieces of copper, described in Items 2 and 3, were not produced by the bolt cutter described in Item 1 (Elimination). 2. The tool marks present in the cut piece of copper described in Item 2 and the cut piece of copper described in Item 3, were not produced by the same tool (Elimination).
3ZGNXE	Item 2: Strong support for H2 (the toolmarks on Item 2 result from another, unknown tool) in comparison to H1 (the toolmarks on Item 2 result from the questioned tool Item 1). Item 3: Moderate support for H1 (the toolmarks on Item 3 result from the questioned tool Item 1) in comparison to H2 (the toolmarks on Item 3 result from another, unknown tool).
4NLXQF	I have considered the proposition that the bolt cutters, item 1, cut the wire, item 2. The results of the examination indicate that item 1 did not cut the submitted wire, item 2. I have considered the proposition that the bolt cutters, item 1, cut the wire, item 3. The results of the examination were inconclusive.

TABLE 2

WebCode	Conclusions
4V6ZXH	Examinations showed that toolmarks present on Item 2 and Item 3 were not made by the same unknown tool. Examinations showed toolmarks present on Item 2 were not made by Item 1. Examinations to determine if toolmarks present on Item 3 were made by Item 1 were inconclusive due to insufficient individual characteristics.
6AGXFN	The test toolmarks generated by using the Item 1 bolt cutters were microscopically compared to the cut end of Item 2 and as a result, I formed the opinion that the Item 1 bolt cutters did not cut the Item 2 wire. This opinion is based on observing differing class characteristics within the toolmarks. The test toolmarks generated by using the Item 1 bolt cutters were microscopically compared to the cut end of Item 3 and the result was inconclusive. I observed agreement of discernible class characteristics and some agreement of individual characteristics but insufficient for an identification.
7WPQXD	Based on the comparative examination, the toolmark observed on the copper wire fragment marked as Item 2 exhibits morphological characteristics that are inconsistent with those of the toolmark found on copper wire piece Item 3, as well as with the testmark produced using Item 1 bolt cutter. Based on the comparative examination, the cutting edge angle of the copper wire piece Item 3 is similar to the edge angle of the testmark made with the Item 1 bolt cutter and installed on the copper wire piece, but the individual characteristics are different. Therefore, the Item 3 toolmark comes from bolt cutter tool, but not from the Item 1 bolt cutter.
7WQN9A	Item 1 is a Pittsburgh® brand bolt cutter that is red and black in color and utilizes a pinching action. The Item 1 bolt cutter bears the numeric characters "12" and "300" on the metal surface. Item 2 is a piece of wire that appears to be copper and bears striated toolmarks consistent with having been produced by a tool that utilizes a pinching/shearing action, which are of value for comparison. Item 3 is a piece of wire that appears to be copper and bears striated and fracture toolmarks consistent with having been produced by a tool that utilizes a pinching/shearing action, which are of value for comparison. The Item 2 piece of copper wire was excluded as having been cut by the Item 1 bolt cutter. The Item 2 and Item 3 pieces of copper wire were excluded as having been cut by the same tool. A pattern examination of toolmarks present on the Item 1 bolt cutter and Item 3 piece of copper wire was inconclusive due to insufficient quality and/or quantity of corresponding individual characteristics.
8E2ZCJ	Test cuts using Item 1 (bolt cutter) were made using lead sheets. Casts were also made of the cutting surfaces of the bolt cutter. Additionally, test cuts were made progressively along the cutting surfaces using copper wire. Using all these samples, they were microscopically compared to the cuts on the copper wires listed as Items 2 & 3. At the conclusion of the examination, it was determined that the bolt cutter (Item 1) did not make the cuts on Items 2 & 3.
8MU9WB	[No Conclusions Reported.]
8MXRKD	The Item 01-02 copper wire was eliminated as having been cut by the Item 01-01 bolt cutters due to differences in class characteristics. The Item 01-03 cut wire could not be identified or eliminated as having been cut by the Item 01-01 bolt cutters. There is some agreement of class characteristics, without agreement or disagreement of patterns of individual characteristics due to absence, insufficiency, or lack of reproducibility. The Item 01-04 copper wire was provided for test material and was not analyzed.
8WKU39	[No Conclusions Reported.]
9BG9ZG	Examinations showed that the toolmarks on Item 2 were not produced by the Item 1 bolt cutter tool. Examinations to determine if the toolmarks on Item 3 were produced by the Item 1 bolt cutter tool were inconclusive due to a lack of sufficient matching or differing individual characteristics and a lack of differing class characteristics.
9NKT37	In my opinion Item 1 was not used to cut Item 2 - CONCLUSIVE ELIMINATION In my opinion Item 1 was not used to cut Item 3 - CONCLUSIVE ELIMINATION
ABFUWM	The Exhibit 1.2 copper wire toolmarks were excluded as having been made by the Exhibit 1 tool. The Exhibit 1.3 copper wire toolmarks were excluded as having been made by the Exhibit 1 tool.
AEDB69	The toolmarks present on Item #2 could not have been made by the tool in Item #1. The toolmarks present on Item #3 could not be identified or eliminated as having been made using the tool in Item #1.

TABLE 2

WebCode	Conclusions
AFARG7	Item 1 is a Pittsburgh brand, 12-inch bolt cutter that uses a pinching action. Items 2 and 3 consist of copper wires that bear toolmarks physically consistent with a pinching action. The ends of the Item 2 and 3 wires that were received painted were not examined. The Item 2 and 3 copper wires were excluded as having been cut by the same tool. The Item 2 copper wire was excluded as having been cut by the Item 1 bolt cutter. A pattern examination of toolmarks present on the Item 1 bolt cutter and the Item 3 copper wire was inconclusive due to insufficient quality and/or quantity of corresponding individual characteristics.
ANNDQA	The toolmark on the piece of copper wire in Item #2 was not made by the bolt cutters in Item #1. The toolmark on the piece of copper wire in Item #3 could not be identified or eliminated as being made by the bolt cutters in Item #1.
AR4978	[No Conclusions Reported.]
AWYWRM	The cut end of Test item 2 was examined and compared with test cuts made with Item 1. Differences were noted in sub class and individual characteristics between Item 2 and the test cuts such that the boltcutters in Item 1 were not responsible for cutting Item 2. The cut end of Test item 3 was examined and compared with the test cuts made with Item 1. Agreement was shown in class, sub-class and individual characteristics between Item 3 and one of the test cuts such that the boltcutters in Item 1 were responsible for cutting Item 3.
CH8RU8	Unknown toolmark #2 was eliminated as having been made by the tool in Item #1. Unknown toolmark #3 was inconclusive as having been made by the tool in Item #1.
CL8ZYH	Item 2 was excluded as having been made with Item 1, the bolt cutters, due to a difference of class characteristics. Comparisons between Item 3 and test marks made with Item 1, the bolt cutters, were inconclusive.
DJHBWJ	Items 1A, 2B (cut copper wire) and test marks from Item 1 (bolt cutters) were physically examined then microscopically compared using light comparison microscopy. Tool marks observed on Item 1A (blue end copper wire) are eliminated as having been produced by Item 1 (bolt cutter). There are differences in class characteristics (machining methods). Tool marks observed on Item 1B (red end copper wire) are inconclusive as having been produced by Item 1 (bolt cutter). These items share agreement of class characteristics but lack consistent and reproducible individual characteristics. Test marks from Item 1 will be returned to the submitting agency.
DUZVB8	The piece of copper wire (Item 2) was excluded as having been cut by the bolt cutter (Item 1). Differences were found in characteristics sufficient to eliminate the bolt cutter as the source of the toolmarks. The piece of copper wire (Item 3) could not be conclusively identified or excluded as having been cut by the bolt cutter (Item 1). There was agreement of all discernible class characteristics, but no significant agreement or disagreement of the individual characteristics was noted. The toolmarks on the piece of copper wire could have been produced by the bolt cutter, or any other tool with similar characteristics.
EHMVED	The toolmarks present on Item 2 were eliminated as having been produced by Item 1 based on significant disagreement of class characteristics. The toolmarks present on Item 3 were eliminated as having been produced by Item 1 based on agreement of all discernible class characteristics and sufficient disagreement of individual characteristics. The toolmarks present on Items 2 and 3 were eliminated as having been produced by the same unknown tool based on significant disagreement of class characteristics.
EK4EZ8	Test cuts created with Item 1 were itemized as Item 1A and will be returned to the submitting agency. Item 2 was eliminated as having been cut by Item 1. This eliminated is based on differences in class characteristics. The difference being the angle of progression. Item 3 was inconclusive (II) to Item 1.
FA2GRX	After comparing item 2 and item 3 with item 1 it was found that item 2 has different class characteristics, therefore it was excluded in the starting phase. As class characteristics of item 3 was matching with item 1, individual characteristics were compared under microscope resulting in positive answer.
FZZUY2	[No Conclusions Reported.]
G9PYAF	1. Examination of Exhibit 1 revealed one Pittsburgh brand bolt cutter designed to be used as a pinching/cutting tool. Exhibit 1 was used to create the Exhibit 1.1 test standards. 2. Examination of

TABLE 2

WebCode	Conclusions
	Exhibit 2 revealed one copper wire displaying damage consistent with that caused by pinching/cutting tool such as bolt cutters or diagonal cutters. Exhibit 2 is suitable for microscopic comparison. 3. Examination of Exhibit 3 revealed one copper wire displaying damage consistent with that caused by pinching/cutting such as bolt cutters. Exhibit 3 is suitable for microscopic comparison and was cut to a shorter length to better facilitate microscopic comparisons. 4. Microscopic comparison revealed: a. Exhibit 1 did not cause the damage on Exhibit 2 due to sufficient disagreement of individual characteristics. b. It could not be determined if the damage on Exhibit 3 was or was not caused by Exhibit 1 due to insufficient agreement and disagreement of individual characteristics. c. Exhibits 2 and 3 were not damaged by the same tool due to sufficient disagreement of individual characteristics. See photos for measurements. Please note all measurements are approximate. TECHNICAL NOTES Class characteristics are defined as measurable features of a firearm/tool which indicate a restricted group source. They result from design features and are determined prior to manufacture of the firearm/tool. Individual characteristics are defined as marks produced by the random imperfections or irregularities of firearm/tool surfaces. These random imperfections or irregularities are produced incidental to manufacture and/or caused by use, corrosion, or damage, and are unique to that specific tool. Any conclusions indicating that a toolmark was made by a specific firearm/tool are not to the absolute exclusion of all other firearms/tools because it is not feasible to examine all possible firearms/tools. However, observing this amount of agreement from a different source is considered extremely remote.
GBQ3XU	The toolmarks on the copper wires submitted in laboratory evidence items 1 (laboratory designated as 1.2 and 1.3) were microscopically compared to test marks made with the bolt cutters contained in laboratory evidence item 1 (laboratory designated as 1.1) with the following results. The toolmarks on laboratory evidence items 1.2 and 1.3 were eliminated as having been made with the bolt cutters contained in laboratory evidence item 1.1.
GCPCQC	Item 2 consisted of a length of wire approximately 72 millimetres long and 3.3 millimetres in diameter. One end of this length of wire had been cut. Item 3 consisted of a length of wire approximately 62 millimetres long and 3.3 millimetres in diameter. One end of this length of wire had been cut. The shape of the cuts in both wires was characteristic as having been cut by a tool or tools with opposing jaws, such as a pair of bolt cutters or pliers. I was asked to determine if the submitted bolt cutters (item 1) were used to cut these wires. Test cuts were made in the same type of wire with the pair of bolt cutters. These test-cuts were compared to the cut ends of items 2 and 3. Using the submitted bolt cutters, I was unable to cut through the wire and a thin section of wire remained between the cutting edge surfaces. The wire then had to be manually broken by bending the wire. The cut surfaces of item 2, showed prominent features from the side of the cutting jaws used to cut this piece of wire. These features were not present on the bolt cutters (item 1). There was also no correspondence of the microscopic detail present on the cutting edge surfaces between the test-cuts and item 2. Therefore in my opinion, the bolt cutters were not used to make the cut in Item 2. I did not find any correspondence of the microscopic detail present in the cut surfaces between the test-cuts and item 3. The cut end of item 3, also showed a wide fractured surface between the cut surfaces as a result of the cutting process. As the submitted bolt cutters could not cut the wire completely, they would not be able to produce a fractured surface as seen in item 3. Therefore in my opinion, the pair of bolt cutters (item 1), could not have made the cut in item 3.
GK32R7	Examinations showed the toolmarks present on Items 2 and 3 were not created by the same unknown tool. Examinations showed the toolmarks present on Item 2 were not created by Item 1. Examinations to determine if the toolmarks present on Item 3 were created by Item 1 were inconclusive due to insufficient individual characteristics.
GQ4DN3	Our reports are table format with no sentence structure. However, if there was free type, the report would say: Toolmarks on Item 2 were not made by the tool in Item 1. Toolmarks on Item 3 could not be identified or eliminated as having been made by the tool in Item 1.
GXNGV6	The bolt cutter (1-01) was functional. The piece of wire (1-02) was eliminated as having been cut by the same tool as the other piece of wire (1-03) due to differences in class characteristics. The piece of wire (1-02) was eliminated as having been cut by the bolt cutter (1-01) due to differences in observed class characteristics. The piece of wire (1-03) was eliminated as having been cut by the bolt cutter (1-01) due to differences in observed class characteristics. A portion of the copper wire submitted as known material (1-04) was used to create test material for comparisons. This material is being returned with the evidence.

TABLE 2

WebCode	Conclusions
H4AT8C	Tool Mark Analysis: Methodology: Physical (Visual Examination) Microscopy (Stereo/Comparison Microscope) Test marks were made with Item 1, the bolt cutter, using submitted testing media. Item 1A, the test marks, was sealed in a manila envelope and will be returned with the evidence to the submitting agency. The tool mark on Item 2, the wire, was not made with Item 1, the bolt cutter, based upon different class and individual microscopic characteristics. Comparisons between the tool mark on Item 3, the wire, and test marks made with Item 1, the bolt cutter, were inconclusive due to insufficient corresponding individual microscopic characteristics.
HPNGV3	Results: Items 1B and 1C (copper wires) and test marks from Item 1A (bolt cutter) were physically examined then microscopically compared using light comparison microscopy. Tool marks observed on Item 1B (copper wire) are eliminated as having been produced by Item 1A (bolt cutter). There are differences in class characteristics (angle of toolmarks to the edge of the cut). Tool marks observed on Item 1B (copper wire) and Item 1C (copper wire) are eliminated as having been produced by the same tool. There are differences in class characteristics (angle of toolmarks to the edge of the cut). Tool marks observed on Item 1C (copper wire) are inconclusive as having been produced by Item 1A (bolt cutter). These items share agreement of class characteristics with some agreement of the individual characteristics observed in the striated marks. The agreement observed is insufficient for an identification. Tool marks generated from Item 1A will be returned to the submitting agency. Conclusion Scale for Microscopic Comparisons: The following descriptions are meant to provide context to the levels of opinions reached in this report. Identification: This is the strongest statement of association that can be expressed. An identification is made when there is agreement of all discernible class characteristics and sufficient agreement of the individual characteristics of toolmarks. When sufficient agreement exists, in part, this means the likelihood of another tool producing the same marks is so remote it is considered a practical impossibility. Elimination: This is the strongest statement of non-association that can be expressed. An elimination is made when one of the following situations is true: -It is a physical impossibility (i.e., there is a clear demonstrable incompatibility in class characteristics) for the items to have been marked by the same tool/fired in the same firearm. -Demonstrable differences in the subclass or reproducible individual characteristics. Inconclusive: An inconclusive is made when one of the following situations is true: -Agreement of all discernible class characteristics and some agreement of individual characteristics, but insufficient for identification. -Agreement of all discernible class characteristics without agreement or disagreement of individual characteristics due to an absence, insufficiency, or lack of reproducibility. -Agreement of all discernible class characteristics and some disagreement of individual characteristics but insufficient for elimination. -Agreement of all discernible class characteristics and disagreement of individual characteristics, however reproducibility or variability of individual characteristics cannot be established. -Agreement of all discernible class and subclass characteristics. The individuality of the characteristics is not discernible; therefore, the items may have been fired from the same firearm or from another firearm that was machined with the same tool in the approximate same state of wear. Unsuitable: An item is considered unsuitable for comparison when it does not bear any class, subclass, and/or individual toolmarks of value for microscopic comparison.
HPRXU2	Item #1-2 (blue) elimination Item #1-1 Item #1-3 (red) inconclusive Item #1-1
J78RVB	In my opinion, the exhibit bolt cutters, Item 1, did not cut the exhibit piece of copper wire, Item 2. In my opinion, the exhibit bolt cutters, Item 1, displayed insufficient agreement of individual characteristics when compared to the exhibit piece of cut wire, Item 3 to render an opinion of identification or elimination.
JMJ94X	Toolmarks on Item #2 were not made by the tool in Item #1. Toolmarks on Item #3 could not be identified or eliminated as having been made by the tool in Item #1. Toolmarks on Item #2 are suitable for further microscopic comparisons.
K2U9DT	Toolmarks on pieces surfaces cooper (Item 2 and Item 3) were compared microscopically with test toolmarks made using Bolt Cutter (Item 1). These comparison results found that toolmarks on Item2 and 3 were not made by Item 1
K3NYJ8	Microscopic examination and comparison reveal that the questioned toolmarks on Item 1.B were not made by the tool, Item 1.A, based on disagreement of class characteristics. Microscopic examination and comparison reveal that the questioned toolmarks on Item 1.C were not made by the tool, Item 1.A, based on disagreement of individual characteristics. Microscopic examination and comparison

TABLE 2

WebCode	Conclusions
	reveal that the questioned toolmarks on Items 1.B and 1.C were not made by the same tool based on disagreement of class characteristics. Microscopic examination reveals that the questioned toolmarks on Item 1.B are suitable for further comparison and are consistent with having been made by a pinching tool. Microscopic examination reveals that the questioned toolmarks on Item 1.C are suitable for further comparison and are consistent with having been made by a shearing tool. One copper wire from Item 1.D was used to make test marks of Item 1.A.
K6UGH4	Items 1-3 were examined. Items 2 and 3 were microscopically compared to tests cut by Item 1. Neither Item 2 nor Item 3 was cut by Item 1 based on different class characteristics. The above analysis began on 05/08/2026.
K7QXUZ	In my opinion, based on the comparison of the appearance of the cut surfaces and toolmarks: - the wire marked "Item 2" was not cut using the bolt-cutter marked "Item 1"; - the wire marked "Item 3" was very unlikely to have been cut using the bolt-cutter marked "Item 1".
K9TTHC	The Item 1 bolt cutter was examined and determined to be functional as designed. The questioned toolmarks on the Item 2 copper wire was eliminated as having been produced by the Item 1 bolt cutter. The questioned toolmarks on the Item 3 copper wire was produced by a different tool than Item 3. The questioned toolmark on the Item 3 copper wire could neither be identified nor eliminated as having been produced by the Item 1 bolt cutter. Although there were some agreements between their class characteristics, there was no agreement or disagreement between their individual characteristics sufficient to support either an identification or an elimination.
LPYEGP	Test cuts were produced using the submitted bolt cutter (Item1) and copper wires of a diameter comparable to that of the questioned specimens Item2 and Item3. Test cuts were made along the entire usable length of the cutting edges, with approximately 1 mm overlap between adjacent cutting locations. The resulting test specimens were sequentially designated from the jaw pivot area to the tip of the cutting edges. Two complete series of test cuts were conducted to assess the reproducibility of the class and individual characteristics imparted by Item1. The cut surfaces of the test specimens were subsequently compared with those observed on Item2 and Item3. Examination of Item2 revealed significant differences in class characteristics when compared with the test cuts produced by Item1. These differences are inconsistent with Item1 having produced the cut observed on Item2. Accordingly, Item1 is eliminated as the source of the cut mark present on Item2. Examination of Item3 revealed certain class characteristics that are generally consistent with those produced by Item1. However, multiple independent morphological features were found to be inconsistent with the cutting characteristics exhibited by Item1 during the test-cut series. In addition, no agreement of individual characteristics was observed between Item3 and any of the test cuts produced by Item1, despite the presence on Item3 of distinctive features suitable for comparison. Based on the observed inconsistencies in class characteristics and morphology, together with the absence of corresponding individual characteristics, Item1 is eliminated as the source of the cut mark present on Item3.
LQT6M6	Item #2 Eliminated as having been cut by item #1 bolt cutters. Item#3 was inconclusive as having been cut by the item #1 bolt cutters.
LURJ89	The tool marks on the copper wires in items 2 and 3 were not made by the bolt cutter in item 1.
LWUGH2	The Item 1 Pittsburgh bolt cutters were examined and the toolmarks on Items 2 and 3 were examined microscopically. Toolmarks on Item 2 were eliminated as having been produced by the Item 1 tool based on differences in class and individual characteristics. The comparison between toolmarks on Item 3 and the Item 1 tool was inconclusive due to a lack of sufficient agreement or disagreement of individual characteristics. It was not possible to identify or eliminate the toolmarks on Item 3 as having been produced by the Item 1 tool.
MZ9CYY	The Item 01-01 Pittsburgh bolt cutter was eliminated as having cut the Item 01-02 piece of cut copper wire. The Item 01-01 Pittsburgh bolt cutter could neither be identified nor eliminated as having cut the Item 01-03 piece of cut copper wire. There is agreement of all discernible class characteristics without agreement or disagreement of individual characteristics due to an absence, insufficiency, or lack of reproducibility.
N86TNV	The toolmarks on the wire in Item #2 were not made using the tool in Item #1 - Elimination based on differences in class characteristics. The toolmarks on the wire in Item #3 could not be identified or eliminated as having been made using the tool in Item #1.

TABLE 2

WebCode	Conclusions
NGVC8C	1. Examination of Exhibit 1 revealed one Pittsburgh brand bolt cutters designed to be used as a pinching action cutting tool. Exhibit 1 was used to create Exhibit 1.1 test standards. Casts were created and are included with the test standards of Exhibit 1.1. The casts will be retained in the laboratory. 2. Examination of Exhibit 2 consists of one non-ferromagnetic copper wire displaying damage consistent with that caused by a pinching action tool, such as a bolt or diagonal cutter. Exhibit 2 is suitable for microscopic comparison. 3. Examination of Exhibit 3 consists of one non-ferromagnetic copper wire displaying damage consistent with that caused by a pinching action tool, such as a bolt cutter. Exhibit 3 is suitable for microscopic comparison. 4. Exhibits 1, 2, and 3 were microscopically compared to one another. Microscopic comparison revealed that the damage on Exhibits 2 and 3 were not caused by Exhibit 1 due to sufficient disagreement of individual characteristics. a. Microscopic comparison revealed that it could not be determined if the damage on Exhibits 2 and 3 were caused by the same tool due to an insufficient disagreement of class characteristics. Without a tool present to evaluate the full tool working surface, it cannot be stated as to whether they were damaged by the same tool. Shall a pinching action tool be discovered, it should be submitted to the laboratory for comparison. See photos for markings and measurements. All measurements are approximate. Technical Notes: Class characteristics are defined as measurable features of a firearm/tool which indicate a restricted group sources. They result from design features and are determined prior to manufacture of the firearm/tool. Individual characteristics are defined as marks produced by the random imperfections or irregularities of firearm/tool surfaces. These random imperfections or irregularities are produced incidental to manufacture and/or caused by use, corrosion, or damage, and are unique to that specific tool. Any conclusions indicating that a toolmark was made by a specific firearm/tool are not to the absolute exclusion of all other firearms/tools because it is not feasible to examine all possible firearms/tools. However, observing this amount of agreement from a different source is considered extremely remote.
NRDVMZ	ELIMINATION: The Item 1 bolt cutters are eliminated as having made the toolmarks on Items 2 and 3 based on differences in class characteristics for Item 3 and differences in individual characteristics for Item 2. ELIMINATION: The toolmarks on Items 2 and 3 are eliminated as having been made by the same tool based on differences in class characteristics.
NX2JG6	Item 2- Elimination- Significant disagreement of discernible class characteristics and individual characteristics. Item 3- Inconclusive- some agreement of individual characteristics and all discernible class characteristics but insufficient for an identification.
P3PHBQ	[No Conclusions Reported.]
PAQU8N	[No Conclusions Reported.]
PBKKD3	Microscopic examination and comparison reveal that the questioned toolmarks on Item 1.C could not be identified or eliminated as having been made by the tool, Item 1.A due to lack of agreement or disagreement of individual characteristics. Microscopic examination and comparison reveal that the questioned toolmarks on Item 1.B were not made by the tool, Item 1.A, based on disagreement of class characteristics. Microscopic examination and comparison reveal that the questioned toolmarks on Items 1.B and 1.C were not made by the same tool based on disagreement of class characteristics. Microscopic examination reveals that the questioned toolmarks on Item 1.B are suitable for further comparison and are consistent with having been made by a pinching tool. Microscopic examination reveals that the questioned toolmarks on Item 1.C are suitable for further comparison and are consistent with having been made by a pinching or shearing tool. Reference copper wire from Item 1.D was used to create test toolmarks from Item 1.A.
PEJ2ND	[No Conclusions Reported.]
PYQ4N2	The toolmark on exhibit 2 (item 2) was not made by exhibit 1 (item 1), the submitted bolt cutter, based on difference in class characteristics. The toolmark on exhibit 3 (item 3) could not be identified or eliminated from exhibit 1 (item 1), the submitted bolt cutter.
Q9AXEN	Item 1 is a 12-inch Pittsburgh brand bolt cutter. The Item 2 copper wire bears toolmarks consistent with having been produced by a tool that utilizes a pinching action, which are of value for microscopic comparison. The Item 3 copper wire bears toolmarks consistent with having been produced by a tool that utilizes a pinching/shearing action, which are of value for microscopic comparison. Comparison of the Submitted Tool to the Copper Wires: The jaws on the Item 1 bolt cutter were excluded as having created the toolmarks present on the Item 2 copper wire. A pattern examination of the Item 3 copper

TABLE 2

WebCode	Conclusions
	wire and jaws of the Item 1 bolt cutter was inconclusive due to insufficient quality and/or quantity of corresponding individual characteristics. Intercomparison of Copper Wires: The Item 2 and Item 3 copper wires were excluded as having been cut by the same tool.
QBEQ72	Comparison microscope examinations were conducted on the evidence listed above. The findings of this examiner are the following: Item 1.2 (item 2) was not cut with item 1.1 (item 1) due to the differences in class and/ or individual characteristics present on cut end of copper wire. Even though item 1.3 (item 3) and test cut copper wire from item 1.1 (item 1) have similar class characteristics, item 1.3 (item 3) could not be identified or eliminated as having been cut by item 1.1 (item 1) due to insufficient agreement of individual characteristics present.
QCUPQQ	Toolmarks on Item 1-1 were not made by the tool in Item 1. Toolmarks on Item 1-2 were inconclusive to being made by the tool in Item 1. Toolmarks on Item 1-1 and Item 1-2 were not made by the same tool.
QQQ4NY	Test cuts were made using the Exhibit 1 bolt cutters into the copper wire provided with the CTS test and additional lead and copper laboratory materials. Additional silicone casts were collected from the jaws of the Exhibit 1 bolt cutters. These casts and test cuts were retained with the evidence as Exhibit 1.1. Microscopic comparison revealed Exhibit 2 has significant differences in both potential subclass and individual markings when compared to the test cuts from the Exhibit 1 bolt cutters. Exhibit 2 was excluded from being cut by the Exhibit 1 bolt cutters. The results of microscopic comparison of Exhibit 3 to test cuts from the Exhibit 1 bolt cutters were inconclusive. There is similarity between the class characteristics of the Exhibit 3 cut wire and the Exhibit 1 test cuts, but there is limited agreement of individual characteristics. This limited agreement provides insufficient support to determine they were both cut by the same source. Some differences were noted in the compared individual characteristics, but these differences were insufficient to exclude Exhibit 3 from being cut by the Exhibit 1 bolt cutters.
QQVLLX	1. Exhibit 1 is a red handled 12" bolt cutter which is an opposed blade cutting tool. a. Exhibit 1 was used to create the Exhibit 1.1 test standards. 2. Exhibits 2 and 3 are each one piece of cut copper wire. a. Examination revealed the Exhibit 2 wire was not cut by the same tool as Exhibit 3, or by the Exhibit 1 bolt cutter based on disagreement of discernible class characteristics. b. Examination of Exhibit 3 revealed it could not be identified or eliminated as having been cut by Exhibit 1 due to insufficient agreement or disagreement of individual characteristics. c. Exhibits 2 and 3 are consistent with having been cut by an opposed blade cutting tool.
RGKJ2X	1. Exhibit 1 is a Pittsburgh 12" bolt cutter which were used to create the Exhibit 1.1 test standards. 2. Exhibits 2 and 3 each contain one piece of copper wire. Examination of the wires revealed each has damage on one end consistent with having been made by an opposed blade cutting tool. a. Microscopic comparison revealed Exhibit 2 was not damaged by the Exhibit 1 bolt cutter based on sufficient disagreement of individual characteristics. b. Microscopic comparison revealed it could not be determined if the Exhibit 1 bolt cutter caused the damage on Exhibit 3 based on insufficient agreement or disagreement of individual characteristics. TECHNICAL NOTES Class characteristics are defined as measurable features of a firearm or tool, which indicate a restricted group source. They result from design features and are determined prior to manufacture of the firearm or tool. Individual characteristics are defined as marks produced by the random imperfections or irregularities of firearm or tool surfaces. These random imperfections or irregularities can be either produced incidental to manufacture or caused by use, corrosion, or damage, and are unique to that specific tool. Any conclusions indicating that a toolmark was made by a specific firearm or tool are not to the absolute exclusion of all other firearms or tools, because it is not feasible to examine all firearms or tools in the world. However, observing this amount of agreement between different sources is considered extremely remote.
RMBTBV	Microscope Comparison Conclusions Identification - Agreement of class and individual characteristics were observed. It is the opinion of the examiner that the observed toolmarks were created by the same tool. Elimination - Disagreement of class characteristics and/or individual characteristics were observed. It is the opinion of the examiner that the observed toolmarks were not created by the same tool. Item 3 (Tool Mark) to Item 1 (Tool) - Identification Item 2 (Tool Mark) to Item 1 (Tool) - Elimination
T3JAU3	The exhibit bolt cutter listed as item 1 did not cut the item 2 piece of copper wire. The toolmarks present on the item 3 piece of copper wire shared the same class characteristics as test marks with the

TABLE 2

WebCode	Conclusions
	item 1 bolt cutter. However, there was insufficient matching striae present, which lead to an inconclusive result.
UDVWJU	Toolmarks observed on the Item A1-2 piece of wire are consistent in class characteristics with the Item A1-1 bolt cutter. Toolmarks observed on the Item A1-3 piece of wire are not consistent in class characteristics with the Item A1-1 bolt cutter. Toolmarks present on the Item A1-2 piece of wire exhibit the same discernable class characteristics as those produced with the Item A1-1 bolt cutter; however, sufficient differences in individual characteristics were observed microscopically to eliminate the Item A1-1 bolt cutter as having produced the toolmarks on the Item A1-2 piece of wire. Because of a difference in class characteristics, the Item A1-3 toolmarks were eliminated as having been produced with the Item A1-1 bolt cutter.
UDYG7W	I compared the item 2 and 3 wires with test cut wire from Item 1. I found a different class of toolmark on Item 2 and similar class of toolmark on Item 3. I found insufficient agreement and insufficient differences of individual marks between Item 1 test cuts and Item 3 for identification or elimination. Conclusion: Item 1 did not cut wire Item 2. Item 1 could not be identified or excluded as having cut Item 3.
UGU8EU	The Item 1 bolt cutters were examined and twelve (12) test marks were produced using laboratory stock material and submitted copper wire. The tests produced are being maintained for possible future examinations. Item 2, Item 3, and the test marks produced using Item 1 were microscopically examined. Toolmarks present on Item 2 were eliminated as having been produced by the Item 1 bolt cutters due to sufficient differences in individual characteristics. Toolmarks present on Item 3 exhibit similar class characteristics as those produced by the Item 1 bolt cutters; however, the result of the microscopic comparison was inconclusive due to the lack of agreement or disagreement of individual characteristics. It was not possible to identify or eliminate the toolmarks present on Item 3 as having been produced by the Item 1 bolt cutters.
UGYR3W	The tool marks on the Item 2 and Item 3 wire were not made by the Item 1 tool in its present condition. The Item 4 copper wire was used to generate test cuts with Item 1 bolt cutter for comparison purposes.
V44ZUX	The following propositions were established for the subsequent comparison before the microscopic comparison examinations were conducted: Proposition 1: The exhibit samples of wire (Item 2 and Item 3) were both cut by the cutter (Item 1). Proposition 2: The exhibit samples of wire (Item 2 and Item 3) were both NOT cut by the cutter (Item 1). The cutting edges of Item 1 were marked 'A', 'B', 'C', and 'D'. Sample cuts were made using Item 1 with excess wire provided as part of the proficiency test at various lengths along the cutting edges. The test cuts were marked accordingly. Comparison (toolmark) Item 1 tests to Item 2: All test cuts from Item 1 were compared against Item 2. The microscopic comparison revealed that Item 2 appeared to have different class characteristics to the test cuts from Item 1. *Item 2 Negative to Item 1* Proposition 1A: The exhibit samples of wire (Item 3) were cut by the cutter (Item 1). Proposition 2A: The exhibit samples of wire (Item 3) were NOT cut by the cutter (Item 1). Comparison (toolmark) Item 1 tests to Item 3: All test cuts from Item 1 were compared against Item 3. The microscopic comparison revealed that the Item 3 sides B and D appear to be consistent in class characteristics to the test cuts from item 1. Furthermore, Item 3 appears to have subclass characteristics similar to that of Item 1, however insufficient agreement of unique striae within the marks to form an identification *Item 3 Inconclusive to Item 1*
VNB4VN	Items 1B (2) and 1C (3) (copper wires) and test marks from Item 1A (1) (bolt cutters) were physically examined then microscopically compared using light comparison microscopy. Tool marks observed on Item 1B (2) (copper wire) are eliminated as having been produced by Item 1A (1) (bolt cutter). There are differences in class characteristics (diagonal/coarse vs straight/fine toolmarks). Tool marks observed on Item 1C (3) (copper wire) are inconclusive as having been produced by Item 1A (1) bolt cutter. These items share agreement of class characteristics with some agreement of the individual characteristics observed in the striated toolmarks. The agreement observed is insufficient for an identification. Test marks created by Item 1A (1) will be returned to the submitting agency.
W2V344	1. Examination of Exhibit 1 revealed it to be one Pittsburgh brand bolt cutter designed to be used as a center cut opposed jaw pinching action tool. Exhibit 1 was used to create Exhibit 1.1, test standards. 2. Examination of Exhibit 2 revealed it to consist of one piece of cut copper wire displaying damage consistent with that caused by a center cut pinching action tool such as bolt cutters. Exhibit 2 is

TABLE 2

WebCode	Conclusions
	suitable for microscopic comparison. a. Microscopic comparison revealed that the toolmarks present at the cut end of Exhibit 2 were not made by the submitted tool in Exhibit 1 due to a disagreement of individual characteristics. 3. Examination of Exhibit 3 revealed it to consist of one piece of cut copper wire displaying damage consistent with that caused by a center cut pinching action tool such as bolt cutters. Exhibit 3 is suitable for microscopic comparison. a. Microscopic comparison revealed that it could not be determined if the toolmarks present at the cut end of Exhibit 3 were or were not made by the submitted tool in Exhibit 1 due to an agreement of class characteristics, but insufficient agreement or disagreement of individual characteristics. 4. Microscopic comparison revealed that the toolmarks present at the cut ends of Exhibit 2 and Exhibit 3 were not caused by the same tool due to an agreement of class characteristics, but a disagreement of individual characteristics. See photos for measurements. All measurements are approximate. TECHNICAL NOTES Class characteristics are defined as measurable features of a firearm/tool which indicate a restricted group source. They result from design features and are determined prior to manufacture of the firearm/tool. Individual characteristics are defined as marks produced by the random imperfections or irregularities of firearm/tool surfaces. These random imperfections or irregularities are produced incidental to manufacture and/or caused by use, corrosion, or damage, and are unique to that specific tool. Any conclusions indicating that a toolmark was made by a specific firearm/tool are not to the absolute exclusion of all other firearms/tools because it is not feasible to examine all possible firearms/tools. However, observing this amount of agreement from a different source is considered extremely remote.
WLGWPG	[No Conclusions Reported.]
WMBMVW	The toolmark on exhibit 2 (item 2) was not made by exhibit 1 (item 1) based on differences in class characteristics. The toolmark on exhibit 3 (item 3) could have been made by exhibit 1 (item 1) based on class characteristics; however, there are no significant similarities to suggest that it was.
WXVQ84	1) Examination of Exhibit 1 revealed one pair of Pittsburgh 12" bolt cutters, red with a black tool working surface and black handles, designed to be used as an opposed jaw, center-cut, pinching action tool. a. The tool working surface is a ferromagnetic metal covered in a black finish with slight areas of wear. b. Test standards were created from Exhibit 1 and were sub-exhibited as Exhibit 1.1. These test standards are suitable for microscopic comparison and will be retained in the laboratory for future comparisons. c. See photos for markings. 2) Examination of Exhibit 2 and Exhibit 3 revealed each to contain one segment of non-ferromagnetic copper wire. a. Each wire segment displays damage on one end consistent with that caused by an opposed jaw - pinching action tool such as bolt cutters or wire cutters. b. These toolmarks are suitable for microscopic comparison. c. A test cut was made using the bottom portion of Exhibit 3 right above where it was marked by the submitter to determine if the collected material was the same type of material/hardness as the wire submitted with the exhibits. The material did not fracture and did not separate from the exhibit and will not be included in the sub-exhibit. This area was then taped with clear tape and marked to indicate it was an alteration made by the examiner. 3) Microscopic comparison revealed the following: a. The damage on Exhibit 2 was not caused by Exhibit 1 due to sufficient disagreement of individual characteristics. b. The damage on Exhibit 3 was not caused by Exhibit 1 due to sufficient disagreement of individual characteristics. c. The damage on Exhibits 2 and 3 was not caused by the same tool due to sufficient disagreement of individual characteristics. d. If any similar tools are collected, please submit for examination. 4) See photos for measurements. All measurements are approximate. Technical Notes Class characteristics are defined as measurable features of a firearm/tool which indicate a restricted group source. They result from design features and are determined prior to manufacture of the firearm/tool. Individual characteristics are defined as marks produced by the random imperfections or irregularities of firearm/tool surfaces. These random imperfections or irregularities are produced incidental to manufacture and/or caused by use, corrosion, or damage, and are unique to that specific tool. Any conclusions indicating that a toolmark was made by a specific firearm/tool are not to the absolute exclusion of all other firearms/tools because it is not feasible to examine all possible firearms/tools. However, observing this amount of agreement from a different source is considered extremely remote.
XJA2JJ	In relation to Item 2 (Blue), significant differences in terms of the manufactured finish were observed between the considered cut mark on this item and the submitted pair of bolt croppers (Item 1). In my opinion, these differences are sufficient to exclude Item 1 from causing the cut marks to Item 2 (Blue). In relation to Item 3 (Red), the manufactured grinding detail appeared broadly similar to that on the

TABLE 2

WebCode	Conclusions
	submitted bolt croppers (Item 1), however no specific correspondence was observed between the test marks made using Item 1, and the fine detail observed on the cut surface of item 3. Furthermore, Item 1 appeared to cause a cut profile of a greater width than that observed on Item 3 (Red). Overall, in my opinion the submitted bolt croppers (Item 1) can be excluded from causing the cut marks to Item 3 (Red).
XQRA8F	Given the significant disagreement of discernible class characteristics of the marks observed on the copper wire (Item 2) and those produced during test cuts using the bolt cutter (Item 1), the use of the bolt cutter (Item 1) in the severance of the copper wire (Item 2) has been excluded. Given the insufficient correspondence between the cut marks observed on the copper wire (Item 3) and those produced during test cuts using the bolt cutter (Item 1), the examination yielded No Conclusive finding either confirming or excluding the use of the bolt cutter (Item 1) in the severance of the copper wire (Item 3).
XRLZDV	1. Exhibit 1 contains Pittsburgh brand 12-inch bolt cutter. Exhibit 1 was used to create the Exhibit 1.1 test standards. 2. Exhibits 2 and 3 each contain one piece of copper wire. Examination of Exhibits 2 and 3 revealed one cut end on each wire consistent with having been cut by an opposed blade cutting tool. 3. Microscopic comparison revealed the following: a. Exhibit 2 was not cut by the Exhibit 1 bolt cutters based on disagreement of individual characteristics. b. Exhibit 1 could not be identified or eliminated as having cut Exhibit 3 based on insufficient agreement or disagreement of individual characteristics.
XYMCAR	Examinations showed that the toolmarks on Item 2 and Item 3 were not produced by the same unknown tool. Examinations showed that the toolmark on Item 2 was not produced by Item 1. Examinations to determine whether the toolmark on Item 3 was produced by Item 1 were inconclusive due to a lack of sufficient matching or differing individual characteristics and a lack of differing class characteristics.
YADK8K	Test toolmarks were obtained by using Item 1 (bolt cutter) and compared with the toolmarks on Items 2 & 3 with the following results: Item 1 (bolt cutter) was not used to cause the toolmarks on Item 2. Item 1 (bolt cutter) could not be positively identified or excluded as causing the toolmarks on Item 3 due to insufficient agreement of individual characteristics with similarities in class characteristics.
YJPK2V	Tool Mark Analysis; Methodology: Physical (Visual Examination) Microscopy (Comparison Microscope) Digital Micrometer Test marks were made with Item 1A using submitted and laboratory standard testing media. Item 1A1 was sealed in a manila envelope and will be returned with the evidence to the submitting agency. Comparisons between the tool mark on Item 1B and test marks made with Item 1A were inconclusive due to insufficient corresponding individual microscopic characteristics. The tool mark on Item 1C was not made with Item 1A based upon different class characteristics. The tool mark on Item 1B and the tool mark on Item 1C were not made with the same tool based upon different class characteristics.
YTURGV	The questioned tool did not cut either of the exhibit copper wires
YU77BW	1. Item 2 was eliminated due to disagreement of both class and individual characteristics. 2. Item 3 displayed similar class characteristics to test cuts from Item 1 however Item 3 was eliminated due to significant disagreement in individual characteristics.
ZU27PM	The findings are that the tool marks on item 2 are not caused by item 1, the bolt cutter. The findings are more probable when the tool marks on item 3 are caused by a different bolt cutter with similar class characteristics than when the tool marks on item 3 are caused by item 1, the bolt cutter.

Additional Comments

TABLE 3

WebCode	Additional Comments
2L6QDN	The evidence piece (Unknown, Item 3) has similar class characteristics as displayed in the tool (Item 1). Evidence pieces (Items 2 and 3) were eliminated from the same unknown tool, based on class characteristics. Item 3, however, did not reach a level of sufficient disagreement as listed in the AFTE range of conclusions to eliminate, nor was there any sufficient agreement that would be consistent with known matches which also exceeded this examiners best known non match to make an identification. Item 3 was a piece of copper wire which is a small sample size compared to the cutting area of the questioned tool. There was no other unknown item given, which could have been Identified to the same unknown tool as item 3, which would have shown that the questioned / unknown tool was successfully reproducing. When looking at the test marks made by Item 1, toolmarks were not always successfully reproducing.
3N4N7U	Exhibit 3 displays horizontal striation marks and fractured areas similar to those found in Exhibit 1.1; however, an insufficient number of consistent patterns were found on multiple areas. Exhibit 1 (tool) produced random fractured areas on copper wire and "V" shaped patterns on specific sections of the working surface. One side of Exhibit 1 (tool) (A1 and A2) displayed impression marks of similar length. Even though there are similarities in some areas, the differences on the striation marks of Exhibits 1.1 and 3 are insufficient to reach an agreement or disagreement. It is recommended that future proficiency tests be designed with a level of complexity that allows for completion within a standard eight-hour window to ensure that testing requirements do not impede the progress of mission critical casework.
3WHD3E	Elimination: Is based in the disagreement of individual characteristics observed through the microscopic comparison examination.
4NLXQF	Whilst there was similarity in the striations noted on it3 vs it1, no correspondence was observed.
4V6ZXH	The evidence piece (Unknown, Item 3) had similar class characteristics as displayed in the tool (Item 1). Evidence pieces were eliminated from the same unknown tool, based on class characteristics. Item 3, however, did not reach a level of sufficient disagreement as listed in the AFTE range of conclusions to eliminate, nor was there any sufficient agreement that would be consistent with known matches which also exceeded this examiners best known non match to make an identification. Item 3 was a piece of copper wire that is consistent with 8AWG wire, which has a nominal measurement of .1285 inches, which is a small sample size of the 3/4 inch cutting area of the questioned tool. There was no other unknown item given, which could have been Identified to the same unknown tool as item 3, which would have shown that the questioned / unknown tool was successfully reproducing. When looking at the test marks made by Item 1, toolmarks were not always successfully reproducing. Seeing that this test predistribution was modified, two times, I believe this to be a flawed tool sample and not consistent to what would be represented in real casework as there would likely be more evidence present from the suspect tool to compare unknowns against.
6AGXFN	The inconclusive result for Item 3 was a result of observing agreement of class characteristics of the cuts, but insufficient agreement of the individual characteristics. Differences of individual characteristics were also observed, but not enough to eliminate the Item 1 bolt cutters.
8MXRKD	I use internal LIMS item numbers: Item 01-01 = Item 1 bolt cutters, Item 01-02 = Item 2 cut wire, Item 01-03 = Item 3 cut wire. Item 01-03 is inconclusive due to having similar class characteristics, but insufficient agreement for identification, and insufficient disagreement for elimination.
9BG9ZG	Item 3 had similar class characteristics as observed in test marks created from the suspected tool (Item 1), however toolmarks observed on Item 3 did not reach a level of sufficient disagreement as listed in the AFTE range of conclusions to eliminate - nor were there sufficient agreement consistent with known matches which also exceed this examiners best known non match to make an Identification.
9NKT37	Item 1 v Item 2: the cutting detail on Item 2 is different in appearance and angle to the detail made by Item 1 in test cuts The impressed cutting edge on Item 3 is significantly less wide than the cutting edge on Item 1 - also no matching detail was found in the impressed cut detail or the striated cutting detail
ABFUWM	Exhibit 1 = CTS Ex. 1 Tool Exhibit 1.2 = CTS Ex. 2 wire Exhibit 1.3 = CTS Ex. 3 wire
AEDB69	The toolmarks present on Item #3 could not be identified or eliminated as having been made using the tool in Item #1. A microscopic comparison was performed; however, there is insufficient detail of the

TABLE 3

WebCode	Additional Comments
AFARG7	class and/or individual characteristics for an identification or elimination finding. ADDITIONAL REASONS WHY INCONCLUSIVE FINDING WAS REACHED: Same class characteristics, similar microscopic patterns were not found Numerous test impressions were made of the tool in Item #1 using various testing materials (see tool panel for the testing materials used). All the test marks made using the tool in Item #1 reproduced well across the various testing materials. Methods: Physical and Visual Examination Physical and visual examinations compare the observable features and class characteristics of evidence items. A conclusion of "physically consistent with" is reached if the observable features or measurable dimensions and/or design features of two items are in agreement or are "physically consistent." If these dimensions and features are clearly different, an elimination conclusion is reached. If there is a lack of observable features or measurable dimensions, the result is inconclusive. Pattern Examination Toolmarks, whether they are present on evidence items or secondary evidence created in the Laboratory, undergo two stages of comparison. First, the class characteristics are examined and compared. If the class characteristics of the toolmarks are not clearly different, the examination moves to a second stage using comparative microscopy. Comparative examinations of the impressed and striated toolmarks, in at least two items, are conducted to determine if patterns of similarity exist. At the completion of these comparisons, one of the following three opinions is issued: A. Source exclusion is an Examiner's conclusion that two toolmarks did not originate from the same source. This conclusion is an Examiner's opinion that the observed difference(s) in class characteristics provides extremely strong support for the proposition that the two toolmarks came from different sources and extremely weak or no support for the proposition that the two toolmarks came from the same source. A source exclusion based on a minor difference in measured class characteristics requires a verification. B. Source identification is an Examiner's conclusion that two toolmarks originated from the same source. This conclusion is an Examiner's opinion that all observed class characteristics are in agreement and the quality and quantity of corresponding individual characteristics is such that the Examiner would not expect to find that same combination of individual characteristics repeated in another source. The basis for a source identification conclusion is an Examiner's opinion that the observed class characteristics and corresponding individual characteristics provide extremely strong support for the proposition that the two toolmarks originated from the same source and extremely weak support for the proposition that the two toolmarks originated from different sources. A source identification requires a verification and is the Examiner's opinion that the probability that the two toolmarks were made by different sources is so small that it is negligible. C. Inconclusive is an Examiner's conclusion that all observed class characteristics are in agreement but there is insufficient quality and/or quantity of corresponding individual characteristics such that the Examiner is unable to identify or exclude the two toolmarks as having originated from the same source. This conclusion is an Examiner's opinion that there is an insufficient quality and/or quantity of individual characteristics to identify or exclude. Reasons for an inconclusive conclusion include the presence of microscopic similarity that is insufficient to form the conclusion of source identification, or a lack of any observed microscopic similarity. Tool The type, action, and manufacturer of a tool are normally determined by directly observing the function and manufacturer markings on the tool in question. When these are not present, published materials and tool literature in the Firearms/Toolmarks Discipline reference library may be used to make determinations. When a microscopic comparison is necessary using a questioned tool, test samples are created using a test material that is softer or similar in quality to the item being compared. Limitations: Physical and Visual Examination A Physical and Visual examination is unsuitable for determining a source identification conclusion. A conclusion of "physically consistent with" signifies a restricted group source, based on class characteristics and/or observable features, from which evidence may have originated. Post-manufacture features cannot be used for elimination purposes. Pattern Examination Firearms/Toolmark Identification is an empirical science that relies on objective measurements and a subjective comparison of microscopic marks of value. Due to variations in substrate, changes in tool working surfaces from wear, corrosion, subclass, damage, or the employment of unusual tool/work piece orientations, toolmark reproduction may be incomplete or insufficient, as a result it may not be possible for an examiner to reach a source conclusion. Additionally, some tool manufacturing methods routinely produce working surfaces that leave limited microscopic marks of value. Damaged, corroded, or fragmented items may be of little or no value for comparison purposes. Tool The results of tool examinations describe type and/or operating condition of the tool as it was received in the Firearms/Toolmarks Discipline.

TABLE 3

WebCode	Additional Comments
CL8ZYH	A total of 26 test marks were made using Item 1 and the copper wire test material, covering the entire blade surface 4 times. Test cuts were also made using the bolt cutters from both sides as to apply force to different cutting surfaces. 20 hours of comparisons were conducted using visual and 3D VCM, with 104 total test scans entered into the database. The highest similarity score achieved between Item 1 and Item 3 was 0.309 as compared to the test to test similarity score of 0.682. Visual comparison did not yield sufficient agreement for identification between Item 3 and Item 1. The 3D VCM system also did not indicate sufficient agreement. Item 2 exhibited class characteristics similar to that of diagonal cutters.
DJHBWJ	Large amount of agreement observed, however it is not consistent with the amount of agreement observed between test toolmarks. Additionally, when looking at the opposing side of the toolmark and test toolmarks, there is not agreement in the same area.
DUZVB8	The piece of copper wire (Item 3) could not be conclusively identified or excluded as having been cut by the bolt cutter (Item 1). There was agreement of all discernible class characteristics, but no significant agreement or disagreement of the individual characteristics was noted. The toolmarks on the piece of copper wire could have been produced by the bolt cutter, or any other tool with similar characteristics. Insufficient sample size to demonstrate reproducibility of toolmarks found on item 3.
EK4EZ8	Inconclusive: II. Agreement of all discernible class characteristics without agreement or disagreement of individual characteristics due to an absence, insufficiency, or lack of reproducibility. Agreement AND disagreement observed when comparing Item 1 test marks to Item 3.
G9PYAF	INC Ex 1.1 and 3: Class: Both exhibits display straight, fine striated toolmarks in double bevels that are cut with an angle of one side larger than the other (anvil and blade) with a projection at the apex over the side of the smaller angle (shear design) Individual: The toolmarks on Exhibit 3 consist of striations of varying width and spacing in between. Insufficient agreement of these patterns of striations was observed in several areas on Exhibit 1.1 and when the exhibits were switched to the opposite side of the bevel the toolmarks in the corresponding area either displayed insufficient agreement or insufficient disagreement. This was observed in both lead and copper tests.
GK32R7	Item 2 and Item 3 were eliminated from being produced by the same unknown tool due to differing class characteristics. Item 3 was observed to have similar class characteristics to Item 1 (the submitted tool). The toolmarks present on Item 3 did not meet the level of sufficient disagreement spelled out by AFTE to eliminate Item 3 from being produced by Item 1. Also, Item 3 did not have enough sufficient agreement of individual characteristics to be consistent with known matches that exceeded this examiner's best known non matches to make an identification.
GQ4DN3	Toolmarks on the copper wire in Item 3 exhibit similar toolmarks as the test marks made with Item 1. Straight parallel toolmarks perpendicular to the cut line were present on both Item 3 and test marks made with Item 1. In addition, they exhibited a similar spacing and overall quality when compared to each other. Even though the toolmarks on Item 3 could have been made by a type of bypass shearing tool, causing the offset fracture line, that characteristic could be easily reproduced with the tool in Item 1 while making test marks in multiple mediums.
H4AT8C	Item 3, the wire had some agreement of individual but was not sufficient to make an identification. It was noted on Item 1, the bolt cutters, to have multiple marks on the blade cutting surface which indicated lead and copper residue. The scenario states that tool was located same day on suspect but there is no indication of time and if the tool was used for more cuts that same day.
HPNGV3	Laboratory policy was used for evidence breakdown, so item numbers listed in question 2 conclusions are as follows: CTS Item 1 = Laboratory Item 1A CTS Item 2 = Laboratory Item 1B CTS Item 3 = Laboratory Item 1C
HPRXU2	A microscopic comparison was performed; however, there is insufficient detail of the class and/or individual characteristics for an identification or elimination finding. ADDITIONAL REASONS WHY INCONCLUSIVE FINDING WAS REACHED: Limited sample size of item(s) Same class characteristics, similar microscopic patterns were not found -Item #1-3 has some visual characteristics of a shearing type of tool used but it also could have been a pinching type tool -test marks made with the submitted tool in Item #1-1 also showed characteristics of a shearing type of toolmark on the same copper wire substrate on some of the test marks and a more traditional pinching type of toolmark as would be seen with bolt cutters on others using the same copper wire substrate
JMJ94X	Inconclusive for Item #3: Some areas of correspondence observed, but not enough quality/quantity of agreement to reach an identification finding. Around and between some of the areas of correspondence

TABLE 3

WebCode	Additional Comments
	were areas that appeared to be different patterns or otherwise incapable of reconciling the differences. With areas of correspondence, considered other areas (opposite side; however still not enough agreement to reach an identification). Numerous test marks made and compared. Some test marks were difficult to identify together. Area with the best correspondence experienced was the beveled side A and flat part of A/C blade approximately 1/8" in from the distal end of the tool. Possible reasoning for inconclusive: same tool used but working edges going through rapid change/seasoning resulting in different marks being left, same tool used but marks simply not replicated sufficiently (normal mark to mark changes), or another tool was used to make the marks on Item #3, etc.
K2U9DT	The toolmarks on Item 2 and 3 are made with the différents tools
K9TTHC	The questioned toolmark on the Item 3 copper wire could have been produced by the Item 1 bolt cutter; however, the insufficiency of corresponding individual characteristics precludes further identification. Multiple test cuts using the submitted copper wires, including laboratory lead sheets and copper wires, were used. Tests to tests comparison revealed very poor reproducibility of marks.
LWUGH2	Justification for inconclusive: Microscopic comparisons revealed an agreement of discernible class characteristics, but no significant agreement or disagreement of individual characteristics. Limitations included the lack of reproducibility of Item 3 (single item) and the time lapsed between the incident and recovery of the tool.
MZ9CYY	When comparing Item 01-03 to test cuts made by Item 01-01, spatial differences were noted. There was agreement of discernible class characteristics without sufficient agreement or disagreement of individual characteristics due to an absence, insufficiency, or lack of reproducibility. Item 01-03 could neither be identified nor eliminated as having been cut by the Item 01-01 Pittsburgh bolt cutter.
N86TNV	A microscopic comparison was performed; however, there is insufficient detail of the class and/or individual characteristics for an identification or elimination finding. ADDITIONAL REASONS WHY INCONCLUSIVE FINDING WAS REACHED: Same class characteristics, similar microscopic patterns were not found Multiple types of testing material were used, and numerous test marks were made for comparison purposes to the toolmarks present in Item #3. The test marks made using the tool in Item #1 reproduced well across all the test materials. An identification or elimination finding could not be determined.
NX2JG6	Item 3- there was an agreement of all class characteristics and an agreement of some individual characteristics but there were also large areas where I was unable to reproduce the visible individual characteristics in the test impressions in lead or in the supplied pieces of wiring. As such, I was unable to reach a sufficient level of agreement of individual characteristics to identify the tool as having made the cut in item 3.
PBKKD3	Inconclusive due to a lack of agreement or disagreement of individual characteristics. CTS Item 1 = Item 1.A CTS Item 2 = Item 1.B CTS Item 3 = Item 1.C Reference wire material = Item 1.D
PYQ4N2	Ex:3 stria at 90 degree angle similar to test cuts from Ex:1, flat portion of Ex:3 cut more dull and gross compared to test cuts from Ex:1. Ex: 3 cut, short cross over between cuts with sharp angle where two angle cuts meet. Unable to reproduce sharp/short angle with Ex:1 cutters (short angle produced slight curve where cutting area met) see photo 4. Fine stria similar in class to Ex: 1 test cuts, leaning more toward elimination but unable to produce a more conclusive finding using multiple test cuts.
Q9AXEN	Methods: Tool The type, action, and manufacturer of a tool are normally determined by directly observing the function and manufacturer markings on the tool in question. When these are not present, published materials and tool literature in the Firearms/Toolmarks Discipline reference library may be used to make determinations. When a microscopic comparison is necessary using a questioned tool, test samples are created using a test material that is softer or similar in quality to the item being compared. Pattern Examination Toolmarks, whether they are present on evidence items or secondary evidence created in the Laboratory, undergo two stages of comparison. First, the class characteristics are examined and compared. If the class characteristics of the toolmarks are not clearly different, the examination moves to a second stage using comparative microscopy. Comparative examinations of the impressed and striated toolmarks, in at least two items, are conducted to determine if patterns of similarity exist. At the completion of these comparisons, one of the following three opinions is issued: A. Source exclusion is an Examiner's conclusion that two toolmarks did not originate from the same source. This conclusion is an Examiner's opinion that the observed difference(s) in class characteristics provides extremely strong support for the proposition that the two toolmarks came from different sources and

TABLE 3

WebCode	Additional Comments
	extremely weak or no support for the proposition that the two toolmarks came from the same source. A source exclusion based on a minor difference in measured class characteristics requires a verification. B. Source identification is an Examiner's conclusion that two toolmarks originated from the same source. This conclusion is an Examiner's opinion that all observed class characteristics are in agreement and the quality and quantity of corresponding individual characteristics is such that the Examiner would not expect to find that same combination of individual characteristics repeated in another source. The basis for a source identification conclusion is an Examiner's opinion that the observed class characteristics and corresponding individual characteristics provide extremely strong support for the proposition that the two toolmarks originated from the same source and extremely weak support for the proposition that the two toolmarks originated from different sources. A source identification requires a verification and is the Examiner's opinion that the probability that the two toolmarks were made by different sources is so small that it is negligible. C. Inconclusive is an Examiner's conclusion that all observed class characteristics are in agreement but there is insufficient quality and/or quantity of corresponding individual characteristics such that the Examiner is unable to identify or exclude the two toolmarks as having originated from the same source. This conclusion is an Examiner's opinion that there is an insufficient quality and/or quantity of individual characteristics to identify or exclude. Reasons for an inconclusive conclusion include the presence of microscopic similarity that is insufficient to form the conclusion of source identification, or a lack of any observed microscopic similarity. Limitations: Tool The results of tool examinations describe type and/or operating condition of the tool as it was received in the Firearms/Toolmarks Discipline. Pattern Examination Firearms/Toolmark Identification is an empirical science that relies on objective measurements and a subjective comparison of microscopic marks of value. Due to variations in substrate, changes in tool working surfaces from wear, corrosion, subclass, damage, or the employment of unusual tool/work piece orientations, toolmark reproduction may be incomplete or insufficient, as a result it may not be possible for an examiner to reach a source conclusion. Additionally, some tool manufacturing methods routinely produce working surfaces that leave limited microscopic marks of value. Damaged, corroded, or fragmented items may be of little or no value for comparison purposes. Virtual Comparison Microscopy Virtual Comparison Microscopy (VCM) is restricted to the surface that a three-dimensional toolmark topographical instrument is capable of measuring to produce a digital reproduction. Additionally, individual characteristics may be present on the evidentiary item but may not be reproduced during a scan. This may be due to interference from lacquer/sealant, environmental damage, debris, or measuring limits for an instrument. Furthermore, physical characteristics that are not measurable, such as the metallic qualities of an item, may not be available for evaluation in the digital reproduction.
QBEQ72	After numerous test cuts with provided samples and with other mediums provided by my laboratory, a more conclusive result could not be rendered due to the class characteristics of Item 3 being similar to item 1, but not enough to no agreement of individual characteristics present for this examiner to identify or eliminate item 1 as being the source tool.
QCUPQQ	Toolmarks on Item 1-1 were not made by the tool in Item 1. Difference in class characteristic pattern in reference to the angle of the toolmarks - toolmarks on Item 1-1 are in a diagonal pattern in reference to the pinched/face of blade area of toolmark versus toolmarks on the test marks are in a parallel pattern perpendicular to the pinched/face of blade area of the toolmark. See attached images. Toolmarks on Item 1-2 were inconclusive to being made by the tool in Item 1. A microscopic comparison was performed; however, there is insufficient detail of the class and/or individual characteristics for an identification or elimination finding. Limited sample size of item(s); one copper wire approximately .1285 inches diameter Same class characteristics, similar microscopic patterns were not found; possibly same type of tool utilized (bolt cutter with same manufacturing process) AREAS OF THE EVIDENCE THAT WERE EXAMINED WHEN ARRIVING AT THE INCONCLUSIVE FINDING: entire blade of tool in Item 1 as well as the entire toolmark (both sides of the pinched/face of blade area of toolmark, as well as the pinched/face of blade mark also) area in the pinched area/face of blade was not as well defined as the toolmarks in Item 1 in the pinched area/face of blade Test marks made with Item 1 reproduced better in the pinched/face of blade area as originally captured in images under the panel for Item 1 then are reproducing to Item 1-2. There could be a possible "seasoning effect" with this tool and now the tool is beginning to reproduce better. Another possibility is that this toolmark was made by a different tool but unable to prove that. Similar class and/or individual characteristics observed on the toolmarks in Item 1-2; however, not sufficiently similar to identify to Item 1. Images attached as potential areas of interest of correspondence circled; however unable to find a definitive pattern for an

TABLE 3

WebCode	Additional Comments
	identification. Similar class and/or not similar individual characteristics observed on the toolmark in Item 1-2; however not sufficiently dissimilar to eliminate Item 1. Images attached as potential areas of interest within the entire blade with minimal areas of interest; however unable to find definitive pattern for an elimination. Toolmarks on Item 1-1 and Item 1-2 were not made by the same tool. Difference in class characteristic pattern in reference to the angle of the toolmarks - toolmarks on Item 1-1 are in a diagonal pattern in reference to the pinched/face of blade area of toolmark versus toolmarks on Item 1-2 are in a parallel pattern perpendicular to the pinched/face of blade area of the toolmark. See attached images.
QQVLLX	Unable to determine reproducibility in single sample. Cut profiles differ. Tests made in Cu using Ex 1 do not cut cleanly, instead only squeezing it very thinly which then must be pulled apart, but more agreement found in cast. Similar stria pattern observed in compression area and angled cut areas with some stria agreement in compression area and some agreement in angled cut areas also (in phase w/ the compression area). With lighting adjusted to remove parallel stria, irregular characteristics observed in Ex 3 compression area which is not observed on Ex 1 full length tests.
RGKJ2X	Ex 3: sufficient Individual characteristics is observed on the surface; however, it is unknown if these marks are reproducible Ex 3 vs Ex 1: -agreement of class (some profile cut areas, width of compression surface, patterns observed of compressed area and top of blades) - some agreement on compressed areas but some disagreement is also observed - pattern of impressed dots on the corner between compression surface and top of blades with some agreement areas but also disagreement - Overall, while more disagreement than agreement was observed, the reproducibility of the Individual Characteristics on Ex 3 is unknown. It could not be determined if the damage on Ex 3 was created or not by Ex 1
RMBTBV	Item 2 is out on class compared to Item 1 due to differences in striated class (widths and roughness) present on both surfaces of Item 2 compared to just 1 surface from the tool (Item 1).
T3JAU3	Inconclusive result for item 3. Test marks were made with the item 1 bolt cutters in lead as well as with the sample of copper wire that was provided. In addition, a sheet of copper was also purchased for additional test marks. Generally, good correspondence of marks was observed when intercomparing the test marks made in lead, though some differences were still encountered. Comparisons between the lead test marks and the item 3 copper wire did not identify any significant correspondence. When assessing intercomparisons of the test marks made in the sample of copper wire, it was noted that some regions showed a good level of correspondence. However, other regions along the length of the marks left by the cutting edge of the item 1 bolt cutters showed very little correspondence. This indicates that test marks made in the sample of the copper wire (of the same type as items 2 and 3) displayed differences from test to test. As the item 3 wire may only represents a small portion of the cutting edge, it is possible that this cut was made in a zone where variability can be expected. This variation may be due to slight changes in angle and pressure when cutting the wire. When comparing the item 3 copper wire to the test marks, there was some correspondence encountered, however the level of correspondence that was observed was not sufficient to conclude that the cut had been made by the cutting edge of the item 1 bolt cutters. From the observations described above, the only conclusion that could be drawn was an inconclusive finding.
UDYG7W	Item 2 has fairly gross cut with an angle that could not be reproduced by the cutters and this was the basis for elimination for Item 2. I found a similar class of marks with Item 3 but found no agreement of individual marks. The angle of striations to the cut line is slightly different with test cuts produced by Item 1 indicating a different tool may have been used. The angle differences were not sufficient for exclusion. I made numerous cuts of test wire at various positions on the cutter edge. I found insufficient agreement for identification and insufficient differences for elimination.
VNB4VN	Some similar marks were observed in the individual characteristics between Item 1C (3) and Item 1A (1), but not sufficient. During further testing, it was observed that when Item 1A (1) was used to cut a copper wire similar to Item 1C (3), there was not an anvil mark present that was on Item 1C (3). Test marks from Item 1A (1) and tool marks on Item 1C (3) appear to be cut by two different tool actions, but due to seeing some similarity in the individual characteristics, it was determined that the conclusion was inconclusive.
W2V344	Item 3 was marked inconclusive due to the similarity of the clear striations perpendicular to the kerf when compared to test standards from Item 1. The similarity was insufficient and the differences were insufficient to conclusively identify or exclude Item 3 as having been cut by Item 1.

TABLE 3

WebCode	Additional Comments
WMBMVW	The toolmark on item 3 is made up of fine striae with a similar angle to that seen on the standards made with item 1. There were small areas of similarities in striae; however, no area of sufficient correspondence was seen to indicate the toolmark on item 3 was made by item 1. There were not enough differences to eliminate conclusively.
XJA2JJ	When Item 1 was used to make test marks were made in the section(s) of spare copper wire provided, it was found that the blades of Item 1 did not completely close, such that this tool was not able to cut cleanly through these sections of spare wire.
XQRA8F	The examination yielded No Conclusive finding either identification or elimination of the use of the bolt cutter (Item 1) in the severance of the copper wire (Item 3) due to insufficient correspondence between the cut marks observed on the copper wire (Item 3) and those produced during test cuts using the bolt cutter (Item 1).
XRLZDV	Exhibit 3 inconclusive due to agreement of class (cut profile, width of compression area) and insufficient agreement or disagreement of individual characteristics. Areas of agreement in compression area were observed, with disagreement also observed. Some agreement present in striations of Exhibit 3 to different areas of Exhibit 1 tests. Reproducibility noted among test standards; unable to determine reproducibility of Exhibit 3. TECHNICAL NOTES Class characteristics are defined as measurable features of a firearm or tool, which indicate a restricted group source. They result from design features and are determined prior to manufacture of the firearm or tool. Individual characteristics are defined as marks produced by the random imperfections or irregularities of firearm or tool surfaces. These random imperfections or irregularities can be either produced incidental to manufacture or caused by use, corrosion, or damage, and are unique to that specific tool. Any conclusions indicating that a toolmark was made by a specific firearm or tool are not to the absolute exclusion of all other firearms or tools, because it is not feasible to examine all firearms or tools in the world. However, observing this amount of agreement between different sources is considered extremely remote.
XYMCAR	The evidence piece (Item 3) had similar class characteristics as displayed in the tool (Item 1). Evidence pieces (Items 2 and 3) were eliminated from the same unknown tool, based on class characteristics. Item 3, however, did not reach a level of sufficient disagreement as listed in the AFTE range of conclusions to eliminate, nor was there sufficient agreement that would be consistent with known matches which also exceeded this examiner's best known non match to make an identification. Item 3 was a piece of copper wire that is consistent with 8AWG wire, which has a nominal measurement of .1285 inches, which is a small sample size of the 3/4 inch cutting area of the questioned tool. There was no other unknown item provided, which could have been identified to the same unknown tool as Item 3, which would have demonstrated that the questioned / unknown tool was successfully reproducing toolmarks. When comparing the test marks made by Item 1, toolmarks were not always successfully reproducing. Seeing that this test pre-distribution was modified two times, I believe this to be a flawed tool sample and not consistent with what would be represented in real casework
YADK8K	Copper wire test material did not break clean under full compression with tool. To obtain tests similar to evidence required partial compression of the test wire and twisting tool to break wire. Small portion of individual marks could be aligned between tests and questioned toolmark, however; significant differences observed were not enough to justify identification or exclusion.
YJPK2V	In reference to the inconclusive between Item 1B and test marks made with Item 1A: All discernable class characteristics are similar, therefore no class exclusion. When examining the individual microscopic characteristics, there were no marks present that would lead to a micro exclusion and not enough agreement present to yield an identification. Therefore, inconclusive is the conclusion between Item 1B and Item 1A.
YU77BW	Item 1 displayed a bifurcation and edge damage toward the end of one of the jaws that appeared relatively recent as it appeared a small piece of metal could have dislodged during preparation for the test or during examination/testing at the Ballistics Unit.

-End of Report-
(Appendix may follow)

Test No. 26-5281: Toolmarks Examination

DATA MUST BE SUBMITTED BY **June 08, 2026, 11:59 p.m. EDT** TO BE INCLUDED IN THE REPORT

Participant Code: U1234A

WebCode: PP6367

The Accreditation Release section can be accessed by using the "Continue to Final Submission" button above. This information can be entered at any time prior to submitting to CTS.

Scenario:

Police have recovered two pieces of copper wire with a questioned toolmark from different crime scenes. In addition, a suspect was apprehended later the same day and bolt cutter was recovered from his possession. Investigators are requesting that you examine the toolmarks and determine if any were made using the suspect's bolt cutter.

Please note the following:

-Be careful when handling the bolt cutter and pieces of copper wire as the blade and cut ends are sharp.

-Item 2 and Item 3 pieces of copper wire are individually packaged in labeled envelopes. It is suggested that when an item is removed, it is marked according to your laboratory's procedure.

-The Item 2 piece of copper wire is painted BLUE on one end to assist in distinguishing the side that is NOT to be examined.

-The Item 3 piece of copper wire is painted RED on one end to assist in distinguishing the side that is NOT to be examined.

-Three additional pieces of copper wire have been included for possible test marking purposes.

Items Submitted (Sample Pack T1):

Item 1: Bolt cutter recovered from the suspect.

Item 2: Piece of copper wire recovered from the crime scene (marked with blue paint).

Item 3: Piece of copper wire recovered from the crime scene (marked with red paint).

1.) Were the questioned toolmarks on either of the pieces of copper wire (Item 2 and Item 3) produced by the suspect's bolt cutter?

	Yes	No	Inconclusive*
Item 2:	☐	☐	☐
Item 3:	☐	☐	☐

*Should an item(s) be marked "Inconclusive", please document the reason in the Additional Comments section of this data sheet.

2.) What would be the wording of the Conclusions in your report?

Note: Please use appropriate punctuation to indicate the end of sentences, sections, and statements in the free-form space below. Extra spacing and returns used for separation within your text will not transfer and may cause your information to be illegible in the Summary Report. The use of lists and tabular formats to deliver information is also cautioned against, as these do not transfer.

3.) Additional Comments

Note: Please use appropriate punctuation to indicate the end of sentences, sections, and statements in the free-form space below. Extra spacing and returns used for separation within your text will not transfer and may cause your information to be illegible in the Summary Report. The use of lists and tabular formats to deliver information is also cautioned against, as these do not transfer.

RELEASE OF DATA TO ACCREDITATION BODIES

The Accreditation Release is accessed by pressing the "Continue to Final Submission" button online and can be completed at any time prior to submission to CTS.

CTS submits external proficiency test data directly to ANAB and/or A2LA. Please select one of the following statements to ensure your data is handled appropriately.

- ☐ This participant's data is intended for submission to ANAB and/or A2LA. (Accreditation Release section below must be completed.)
- ☐ This participant's data is **not** intended for submission to ANAB and/or A2LA.

Have the laboratory's designated individual complete the following steps
only if your laboratory is accredited in this testing/calibration discipline
by one or more of the following Accreditation Bodies.

Step 1: Provide the applicable Accreditation Certificate Number(s) for your laboratory.

ANAB Certificate No.

A2LA Certificate No.

Step 2: Complete the Laboratory Identifying Information in its entirety.

Authorized Contact Person and Title

Laboratory Name

Location (City/State)