



## Toolmarks Examination Test No. 22-5281 Summary Report

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Each sample set contained a hose cutter (Item 1) and two pieces of hose containing questioned toolmarks (Items 2 and 3). Participants were requested to examine these items and report their findings. Data were returned from 126 participants and are compiled into the following tables:

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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 set contained one tube cutter (Item 1) and two sections of hose containing questioned toolmarks (Items 2 and 3). Participants were requested to determine if any of the questioned toolmarks were made by the submitted tool. Each questioned piece of hose contained a painted end to assist examiners in determining which side was not intended for examination. The Item 2 hose piece was cut by the Item 1 tube cutter. The Item 3 hose piece was cut by a different tube cutter that was not provided for examination.

ITEM 2 (IDENTIFICATION MARKS): The Item 2 black hose was cut by the Item 1 tube cutter and packaged into a pre-labeled Item 2 envelope. The corresponding tube cutter was labeled with an Item 1 label and packaged in bubble wrap. Items 1 and 2 were then immediately assembled into the pre-labeled sample pack box as described below. The above process was repeated until all identification toolmarks had been prepared.

ITEM 3 (ELIMINATION MARKS): The Item 3 black hose was cut by a pair of mini tube cutters (not provided) and packaged into a pre-labeled Item 3 envelope. The above process was repeated until all elimination toolmarks had been prepared.

SAMPLE PACK ASSEMBLY: The corresponding Item 1 tube cutter, along with the Item 2 and Item 3 hose were packaged into a pre-labeled sample pack box. Additional pieces of each hose substrate were included for testing purposes. This process was repeated until the required number of sample packs were produced.

VERIFICATION: In addition to the sample sets examined and confirmed by predistribution laboratories, ten randomly selected sample sets were examined by a qualified toolmark examiner who also confirmed the expected results.

## **Summary Comments**

This test was designed to allow participants to assess their proficiency at a toolmark examination involving striated toolmarks. Each sample set consisted of one tube cutter (Item 1) and two pieces of hose (Items 2 and 3) containing the questioned toolmarks. Participants were requested to determine if the hose cutter could have cut either of the questioned pieces of hose. (Refer to Manufacturer's Information for preparation details.)

All 126 responding participants (100%) identified the Item 1 tube cutter as having cut the Item 2 hose piece and either eliminated (93) or were inconclusive (30) as to it having cut the Item 3 hose piece. The remaining three participants identified both Items 2 and 3 as being cut by the Item 1 hose cutter.

Regarding Item 3, as a matter of policy, many labs will not eliminate without access to the tool or when class characteristics match. Thus, responses of inconclusive are not indicated as outliers for elimination items.

## Examination Results

*Did the suspect's hose cutter (Item 1) produce the questioned toolmarks on either of the submitted pieces of hose (Items 2 or 3)?*

TABLE 1

WebCode	Item 2	Item 3	WebCode	Item 2	Item 3
2F9QTC	Yes	No	84FBDP	Yes	Inc
2T272K	Yes	No	8KRPUM	Yes	No
3JUQTR	Yes	No	9CP7N9	Yes	Inc
3TEYFZ	Yes	No	9RYTC6	Yes	No
3TX3MZ	Yes	No	9WFBDM	Yes	No
3UP7AF	Yes	No	9X8EZ3	Yes	No
3WY7EM	Yes	No	A3E639	Yes	Inc
4GLXEJ	Yes	No	AAEEFT	Yes	No
4GWW9T	Yes	No	AEB4YK	Yes	No
4PTUWV	Yes	Inc	ALCFUH	Yes	No
4QKWHB	Yes	Yes	AVJXQU	Yes	No
63VKDU	Yes	No	B89LT8	Yes	Inc
63VKEE	Yes	No	C46ZMM	Yes	No
6KUM9C	Yes	No	C7RLFA	Yes	No
6NAEY7	Yes	No	CJGGTN	Yes	Inc
6U38FF	Yes	No	CME2EZ	Yes	No
72XRUF	Yes	Inc	D2TKTL	Yes	No
78KLRD	Yes	No	D9U4QB	Yes	No
7XJWEH	Yes	No	DA7GV8	Yes	No

TABLE 1

WebCode	Item 2	Item 3	WebCode	Item 2	Item 3
DCDUGE	Yes	No	KBKCHZ	Yes	No
E4HBFC	Yes	No	KDN7YH	Yes	No
E98VG7	Yes	Inc	KX976D	Yes	No
E9C83G	Yes	No	LEDR8Z	Yes	Inc
EM8U7N	Yes	Inc	LGEVW2	Yes	No
ENXXT4	Yes	No	LLRN4T	Yes	No
EXR27D	Yes	No	LVZDLY	Yes	No
FKWAXE	Yes	No	MHAZQZ	Yes	No
FMHVMV	Yes	Yes	MWQV6B	Yes	Inc
FMMDKU	Yes	Yes	N3AGP3	Yes	No
GE68L3	Yes	No	N9JG7Z	Yes	No
GETML6	Yes	Inc	NGA6WW	Yes	Inc
H9F2BD	Yes	No	NQE97Z	Yes	No
HZJBKW	Yes	No	NZ37NT	Yes	No
HZMVD6	Yes	No	P34LJ2	Yes	No
J2CEX4	Yes	No	P9B39P	Yes	No
JFV36F	Yes	No	P9DMZY	Yes	No
JJVD42	Yes	No	PEGV3L	Yes	No
JQRDC3	Yes	No	PEJFUV	Yes	Inc
JVB327	Yes	Inc	PH47KY	Yes	No
KAZRB9	Yes	No			

TABLE 1

WebCode	Item 2	Item 3	WebCode	Item 2	Item 3
PHJMD8	Yes	Inc	UJYMFH	Yes	No
PN7JXN	Yes	Inc	UNUAFX	Yes	Inc
PNMFPM	Yes	Inc	UQYYH8	Yes	No
PNPZGW	Yes	Inc	UVRW3	Yes	Inc
PNRXNL	Yes	No	VGNXW7	Yes	No
PQWJHD	Yes	No	VPKW8T	Yes	No
PR6VTN	Yes	Inc	VUU94T	Yes	No
PUVUDD	Yes	No	W6RB62	Yes	No
Q6B2RT	Yes	No	WJBWPV	Yes	Inc
Q77JUU	Yes	No	WLHDL7	Yes	Inc
QA63T8	Yes	No	WMA8LV	Yes	No
QBGXBT	Yes	Inc	WRHTAR	Yes	No
QJURQV	Yes	No	WYLJUJ	Yes	No
QLXMAY	Yes	No	WYP4LR	Yes	No
RDXJJ8	Yes	No	XAEMBH	Yes	Inc
RF62H3	Yes	No	XDDX8H	Yes	Inc
RGW64H	Yes	No	XWQFHM	Yes	No
T2XDZT	Yes	No	XWVT4X	Yes	No
U9ZRHM	Yes	No	XXMVQD	Yes	No
UACGP7	Yes	Inc	Y4BT2M	Yes	No
UGQAXG	Yes	No			

TABLE 1

WebCode	Item 2	Item 3	WebCode	Item 2	Item 3
YPR7RN	Yes	No			
YQK2EX	Yes	Inc			
YXHRXM	Yes	No			
Z2WVZA	Yes	No			
ZCXBTZ	Yes	Inc			
ZP8PCL	Yes	No			

Response Summary			Total Participants: 126	
<i>Did the suspect's hose cutter (Item 1) produce the questioned toolmarks on either of the submitted pieces of hose (Items 2 or 3)?</i>				
		<u>ITEM 2</u>	<u>ITEM 3</u>	
<b>Responses</b>	Yes	<b>126</b> (100.0%)	<b>3</b> (2.4%)	
	No	<b>0</b> (0.0%)	<b>93</b> (73.8%)	
	Inc	<b>0</b> (0.0%)	<b>30</b> (23.8%)	

# Conclusions

## TABLE 2

WebCode	Conclusions
2F9QTC	The cut end of the hose in Test item 2 was examined and compared with the test cuts made with Item 1. Agreement was shown in class, sub-class and individual characteristics between Item 2 and one of the test cuts such that, in our opinion, the cutter in Item 1 was responsible for cutting the piece of hose in Item 2. The cut end of the hose in Test item 3 was examined and compared with the test cuts made with Item 1. Differences were noted in individual characteristics between Item 3 and the test cuts such that, in our opinion, the cutter in Item 1 was not responsible for cutting the piece of hose in Item 3.
2T272K	Comparison microscope examinations were conducted and the findings of this examiner are as follows: The toolmarks found on the submitted hose, Item 2, were identified as having been made by the submitted hose cutter tool, Item 1. The toolmarks found on the submitted hose, Item 3, were not made by the submitted hose cutter tool, Item 1, based on differences in individual characteristics.
3JUQTR	H1: The toolmarks are caused by the hose cutter (item 1). H2: The toolmarks are caused by another cutting tool. Item 2: The observations give extremely more support to hypothesis H1 than to hypothesis H2. Item 3: The observations give no support to hypothesis H1. H1 is excluded, H2 is true.
3TEYFZ	The Item 2 tube segment is identified as having been cut using the Item 1 hose cutter. The Item 3 tube segment is eliminated as having been cut using the Item 1 hose cutter.
3TX3MZ	A comparison of the tool marks on the pieces of hose in items 2 and 3 with test marks made using the suspected hose cutter in item 1 was undertaken. A high degree of correspondence was noted between the tool marks on item 2 and the test marks. There was no correspondence with the tool marks on item 3 and the test marks. I have considered the proposition that the tool marks on the piece of hose in item 2 were made using the suspected hose cutter; the results of this examination provide conclusive support for this proposition. The tool marks on the piece of hose in item 3 have been made by a different tool.
3UP7AF	Results of Examinations: Item 1 is a hose cutter of an unknown manufacturer, which uses a slicing/cutting action. Item 2 is a piece of hose that exhibits a slicing/cutting toolmark. Toolmarks present on the Item 2 hose were identified as having been produced by the Item 1 hose cutter. Item 3 is a piece of hose that exhibits a slicing/cutting toolmark. Due to a difference in class characteristics, the Item 3 hose was excluded as having been cut by the Item 1 hose cutter.
3WY7EM	Visual and Microscopic examination of the black polymer hose (Item 2) revealed damage consistent with that produced by cutting with a sharp bladed instrument. Microscopic examination and comparison of the black polymer hose (Item 2) revealed sufficient agreement of individual characteristics to conclude that the damage was created by the blade of the single bladed tube cutter (Item 1). Visual and Microscopic examination of the black polymer hose (Item 3) revealed damage consistent with that produced by cutting with a sharp bladed instrument. Microscopic examination and comparison of the black polymer hose (Item 3) revealed that the damage can be eliminated as having produced by the blade of the single bladed tube cutter (Item 1). Evidence examined for this report will be returned to the [Laboratory] Quality Manager. Test-fired exemplars will be retained at the [Laboratory].
4GLXEJ	1. Examination of Exhibit 1 revealed it to be a yellow plastic hose cutter designed to be used as a slicing tool. Exhibit 1.1, test standards, was generated and is being returned with Exhibit 1. 2. Examination of Exhibit 2 revealed it to be one piece of black hose measuring 48.47 mm long, 10.81 mm outer diameter, and 1.63 mm wall thickness. One end displays damage consistent with slicing. 3. Examination of Exhibit 3 revealed it to be one piece of black hose measuring 65.25 mm long, 10.91 mm outer diameter, and 1.88 mm wall thickness. One end displays damage consistent with slicing. 4. As a result of microscopic comparison, the damage on Exhibit 2 was made by Exhibit 1 due to sufficient agreement of individual characteristics. The damage on Exhibit 3 was not made by Exhibit 1 due to sufficient disagreement of individual characteristics. a. If a slicing action tool such as a hose cutter is collected it should be submitted to the laboratory along with Exhibit 3 for comparison. All measurements are approximate.

## TABLE 2

WebCode	Conclusions
4GWW9T	Toolmarks present on Item 2 were identified as having been produced by Item 1 based on corresponding class and individual characteristics. Toolmarks present on Item 3 were eliminated as having been produced by Item 1 due to differences in individual characteristics.
4PTUW	The hose cutter (Item 1) was identified as having cut the piece of tubing (Item 2). Agreement of the characteristics is sufficient to identify the hose cutter as the source of the toolmarks. The hose cutter (Item 1) could not be conclusively identified or excluded as having cut the piece of tubing (Item 3). However, it is inconsistent the hose was cut by the hose butter. There was agreement of all discernible class characteristics and disagreement of some characteristics, but the disagreement was insufficient for exclusion.
4QKWHB	Both of Item 2 and Item 3 were cut from Item 1
63VKDU	The toolmarks on Items 2 and 3 were examined microscopically. The toolmarks on Item 2 were identified as having been produced by the Item 1 tool based on corresponding class and individual characteristics. The toolmarks on Item 3 were eliminated as having been produced by the Item 1 tool based on sufficient differences in individual characteristics.
63VKEE	1. Examination of Exhibit 1 revealed one yellow polymer hose cutter designed to be used as a single blade slicing tool. Exhibit 1 was used to create test standards which were sub-exhibited as Exhibit 1.1. 2. Examination of Exhibits 2 and 3 revealed each contains one piece of black polymer tubing displaying damage consistent with that caused by a slicing or cutting tool. 3. Microscopic comparison revealed the damage on Exhibit 2 was caused by Exhibit 1 due to sufficient agreement of individual characteristics. 4. Microscopic comparison revealed the damage on Exhibit 3 was not caused by Exhibit 1 due to sufficient disagreement of individual characteristics.
6KUM9C	1-(Item 2) First cut piece of hose recovered from the maintenance building (gold paint) cut by (Item 1) Hose cutter recovered from suspect's backpack. 2-(Item 3) Second cut piece of hose recovered from the maintenance building (white paint) cut by another hose cutter
6NAEY7	In my opinion, the findings show conclusively that Item 2 has been cut by the recovered hose cutter, Item 1. In my opinion, Item 3 has not been cut by the recovered hose cutter, Item 1.
6U38FF	1) Examination of Exhibit 1 revealed one yellow hose cutter containing a blade measuring 19mm long and 0.46mm thick. a. Test standards made from tubing of similar dimension and material to Exhibits 2 and 3 were created using Exhibit 1 and labeled Exhibit 1.1. 2) Examination of Exhibits 2 and 3 revealed each to contain one segment of black synthetic tubing measuring 51.77mm and 58.68mm in length, respectively, and each having an inner diameter of 7.50mm and outer diameter of 11.00mm. a. Both Exhibits contain severed ends with one end painted (gold for Exhibit 2, white for Exhibit 3). The painted ends were not examined. The other end of each Exhibit contained a toolmark consistent with those made by either a single bladed slicing tool (knife) or blade and anvil type tool, such as a hose cutter. 3) Microscopic comparison of Exhibit 1.1 to Exhibits 2 and 3 revealed the following: a. Exhibit 2 toolmark was created by Exhibit 1 due to a sufficient agreement of individual characteristics. b. Exhibit 3 toolmark was not created by Exhibit 1 due to an agreement of class characteristics and a sufficient disagreement of individual characteristics. All measurements are approximate.
72XRUF	Items 2 and 3 were compared to each other; their toolmarks display class characteristics indicative of a slicing tool but they could not be identified nor eliminated as having been caused by the same tool. Some similarities and differences were observed, but insufficient differences for a conclusive exclusion. Item 2 was compared to the test cuts made by the Item 1 tool. There were sufficient corresponding individual marks to conclude that the Item 1 hose cutter was used to cut the Item 2 hose. Item 3 was compared to the test cuts made by the Item 1 tool; their toolmarks display class characteristics indicative of a slicing tool but they could not be identified nor eliminated as having been caused by the same tool. Some similarities and differences were observed, but insufficient differences for a conclusive exclusion.
78KLRD	Tool Mark Analysis: Methodology: Physical (Visual Examination): Microscopy (Comparison Microscope): Test marks were made with Item 1, the tube cutter, using submitted testing media. Item

TABLE 2

WebCode	Conclusions
	1A, the test marks, was sealed in a manila envelope and will be retained in the laboratory for possible future analysis. The tool mark on Item 2, the section of tube, was made with Item 1, the tube cutter, based upon corresponding class and individual microscopic characteristics. The tool mark on Item 3, the section of tube, was not made with Item 1, the tube cutter, based upon different individual microscopic characteristics.
7XJWEH	Item 2 was cut by Item 1. Item 3 was not cut by Item 1.
84FBDP	The yellow hose cutter (1-01) was functional. One of the pieces of cut hose (1-02) was identified as having been cut by the hose cutter due to consistent and repeatable marks. One of the pieces of cut hose (1-03) was not identified or eliminated as having been cut by the hose cutter due to agreement in available class characteristics but a lack of consistent and repeatable individual marks. One of the pieces of hose (1-04) was consumed in the creation of test material. No analysis was conducted on the other piece of hose.
8KRPMU	Item 1 consists of an orange hose cutter with a straight blade. Item 2 consists of a piece of cut black rubber tubing bearing striated-type toolmarks which, based on sufficient correspondence of class and individual details, were identified as having been made by the hose cutter in Item 1. Item 3 consists of a piece of cut black rubber tubing bearing striated-type toolmarks which exhibit sufficient differences in individual characteristics from marks produced by the hose cutter in Item 1 to eliminate the tool as the source of the striated-type marks in the Item 3 cut black rubber tubing.
9CP7N9	Item 1 consists of a single-bladed hose cutter, that uses a slicing action. Item 2 consists of a black-colored piece of hose bearing toolmarks consistent with having been produced by a tool that utilizes a slicing-type action. Toolmarks present on the Item 2 piece of hose were identified as having been produced by the Item 1 hose cutter. Item 3 consists of a black-colored piece of hose bearing toolmarks consistent with having been produced by a tool that utilizes a slicing-type action. A pattern examination of toolmarks present on the Item 3 piece of hose and Item 1 hose cutter was inconclusive due to insufficient quality and/or quantity of corresponding individual characteristics. Furthermore, a pattern examination of toolmarks present on the Item 2 piece of hose and the Item 3 piece of hose was inconclusive due to insufficient quality and/or quantity of corresponding individual characteristics.
9RYTC6	The toolmark of Item 2(gold paint) is produced by Item 1(hose cutter recovered from suspect's backpack). (Shape of toolmark and scratch are accordant overall.) The toolmark of Item 3(white paint) is not produced by Item 1(hose cutter recovered from suspect's backpack). (Shape of toolmark and scratch are disaccordant overall.)
9WFBDM	The toolmarks on Item 2 and Item 3 were microscopically compared to tests made using the Item 1 hose cutter. The Item 1 hose cutter was identified as having made the questioned toolmarks on Item 2 due to sufficient agreement of individual characteristics. The Item 1 hose cutter was eliminated as having made the toolmarks on Item 3 due to differences in individual characteristics. The significance of this identification is made to the practical, not absolute, exclusion of all other tools.
9X8EZ3	In my opinion Item 1 cut Item 2 (conclusive association). In my opinion Item 1 has not been used to cut Item 3 (conclusive elimination).
A3E639	Toolmarks present on the Item 2 cut hose were identified as having been produced by the Item 1 hose cutter. A pattern examination of toolmarks present on the Item 3 cut hose and Item 1 hose cutter was inconclusive due to insufficient quality and/or quantity of corresponding individual characteristics.
AAEEFT	Item 2 was identified as having been produced by the suspect tool. Item 3 was eliminated as having been produced by the suspect tool.
AEB4YK	a complete match (identification) was found between the marks created by item 1 and the marks observed in item2. the marks observed in item2 were created by item1 (identification). the marks observed in item3 were not created by item1 (negative).
ALCFUH	This report refers to exhibits by Lab Number. The following results only apply to the items tested. Exhibit 1, the hose cutter, was used to generate test cuts. The test cuts were labeled as Exhibit 1.1. Exhibit 2, the cut hose segment, was microscopically compared to the test cuts, Exhibit 1.1. Based on

TABLE 2

WebCode	Conclusions
	an agreement of class characteristics and sufficient agreement of individual characteristics, Exhibit 2 was identified as having been cut by Exhibit 1. The probability that the two toolmarks were made by a different source is so small that it is negligible. Exhibit 3, the cut hose segment, was microscopically compared to Exhibit 1.1 test cuts and Exhibit 2. Based on an agreement of class characteristics, but disagreement of individual characteristics, Exhibit 3 was excluded as having been cut by Exhibit 1. These conclusions conform with the relevant Department of Justice policy on Uniform Language for Testimony and Reports available at <a href="http://www.justice.gov">www.justice.gov</a> .
AVJXQU	Observed toolmarks on item 2 have been produced by item 1. Observed toolmarks on item 3 have not been produced by item 1.
B89LT8	The Q1 (black tubing; Item #02) was microscopically compared to the laboratory test cuts of the K1 tool (side A) and determined to have consistent class characteristics and sufficient agreement of individual characteristics to render an identification. Therefore, the K1 tool produced the toolmarks on the Q1. The Q2 (black tubing; Item #03) was microscopically compared to the laboratory test cuts of the K1 tool (both side A and side B) and was determined to have consistent class characteristics, however, displayed insufficient agreement of individual characteristics to render either an identification or elimination. Therefore, it is inconclusive if the K1 tool produced the toolmarks displayed on the Q2.
C46ZMM	[No Conclusions Reported.]
C7RLFA	Tool Mark Analysis: Methodology: Physical (Visual Examination): Microscopy (Comparison Microscope): Item 1, the tube cutter, was successfully used to make Item 1A, the test marks, with the submitted test material. 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 rubber tube, was made with Item 1, the tube cutter, based upon corresponding class and individual microscopic characteristics. The tool mark on Item 3, the rubber tube, was not made with Item 1, the tube cutter, based upon different individual microscopic characteristics.
CJGGTN	[No Conclusions Reported.]
CME2EZ	It is my opinion that the hose cutter was used to sever the pipe / hose in item 2
D2TKTL	The item 1 hose cutter was examined and test standards were obtained for future reference and comparison purposes. Sufficient agreements of class and individual characteristics confirmed the item 2 piece of hose was cut by the item 1 hose cutter. Agreements of class characteristics were observed between the item 3 piece of hose and the item 1 hose cutter. However, disagreements of additional class characteristics and sufficient disagreements of individual characteristics confirmed item 3 was not cut by item 1.
D9U4QB	In my opinion: Item 2 was found to have toolmarks with sufficient agreement with the toolmarks present on the ends of the known hose lengths cut with Item 1. Item 2 was cut using the received Item 1. Item 3 was found to have toolmarks with sufficient disagreement with the toolmarks present on the ends of the known hose lengths cut with Item 1. Item 3 was not cut using the received Item 1.
DA7GV8	Reference cut made with hose cutter item 1 have been compared with the cut observed on item 2. Following comparison between these items, numerous features in terms of shape, striations and relative positions were found in agreement. Given the short time frame between the incident and the seizure of item 1, these results were fully expected if tool item 1 cut the hose item 2. If another tool had been used to cut item 2, the probability of observing such an agreement is extremely low. I assessed that probability to be below 1/10 000. Overall these results provide extremeley strong support for the view that item 2 had been cut with the tool item 1, as opposed to another tool. For Item 3, we have observed no agreement with the references produced by hose cutter item 1. Given the circumstances at hand, we have decided to exclude tool Item 1 from having produced the cut on item 3.
DCDUGE	Items 1-3 were examined. Items 2 and 3 were microscopically compared to tests made with Item 1. Item 2 was cut by Item 1 based on the sufficient agreement of individual characteristics. Item 3 was not cut by Item 1 based on the significant disagreement of individual characteristics. The above analysis began on 06/07/2022.

TABLE 2

WebCode	Conclusions
E4HBFC	1. Examinations showed Item 1 did produce the toolmarks on Item 2. 2. Examinations showed Item 1 did not produce the toolmarks on Item 3.
E98VG7	After physical and microscopic examination of the cut hose section listed as Item 2 and the test cuts made with the hose cutter (Item 1), it was determined that the hose cutter produced the cut made on Item 2. The cut hose section listed as Item 3 was also compared to the test cuts made with the hose cutter. Although they share the same class characteristics, there was insufficient agreement of individual marks, and therefore the findings are inconclusive.
E9C83G	Tests were made with the submitted tube cutter, Item #1. These tests were compared with cuts on the submitted tubing, Items #2 and #3. There is agreement in all discernible class characteristics. Item #2 - There is sufficient agreement in corresponding individual characteristics for identification. Item #2 was cut by the submitted tube cutter, Item #1. Item #3 - There is sufficient disagreement in individual characteristics for elimination. Item #3 was not cut by the submitted tube cutter, Item #1.
EM8U7N	Microscopic comparison examinations were conducted between Q-1, Q-2 and test tool marks cut by K-1, resulting in the conclusions: 9846-002 (Q-1) was cut with 9846-001 (K-1) based on a correspondence of all discernable class characteristics and sufficient agreement of individual characteristics. 9846-003 (Q-2) cannot be identified or eliminated as having been cut with 9846-001 (K-1). This conclusion was based on a correspondence of all discernable class characteristics but a lack of sufficient agreement or disagreement of individual characteristics.
ENXT4	Results of Examinations: Item 1 is a hose cutter that contains a ground double-edge blade having a tip, manufacturer unknown. Item 2 and 3 are pieces of black hose. A pattern examination of toolmarks present on the Item 2 piece of hose were identified as having been produced by the Item 1 hose cutter. Due to observed differences in class characteristics (tip formation), the Item 1 hose cutter was eliminated as having produced the toolmarks present on the Item 3 piece of hose.
EXR27D	Item 2 was microscopically compared with test specimens produced by the Item 1 tool, revealing correspondence of class characteristics and individual distinguishing characteristics. It was concluded that Item 2 was cut by the Item 1 tool blade. Item 3 was microscopically compared with test specimens produced by the Item 1 tool, revealing significant individual characteristic differences. It was concluded that Item 3 was not made by the Item 1 tool.
FKWAXE	The toolmark on item 2 was made by the hose cutter, item 1. The toolmark on item 3 was not made by the hose cutter, item 1.
FMHVMV	The hose cutter (Item1) produced Item 2 and Item 3.
FMMDKU	item 1 was identified of being the source of the toolmarks on item (2 and 3).
GE68L3	It is clear (definite conclusion of identity) that the hose (Item 2) was cut through with the hose cutter (Item 1). It can be ruled out (definite exclusion), that the hose (Item 3) was cut through with the hose cutter (Item 1).
GETML6	The Item 2 hose was microscopically identified as having been cut by the Item 1 hose cutter. The Item 3 hose displays similar class characteristics as the Item 1 hose cutter, however, differences in individual characteristics suggest another hose cutter was used.
H9F2BD	The item 2 tubing is identified as having been cut by the item 1 tubing cutter. The item 3 tubing is eliminated as having been cut by the item 1 tubing cutter.
HZJBKW	The suspect's hose cutter, that is, Item 1, produced the questioned toolmarks on the submitted piece of hose, Item 2.
HZMVD6	I conducted a comparative microscopic examination between the cut surfaces of the two pieces of tubing (Item 2) and (Item 3), to the surfaces created when I cut similar plastic tubing using the tube cutters (Item 1). I compared the overall shape of the cuts as well as the pattern of fine striae within the cut surfaces created by the responsible tool (blade). The results of my examination are detailed below. Item 2 compared to test cuts made with the Item 1 tube cutters. I observed an overwhelming amount

## TABLE 2

WebCode	Conclusions
	of agreement and matching of the patterns of striae between these two items both in quality and quantity. In my opinion the amount of agreement I saw was far beyond what could be expected to occur by chance if a different tool had been used to cut Item 2. In my opinion, the hose cutters (Item 1) were responsible for cutting the tubing (Item 2). Item 3 compared to test cuts made with the Item 1 tube cutters. I could find no areas of agreement in the pattern beyond small amounts of randomly matching striae. What I observed was what I would expect to see if a similar class of tool (but NOT the cutters Item 1) had been used to cut the tubing Item 3. In my opinion, the hose cutters (Item 1) were not responsible for cutting the tubing (Item 3).
J2CEX4	1. Exhibit 1 is a hose cutter which is a single bladed cutting tool. a. Exhibit 1 was used with the supplied rubber hose to create the Exhibit 1.1 Test Standards. 2. Exhibits 2 and 3 are each one piece of rubber hose. a. Comparison revealed Exhibit 2 was cut by Exhibit 1 based on sufficient agreement of class and individual characteristics. b. Comparison revealed Exhibit 3 was not cut by Exhibit 1 based on sufficient disagreement of individual characteristics. Exhibit 3 is consistent with having been cut by a single bladed cutting tool.
JFV36F	The Item 1 hose cutter was determined to be functional as received. Test cuts were produced using one of the submitted loose hoses. The test cuts were packaged with the hose cutter. The questioned toolmark on the Item 2 cut hose was determined to have been caused by the cutting blade of the Item 1 hose cutter. The identification of the toolmark to the hose cutter was a result of the sufficient agreement of individual characteristics exhibited by the evidence and test cuts from Item 1. The questioned toolmark on the Item 3 cut hose was not caused by the cutting blade of the Item 1 hose cutter, as a result of the significant disagreement of individual characteristics exhibited by the evidence and test cuts from Item 1.
JJVD42	Based upon an agreement of class and individual characteristics, the toolmarks observed on Item 2 were microscopically identified as having been made by the hose cutter of Item 1. Based upon a significant disagreement of individual characteristics, the toolmarks observed on Item 3 were microscopically eliminated as having been made by the hose cutter of Item 1.
JQRDC3	Tool Mark Analysis: Methodology: Physical (Visual Examination): Microscopy (Comparison Microscope): The tool mark on Item 2, the section of tube, was made with Item 1, the tube cutter, based upon corresponding class and individual microscopic characteristics. The tool mark on Item 3, the section of tube, was not made with Item 1, the tube cutter, based upon different individual microscopic characteristics.
JVB327	Lab Items #1 (hose cutters), #2-3 (two pieces of black tubing) were examined and microscopically compared on 05/03/2022. Based on agreement of all discernable class characteristics and sufficient agreement of individual characteristics, the toolmark on Lab Item #2 (one piece of black tubing) was positively identified as having been created using Lab Item #1 (hose cutters). Based on agreement of all discernable class characteristics and insufficient disagreement of individual characteristics, the toolmark on Lab Item #3 (one piece of black tubing) could not be eliminated as having been created using Lab Item #1 (hose cutters).
KAZRB9	The toolmark on Item 2 (piece of cut hose) was identified as having been produced by Item 1 (hose cutter). Item 1 did not produce the toolmark on Item 3 (piece of cut hose). Source identification is reached when the discernable class and individual characteristics have corresponding detail and the examiner would not expect to see the same arrangement of details repeated in another source.
KBKCHZ	Exhibit 1 is a hose cutter that employs an anvil shear tool action and bears toolmarks of value for comparison. Test cuts were obtained from both sides of the Exhibit 1 blade and were designated 1.1(A1, A2, B1 and B2). Exhibits 2 and 3 each contain one cut end, produced by a slicing tool action that contain toolmarks of value for comparison. Microscopic comparisons/conclusions: The 1.1 test cuts were microscopically compared to Exhibits 2 and 3 with the following results: Based on agreement of all discernible class characteristics and a sufficient correspondence of individual characteristics, Exhibit 2 was identified as having been cut by Exhibit 1. Based on sufficient disagreement of individual characteristics, Exhibit 3 was excluded as having been cut by Exhibit 1.
KDN7YH	Analysis of the K1 hose cutter (Item 1) and the Q1 (Item 2) and Q2 (Item 3) cut pieces of hose was

## TABLE 2

WebCode	Conclusions
	initiated on June 10, 2022. K1 (Item 1) was visually examined. Visual and microscopic analyses of Q1 (Item 2), Q2 (Item 3), and tests produced with K1 (Item 1) were conducted, and the results of the comparisons and evaluations are as follows: Based on discernible class characteristics and sufficient agreement of individual characteristics, Q1 (Item 2) was identified as having been cut by K1 (Item 1). Based on agreement of discernible class characteristics, but significant disagreement of individual characteristics, Q2 (Item 3) was eliminated as having been cut by K1 (Item 1). Q2 (Item 3) has marks of value and is suitable for future microscopic comparison. Should any additional suspect tools be recovered, please submit and reference the above CC #. SUFFICIENT AGREEMENT: Sufficient agreement is related to the significant duplication of random toolmarks as evidenced by a pattern or combination of patterns of surface contours. The statement that "sufficient agreement" exists between two toolmarks means that the agreement of individual characteristics is of a quantity and quality that the likelihood another tool could have made the mark is so remote as to be considered a practical impossibility.
KX976D	Item 2 was identified as having been cut by Item 1 based on the agreement of class characteristics, and individual characteristics observed within the marked surfaces (toolmarks). Item 3 was eliminated as having been cut by Item 1. This eliminated is based on differences in individual characteristics within the marked surfaces (toolmarks).
LEDR8Z	Item 2: The plastic tube (item 2) was identified as having been cut using the plastic tube cutter (item 1). Item 3: The results of the examination and comparison were inconclusive. The inconclusive result was based on the lack of sufficient agreement of individual markings to identify or eliminate the plastic tube as having been cut using the tube cutter (item 1).
LGEVW2	1. Examination of Exhibit 1 revealed one yellow hose cutter designed for use as a cutting tool. Exhibit 1 was used to create test standards which were sub-exhibited as Exhibit 1.1. 2. Examination of Exhibits 2 and 3 revealed each contains one piece of black cut hose with damage consistent with that caused by a cutting tool. 3. Microscopic comparison revealed the damage on Exhibit 2 was caused by Exhibit 1 due to sufficient agreement of individual characteristics. 4. Microscopic comparison revealed the damage on Exhibit 3 was not caused by Exhibit 1 due to sufficient disagreement of individual characteristics. 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.
LLRN4T	The suspect's hose cutter (Item 1) was used to produce the questioned tool marks on Item 2. The suspect's hose cutter (Item 1) was not used to produce the questioned tool marks on Item 3.
LVZDLY	The toolmark on the piece of hose in item 2 was made by the suspect's hose cutter in item 1. The toolmark on the piece of hose in item 3 was not made by the suspect's hose cutter in item 1.
MHAZQZ	1) Exhibit 1 is a hose cutter consistent with being used as an opposed jaw, single-blade cutting tool. Exhibit 1 was used to create the Exhibit 1.1 test standards. 2) Exhibit 2 contains one black color polymer tube. The Exhibit 1 hose cutter caused the damage on the Exhibit 2 tube based on an agreement of all discernible class characteristics and a sufficient agreement of individual characteristics. 3) Exhibit 3 contains one black color polymer tube. The Exhibit 1 hose cutter did not cause the damage on the Exhibit 3 tube based on an agreement of all discernible class characteristics but a sufficient disagreement of individual characteristics.
MWQV6B	Item A1-1 was compared to item A1-2. The Item A1-2 toolmarks were examined, compared microscopically, and identified as having been produced with the Item A1-1 hose cutter. An Identification conclusion is based on an examiner's determination that all discernible class and individual characteristics agree such that the extent of agreement exceeds that which has been demonstrated by toolmarks made by different tools and is consistent with the agreement demonstrated

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WebCode	Conclusions
	by toolmarks known to have been made by the same tool. Item A1-1 was compared to item A1-3. Toolmarks present on the Item A1-3 piece of tubing have the same discernable class characteristics as those produced with the Item A1-1 hose cutter; however, because of the lack of sufficient suitable corresponding microscopic markings, it was not possible to identify or eliminate the Item A1-1 hose cutter as having produced the toolmarks on the Item A1-3 piece of tubing.
N3AGP3	This report refers to exhibits by Lab Number. The following results only apply to the items tested. The Exhibit 1 is a yellow colored tube cutter. Exhibit 1 was used to generate test cuts labeled as Exhibit 1.1. The Exhibit 2 cut tubing segment was microscopically compared to the Exhibit 1.1 test cuts. Based on an agreement of class characteristics and sufficient agreement of individual characteristics, Exhibit 2 was identified as having been cut by the Exhibit 1 tube cutter. The probability that the toolmarks on Exhibit 2 were made by a different source, other than Exhibit 1, is so small that it is negligible. The Exhibit 3 cut tubing segment was microscopically compared to the Exhibit 1.1 test cuts and Exhibit 2. Based on an agreement of class characteristics, but a disagreement of individual characteristics, Exhibit 3 was excluded as having been cut by the Exhibit 1 tube cutter. These conclusions conform with the relevant Department of Justice policy on Uniform Language for Testimony and Reports available at <a href="http://www.justice.gov">www.justice.gov</a> .
N9JG7Z	Having conducted a tool mark comparison I have formed the opinion that item 1 was responsible for producing the cut on item 2, based on an agreement of individual characteristics and all discernible class characteristics where the extent of the agreement exceeds that which can occur in the comparison of toolmarks from a different tool and is consistent with agreement demonstrated by toolmarks known to have produced by the same tool. There was a significant disagreement of individual characteristics between Item 1 and Item 3, and therefore item 1 could be excluded from producing the cut on item 3.
NGA6WW	Results of Examinations: Item 1 is a hose cutter of an unknown brand. Toolmarks present on the Item 2 hose were identified as having been produced by the Item 1 hose cutter. A pattern examination of toolmarks present on the Item 3 hose was inconclusively compared to the Item 2 hose and test-cuts from the Item 1 hose cutter due to insufficient quality and/or quantity of corresponding individual characteristics.
NQE97Z	1. Examinations showed the tool marks on Item 2 were made by Item 1. 2. Examinations showed the tool marks on Item 3 were not made by Item 1.
NZ37NT	Upon the examination, it is possible to conclude that the first questioned cut piece of hose recovered from the maintenance building (Item 2) is cut with the suspect's hose cutter (Item 1) and the second questioned cut piece of hose recovered from the maintenance building (Item 3) is not cut with the suspect's hose cutter (Item 1).
P34LJ2	Exhibit 1 is a hose cutter employing a slicing action. Test toolmarks were produced using the Exhibit 1 hose cutter and designated Exhibit 1.1. Exhibits 2 and 3 consist of two (2) pieces of hose that bear toolmarks of comparative value on the cut end of each hose. Microscopic comparisons were conducted between the toolmarks observed on the cut ends of Exhibits 2 and 3 and the test toolmarks produced using the Exhibit 1 hose cutter. Based on agreement of all discernible class characteristics and sufficient correspondence of individual characteristics, the toolmarks on the cut end of the Exhibit 2 hose were identified as having been produced by the Exhibit 1 hose cutter. An identification conclusion indicates the probability that the Exhibit 2 toolmarks were produced by a different tool is so small that it is negligible. Based on significant disagreement of individual characteristics, the toolmarks on the cut end of the Exhibit 3 hose were excluded as having been produced by the Exhibit 1 hose cutter. The toolmarks observed on Exhibit 3 are consistent with having been produced by a single-bladed tool utilizing a slicing action, such as a knife, boxcutter, or hose cutter.
P9B39P	[No Conclusions Reported.]
P9DMZY	No correspondence of striae was found between the cut to the second hose (item 3) and test cuts made using the hose cutters (item 1). Therefore, in my opinion, the hose cutters (item 1) did not make the cut to the second hose (item 3). An excellent correspondence of matching striae was found between the cut to the first hose (item 2) and test cuts made using the hose cutters (item 1). In

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WebCode	Conclusions
	interpreting the toolmark evidence, I have considered the likelihood of observing this correspondence if the hose cutters had cut the first hose, as opposed to finding the correspondence if the cut to the first hose was not made using the hose cutters. Given the range of cutting tools available, in my opinion the finding of corresponding striae provides extremely strong support for the suggestion that the hose cutters cut the first hose. I have chosen the term 'extremely strong support' from the following scale: neutral, slight support, moderate support, strong support, very strong support and extremely strong support.
PEGV3L	1. The toolmark present in the hose described in the item 2, was produced by the hose cutter described in the item 1 (identification). 2. The toolmark present in the hose described in the item 3, was not produced by the hose cutter described in the item 1.
PEJFUV	CONCLUSIONS: The Item 1 hose cutter was identified, within the limits of practical certainty <sup>1</sup> , as having cut the Item 2 hose. The Item 1 hose cutter could neither be identified nor eliminated as having cut the Item 3 hose. LIMITATIONS: 1 Practical Certainty: Since it is not possible to collect and examine samples of all tools, it is not possible to make an identification with absolute certainty. However, all scientific research and testing to date and the continuous inability to disprove the principles of toolmark analysis have demonstrated that tools produce unique, identifiable characteristics which allow examiners to reliably make identifications. Toolmark Identification is an empirical science that relies on objective observations and a subjective interpretation of microscopic marks of value.
PH47KY	1.) Examinations showed the tool marks on Item 2 were produced using Item 1. 2.) Examinations showed the tool marks on Item 3 were not produced using Item 1.
PHJMD8	The toolmark on the questioned end of Item 01-02 was made by the plastic tube cutter, Item 01-01. Due to insufficient individual characteristics, the toolmark on the questioned end of Item 01-03 was unable to be identified or eliminated as having been made by the same tool as Item 01-02 or by the submitted plastic tube cutter, Item 01-01.
PN7JXN	[No Conclusions Reported.]
PNMFPM	The first cut piece of hose recovered from the maintenance building was identified as having been made by the suspect's hose cutter. The second cut piece of hose recovered from the maintenance building could not be identified nor excluded from been made by the suspect's hose cutter thus being inconclusive.
PNPZGW	Item 2 was identified as having been cut by Item 1. A comparison of Item 3 to the test cuts generated from Item 1 was inconclusive based on agreement of all discernable class characteristics and agreement of some individual characteristics; however, insufficient for an identification or elimination.
PNRXNL	Cut marked as Item 2 piece of hose recovered from the maintenance building (gold paint) has been cutted using hose cutter recovered from suspect's backpack. Cut marked as Item 3: piece of hose recovered from the maintenance building. (white paint) has not been cutted using hose cutter recovered from suspect's backpack.
PQWJHD	Visual and microscopic analyses were initiated on May 31, 2022 and the results of the evaluations and comparisons are as follows: Based on agreement of discernible class characteristics and sufficient agreement of individual characteristics Q1 (Item 2) was identified as having been cut with K1 (Item 1). Based on disagreement of individual characteristics Q2 (Item 3) was eliminated as having been cut with K1 (Item 1).
PR6VTN	[No Conclusions Reported.]
PUVUDD	The following evidence was received, analyzed on the below listed dates and marked for identification as follows: Item 1: Hose cutter from suspect backpack marked K1. Item 2: First cut piece of hose (gold paint) marked Q1. Item 3: Second cut piece of hose (white paint) marked Q2. The visual and microscopic analyses of the toolmarks present on evidence sections of hose Q1 and Q2 (Items 2 and 3) and toolmarks created with test material by K1 suspect hose cutter (Item 1) were initiated on 6/8/2022 and the results of the comparisons and evaluations are as follow: Based on agreement of class characteristics and sufficient agreement of individual characteristics, the toolmarks present on

## TABLE 2

WebCode	Conclusions
	<p>Q1 cut section of hose (Item 2) were created with K1 suspect hose cutter (Item 1). Based on significant disagreement of individual characteristics, the toolmarks present on Q2 cut section of hose (Item 3) were created with a different tool than K1 suspect hose cutter (Item 1). The listed evidence will be retained within the Firearms Analysis Unit. SUFFICIENT AGREEMENT: "Sufficient agreement" exists between two toolmarks means that the agreement is of a quantity and quality that the likelihood another tool could have made the mark is so remote as to be considered a practical impossibility. Sufficient agreement is related to the significant duplication of random toolmarks as evidenced by a pattern or combination of patterns of surface contours.</p>
Q6B2RT	<p>1. Examination of Exhibit 1 revealed it to be one yellow plastic tubing cutter, hinged design with v-shaped slicing cutting blade. Exhibit 1 was used to create test standards which were sub-exhibited as Exhibit 1.1. 2. Examination of Exhibits 2 and 3 revealed that each exhibit consists of one piece of black polymer tubing with a cut end. 3. Microscopic comparison revealed that the cut end of Exhibit 2 was cut by the tubing cutter in Exhibit 1 due to sufficient agreement of individual characteristics. 4. Microscopic comparison revealed that the cut end of Exhibit 3 was not cut by the tubing cutter in Exhibit 1 due to sufficient disagreement of individual characteristics.</p>
Q77JUJ	<p>The Exhibit 1 hose cutter was visually and microscopically examined. Four (4) test toolmarks were produced using laboratory stock material and were designated Exhibit 1.1. Exhibit 2 was visually examined and found to consist of one (1) cut portion of black plastic hose. Toolmarks present on the cut end of the Exhibit 2 hose were microscopically compared to the Exhibit 1.1 test toolmarks. Based on an agreement of class characteristics and sufficient agreement of individual characteristics, the Exhibit 2 toolmarks were identified as having been produced by the Exhibit 1 hose cutter. Exhibit 3 was visually examined and found to consist of one (1) cut portion of black plastic hose. Toolmarks present on the cut end of the Exhibit 3 hose bear class characteristics consistent with having been produced by a slicing tool such as a knife or hose cutter. Due to sufficient differences in individual characteristics, toolmarks present on the Exhibit 3 hose were excluded as having been produced by the Exhibit 1 hose cutter.</p>
QA63T8	<p>Items: Description/Visual Examination: Item 1: One (1) yellow hose cutting tool. Items 2 &amp; 3: Two (2) black cut tubes with striated type toolmark impressions Examination Results: Test toolmarks were created on black tubing with Item 1 for microscopic comparison purposes. Microscopic Comparison Conclusions: Identification: Based upon the reproducibility of class characteristics and microscopic individual characteristics, the following identifications were made: Item 1 is the tool that created the toolmarks on Item 2. Elimination: Based upon the difference in individual characteristics, the following eliminations were made: Item 1 is not the tool that created the toolmarks on Item 3.</p>
QBGXBT	<p>1. Examination of Exhibit 1 revealed one polymer hose cutter (slicing action) type tool with metal blade. No visible damage observed on Exhibit 1. Exhibit 1.1 (Test standards) was created for comparison and is being retained with Exhibit 1. 2. Examination of Exhibit 2 revealed one black polymer hose with one end marked with gold color and the other end containing toolmarks, suitable for comparison, consistent with a slicing type tool, such as a knife or hose cutter. These toolmarks were microscopically compared to Exhibit 1.1. a. Toolmarks observed on Exhibit 2 were made by the tool in Exhibit 1 due to sufficient agreement of individual characteristics observed. 3. Examination of Exhibit 3 revealed one black polymer hose with one end marked with white color and the other end containing toolmarks, suitable for comparison, consistent with a slicing type tool, such as a knife or hose cutter. These toolmarks were microscopically compared to Exhibit 1.1. a. It could not be determined if the toolmarks observed on Exhibit 3 were or were not made by the tool in Exhibit 1 due to insufficient agreement or disagreement of individual characteristics observed. TECHNICAL NOTES: Class characteristics are defined as measureable 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</p>

## TABLE 2

WebCode	Conclusions
	extremely remote.
QJURQV	The suspect toolmark on exhibit 2 (Item 2) was made by the submitted hose cutter, exhibit 1 (Item 1). The suspect toolmark on exhibit 3 (Item 3) was not made by the submitted hose cutter, exhibit 1 (Item 1) based on differences in individual characteristics.
QLXMAY	Examinations showed that the tool marks present on Item 2 were produced by the Item 1 tool.
RDXJJ8	The Item 1 hose cutter was examined and three (3) tests were produced using submitted hose material. The tests produced are being maintained for possible future examinations. Toolmarks present on Item 2 were microscopically examined and identified as having been produced by the Item 1 tool based on corresponding class and individual characteristics. Toolmarks present on Item 3 were microscopically examined and eliminated as having been produced by the Item 1 tool due to differences in individual characteristics. Date(s) of testing: 04/20/2022 – 04/22/2022. Supporting examination documentation is maintained in the case file. The above listed methods are those approved for use at the time of analysis. Current methods can be found in the Firearms and Toolmarks Procedures Manual, which can be found at [Website].
RF62H3	Item 2 piece of hose (gold paint) was cut with Item 1 hose cutter. Item 3 piece of hose (white pant) was not cut with Item 1 hose cutter.
RGW64H	Item 1, the submitted hose cutter, was examined. The cutter is comprised of a single blade that is designed to cut through a piece of hose or tubing using a slicing action. The edge profile of the blade is angled, forming an apex (point) in the center. The cutter was used to make test marks in the tubing provided for this purpose. No trace evidence was observed on the blade prior to making the test cuts. Items 2 and 3, the questioned pieces of cut hose, were examined. The cut ends of both items had class characteristics similar to the test cuts made by Item 1. The test marks from Item 1 were microscopically compared to Items 2 and 3. Sufficient agreement was observed between the striated marks on the test cuts from Item 1 and those on Item 2 to conclude that Item 1 was used to cut Item 2. Significant disagreement was observed between the striated marks on the test cuts from Item 1 and those on Item 3; therefore, Item 1 was excluded as having been used to cut Item 3.
T2XDZT	Tool Mark Analysis: Methodology: Physical (Visual Examination): Microscopy (Comparison Microscope): Test Marks were made with Item 1, the hose 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 black rubber hose, was made with Item 1, the hose cutter, based upon corresponding class and individual microscopic characteristics. The tool mark on Item 3, the black rubber hose, was not made with Item 1, the hose cutter, based upon different class and individual microscopic characteristics.
U9ZRHM	Examinations showed Item 2 was cut using Item 1 (side A). Examinations showed Item 3 was not cut using Item 1 (side A or B) due to insufficient corresponding individual marks.
UACGP7	[No Conclusions Reported.]
UGQAXG	Hose cutter (Item 1) produced toolmarks on piece of hose Item 2. Item 3 was cutted with other cutter.
UJYMFH	CTS Item 1 hose cutter functioned as designed during testing. CTS Item 1 hose cutter was used to cut CTS Item 2 black in color hose. CTS Item 1 hose cutter was not used to cut CTS Item 3 black in color hose. CTS Item 3 is consistent with being cut by a tool that uses a slicing/pinching action and may possibly be a single bladed instrument.
UNUAFX	Item 1.1 is a yellow colored spring action tube cutter. Test cuts were made in tubing from the laboratory supply. The tests will be returned with the other items of evidence. Item 1.2 is a black section of cut hose. It was microscopically compared to the test cuts made using Item 1.1. Based on agreement of all discernible class characteristics and corresponding individual detail, Item 1.2 was identified as having been cut by Item 1.1. Item 1.3 is a black section of cut hose. It was microscopically compared to the test cuts made using Item 1.1. Based on agreement of all discernible class characteristics and disagreement of individual characteristics, but insufficient for an elimination, Item 1.3 can neither be identified nor eliminated as having been cut by Item 1.1.

TABLE 2

WebCode	Conclusions
UQYYH8	Based on the comparison of appearance and individual characteristics between the marks on Item 2 and testmarks produced using Item 1, Item 2 was cut by Item 1. Based on sufficient disagreement of individual characteristics between the marks on Item 3 and testmarks produced using Item 1, Item 3 was not cut by Item 1.
UVRW3	The submitted hose, item 2, was cut by the submitted tube cutter, item 1. Due to class agreement and lack of individual agreement, the submitted hoses, items 2 and 3, were neither identified nor eliminated as being cut by the same tool. Due to class agreement and lack of individual agreement, the submitted hose, item 3, was unable to be eliminated or identified as having been cut by the submitted hose cutter, item 1.
VGNXW7	Item 1-1 (CTS item 1) was determined to be a hose cutter that used pinching action with a blade an anvil to create striated toolmarks. Item 1-1 hose cutter was used to make test toolmarks with the submitted reference hose, item 1-4. The test toolmarks were determined to be suitable for microscopic comparison. Item 1-2-1 (CTS item 2) was determined to be a section of hose with a questioned toolmark at one end. The toolmark was striated and was consistent with having been made by a tool using slicing or pinching action (blade and anvil). The toolmark on item 1-2-1 was determined to be suitable for microscopic comparison. Item 1-3-1 (CTS item 3) was determined to be a section of hose with a questioned toolmark at one end. The toolmark was striated and was consistent with having been made by a tool using slicing or pinching action (blade and anvil). The toolmark on item 1-3-1 was determined to be suitable for microscopic comparison. Item 1-4 was determined to be two sections of hose submitted as reference material. Item 1-4 was used to make test toolmarks with item 1-1 hose cutter. No further analysis was performed on item 1-4 hose. Based on microscopic comparisons, the following conclusions were made: The toolmark on item 1-2-1 was identified as having been made by the item 1-1 hose cutter, in the opinion of the laboratory. The toolmark on item 1-3-1 was eliminated as having been made by the item 1-1 hose cutter, in the opinion of the laboratory.
VPKW8T	The exhibit hose cutter Item 1 had cut the exhibit hose Item 2. The exhibit hose cutter Item 1 was eliminated from having cut Item 3.
VUU94T	Examinations showed the tool marks on Item 2 were created by Item 1. Examinations showed the tool marks on Item 3 were not created by Item 1.
W6RB62	Items: Description/Visual Examination: Item 1: One (1) yellow hose cutter. Item 2: One (1) cut piece of hose, black in color, with one end painted gold, striated toolmarks present. Item 3: One (1) cut piece of hose, black in color, with one end painted white, striated toolmarks present. Examination Results: Tests Toolmarks were created using Item 1 for comparison purposes. Microscopic Comparison Conclusions: Identification: Based upon the reproducibility of class characteristics and microscopic individual characteristics, the following identifications were made: Lab Item #: 2. Evidence Type: Striated toolmarks. Conclusion: Created by Item 1 (hose cutter) Elimination: Based upon the difference in individual characteristics, the following eliminations were made: Lab Item #: 3. Evidence Type: Striated toolmarks. Conclusion: Not created by Item 1 (hose cutter).
WJBWPV	The toolmarks on Item 2, the cut piece of hose with gold paint, were made by Item 1, the hose cutter. This identification was made by having sufficient agreement of unique surface contours and microscopic defects. The toolmarks on Item 3, the cut piece of hose with white paint, could have been made by Item 1, the hose cutter. There was agreement of class characteristics, and some disagreement of individual characteristics, but not sufficient for an elimination.
WLHDL7	Item 2 is identified as having been cut by the Item 1 cutter. Item 3 is inconclusive as having been cut by the Item 1 cutter. There is agreement in the discernable class characteristics and a lack of agreement/disagreement in the individual characteristics.
WMA8LV	Item 1 - One (1) hose cutter (1). Item 2 - One (1) piece of cut hose (2). Item 3 - One (1) piece of cut hose (3). The submitted specimen marked as Item 1 was examined and identified as one (1) hose cutter. The submitted specimens marked as Item 2 and Item 3 were examined and identified as two (2) pieces of cut hose exhibiting toolmarks on one end. Test toolmarks were generated using Item 1 and were microscopically compared to toolmarks exhibited on Item 2 and Item 3. As a result of

TABLE 2

WebCode	Conclusions
	microscopic comparison, it was concluded that Item 1 was identified as having created the toolmarks exhibited on Item 2. Item 1 was eliminated as having created the toolmarks exhibited on Item 3 due to significant disagreement of individual characteristics.
WRHTAR	Items 2 and 3 were microscopically compared to each other and to test cuts from the Item 1 hose cutter, and Item 1 was identified as being the source of the toolmarks on Item 2. Item 1 was eliminated from being the source of the toolmarks on Item 3 due to significant disagreement of individual characteristics.
WYLJUU	Item #2 is identified as being cut by the submitted hose cutter, Item #1, based on a significant agreement seen in the striations created by the cutter. Item #3 is eliminated as being cut by the submitted hose cutter based on the differences in individual class characteristics observed. See photos for areas of comparison. [Photos not provided by participant.]
WYP4LR	The Item 2 hose was cut by the Item 1 hose cutter. The Item 1 hose cutter was not used to cut the Item 3 hose.
XAEMBH	Results of Examinations: Item 1 is a hose cutter of unknown manufacture/brand, which uses a slicing action. Items 2 and 3 are black hoses which bear toolmarks that were produced using a slicing action. Toolmarks present on the Item 2 hose were identified as having been produced by the Item 1 hose cutter. A pattern examination of toolmarks present on the Item 3 hose compared to the Item 1 hose cutter and toolmarks present on the Item 2 hose was inconclusive due to a lack of sufficient corresponding microscopic marks of value.
XDDX8H	Results of Examinations: Item 1 is a hose cutter of unknown manufacturer. Item 2 and Item 3 are cut pieces of hose. Toolmarks present on the Item 2 hose were identified as having been produced by the Item 1 hose cutters. A pattern examination of toolmarks present on the Item 3 hose and Item 1 hose cutter, as well as the Item 2 hose, was inconclusive due to insufficient quality and/or quantity of corresponding individual characteristics.
XWQFHM	One of the cut pieces of hose, Item 2, was identified as having been cut by the submitted tool, Item 1. The second cut piece of hose, Item 3, was eliminated as having been cut by the submitted tool, Item 1. The items have toolmarks with similar class characteristics, but they exhibit significant differences in individual characteristics.
XWVT4X	(1) This hose cutter was used to make test marks. (2 and 3) The cut ends of Items 2 and 3 have been examined and compared microscopically with each other and tests made using the submitted hose cutter, Item 1. Based on the observed agreement of their class characteristics and sufficient agreement of their individual characteristics, the cut end on Item 2 was made by Item 1. Based on the difference in individual characteristics Item 3 was not cut by the hose cutter, Item 1.
XXMVQD	Two rubber-like black pieces of cut hose (Items 2 and 3) and a hose cutter have been submitted for the examination. Two pieces of tubing have also been presented for the possible test mark purposes. The aim of the examination is to determine whether the two cut pieces of hose (Items 2 and 3) have been cut with the submitted hose cutter. The examination process was initiated with a visual and microscopic (National) inspection and examination of the cut marks on the questioned pieces of hose and the cutting surface. One side of the Item 2 (first cut piece of hose) contains cut marks and the other side of the tubing is covered with gold paint. One side of the Item 3 (second cut piece of hose) contains cut marks on one side and the other side of the tubing is covered with white paint. In order to determine whether the two cut pieces of hose (Items 2 and 3) have been cut with the submitted hose cutter, two pieces of undamaged tubing (which were included for possible test mark purposes) were experimentally cut in a laboratory environment. The pattern of the tool marks generated by the hose cutter in the laboratory experimental environment and the pattern of the tool marks on Items 2 and 3 have been compared under the microscopes (National and LEICA DFC 495) to detect differences in traces and microrelief. Based on the findings of the analysis, we conclude that Item 2 (the first cut piece of hose) has been cut with the submitted hose cutter, while Item 3 (the second cut piece of hose) has not been cut with the submitted hose cutter.
Y4BT2M	The toolmark on the cut piece of hose submitted in item 2 was microscopically compared to test marks

TABLE 2

WebCode	Conclusions
	made with the hose cutter contained in item 1 with the following results. The toolmark on laboratory evidence item 2 was identified as having been made with the hose cutter contained in laboratory evidence item 1. The toolmark on the cut piece of hose submitted in item 3 was microscopically compared to test marks made with the hose cutter contained in item 1 with the following results. The toolmark on item 3 was eliminated as having been made with the hose cutter contained in laboratory evidence item 1.
YPR7RN	Item 2 was identified as having been cut with Item 1, hose cutter from suspect's backpack, based on sufficient agreement of individual characteristics present. Item 3 was eliminated as having been cut with Item 1, hose cutter from suspect's backpack, due to the differences in individual characteristics present.
YQK2EX	The Item 01-02 piece of black tubing was identified as having been cut by the Item 01-01 hose cutter. The Item 01-03 piece of black tubing was unable to be identified or eliminated as having been cut by the Item 01-01 hose cutter due to a lack of reproducible marks. The Item 01-04 pieces of black tubing were not analyzed, although one piece was utilized in the generation of test cuts using the Item 01-01 hose cutter.
YXHRXM	Comparison microscope examinations were conducted between unknown cut pieces of hose and standards made with the submitted tool. 1. The toolmarks found on the submitted hose, Exhibit 2, were identified as having been made by the submitted hose cutter tool, Exhibit 1. 2. The toolmarks found on the submitted hose, Exhibit 3, were not made by the submitted hose cutter tool, Exhibit 1, based on differences in individual characteristics.
Z2WVZA	After comparison under the microscope it was concluded that hose cutter recovered from suspect backpack as mentioned Item 1 was used to cut Item 2 (hose recovered from the maintenance building (gold paint)). After comparing item 1 with item 3 (second cut piece of the hose recovered from the maintenance building (white paint)) doesn't match with each other.
ZCXBTZ	[No Conclusions Reported.]
ZP8PCL	Item 2 was cut by the submitted hose cutter (Item 1) based on sufficient agreement of individual characteristics observed. Item 2 was not cut by the same hose cutter as the Item 3 hose based on differences in individual characteristics observed. Item 3 was not cut by the submitted hose cutter (Item 1) based on differences in individual characteristics observed.

# Additional Comments

## TABLE 3

WebCode	Additional Comments
2F9QTC	<p>A technical information paragraph would be included in the report as well as a background information paragraph relating to the case. Tool Impressions: When a tool comes into contact with a hard surface an impression may be left on that surface. An impression can contain detail from the surface of a tool, from the edge of a tool or from the action of a tool on a surface, for example, bolt cutters cutting a padlock. An impression can contain detail of the class of tool that made it, its dimensions and individual characteristics. Examination of a tool can identify features unique to that tool either from the finishing techniques during its manufacture, or from damage acquired by the tool through its use. Certain finishing techniques, for example grinding, and damage are acquired in a random manner, and as a result, are regarded as individual to that tool. Comparison of a tool with an impression generally involves the making of test impressions with the tool and comparing them to the recovered impression to enable the scientist to determine whether any relationship exists between the tool and the impression, and to what degree of certainty.</p>
3UP7AF	<p>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 reviewed and compared. If the class characteristics of the toolmarks are not clearly different, the examination moves to a second stage using comparative microscopy. A microscopic comparison examination consists of a search of the impressed and striated marks present in two toolmarks to determine if patterns of similarity exist. At the completion of these comparisons, one of the following three opinions is issued: 1) Source Exclusion: 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. 2) Source Identification: 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. 3) Inconclusive (No Conclusion): 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 variation in substrate, changes in tool working surfaces from wear, corrosion, and damage, or the employment of unusual tool/work piece orientations, 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</p>

TABLE 3

WebCode	Additional Comments
	fragmented items may be of little or no value for comparison purposes.
4GLXEJ	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.
4GWW9T	Items 1, 2, and 3 were microscopically examined. Four (4) tests produced using Item 1 are being returned as Item 1T in the provided container and should be maintained for possible future examinations.
63VKEE	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 tool are not to the absolute exclusion of all other tools because it is not feasible to examine all possible tools. However, observing this amount of agreement from a different source is considered extremely remote.
6U38FF	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.
72XRUF	Factors to consider for not being able to come to a conclusive exclusion: using the tool in a way that it is not designed to be used, ie. not placing the hose centered in V-slot. variability of how the marks are made when the hose is not placed centered in the V-slot of the hose cutter. whether or not the entire blade/working surface was captured in test cuts when hose was not centered in V-slot.
84FBDP	One of the pieces of cut hose (1-03) was not identified or eliminated as having been cut by the hose cutter due to agreement in available class characteristics but a lack of consistent and repeatable individual marks.
9X8EZ3	tool was not very robust and broke during our examination
A3E639	A pattern examination of toolmarks present on the Item 3 cut hose and Item 1 hose cutter was inconclusive due to insufficient quality and/or quantity of corresponding individual characteristics.
CME2EZ	It is my opinion that the hose cutter was NOT responsible for severing the pipe / hose in item 3
E98VG7	The cut hose section listed as Item 3 was also compared to the test cuts made with the hose cutter. Although they share the same class characteristics, there was insufficient agreement of individual marks, and therefore the findings are inconclusive.
EM8U7N	See above [Conclusions] for item 9846-003 (Q-2) inconclusive reasoning.
ENXT4	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,

TABLE 3

WebCode	Additional Comments
	<p>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 reviewed and compared. If the class characteristics of the toolmarks are not clearly different, the examination moves to a second stage using comparative microscopy. A microscopic comparison examination consists of a search of the impressed and striated marks present in two toolmarks to determine if patterns of similarity exist. At the completion of these comparisons, one of the following three opinions is issued: 1) Source Exclusion: 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. 2) Source Identification: 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. 3) Inconclusive (No Conclusion): 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 variation in substrate, changes in tool working surfaces from wear, corrosion, and damage, or the employment of unusual tool/work piece orientations, 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.</p>
FKWAXE	<p>Items 1 - 3 were examined using a stereomicroscope. Exemplar toolmarks were made by cutting similar hose with item 1. Mikrosil casts of the exemplar toolmarks and the toolmarks on items 2 and 3 were compared using the toolmark microscope. Photomicrographs of the items and the casts are stored on a DVD in the case package. Currently, the interpretation of individualization/identification is subjective in nature, founded on scientific principles and based on the examiner's training and experience. Opinions of common origin are made when toolmarks are in significant agreement.</p>
J2CEX4	<p>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.</p>

TABLE 3

WebCode	Additional Comments
KX976D	Class and individual characteristics defined in "Technical Notes" section of report.
MHAZQZ	<p>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</p>
NGA6WW	<p>Methods: 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 reviewed and compared. If the class characteristics of the toolmarks are not clearly different, the examination moves to a second stage using comparative microscopy. A microscopic comparison examination consists of a search of the impressed and striated marks present in two toolmarks to determine if patterns of similarity exist. At the completion of these comparisons, one of the following three opinions is issued: 1) Source Exclusion: 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. 2) Source Identification: 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. 3) Inconclusive (No Conclusion): 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: 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 variation in substrate, changes in tool working surfaces from wear, corrosion, and damage, or the employment of unusual tool/work piece orientations, 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.</p>
PEGV3L	<p>Identification: Is based on the agreement of the individual characteristic observed through the microscopic comparison examination.</p>

TABLE 3

WebCode	Additional Comments
PEJFUV	Although I don't think Item 3 was cut by Item 1, I typically don't exclude if class is in agreement because I can't discount that the tool surface has been altered between the questioned cut and "seizing by police".
PHJMD8	Items are referred to by Laboratory Evidence Tracking Numbers: Item 1 is 01-01, Item 2 is 01-02 and Item 3 is 01-03.
PNPZGW	Based on my training and experience, Item 3 had insufficient reproducible individual characteristic for an identification or elimination.
PQWJHD	Sufficient agreement is related to the significant duplication of random toolmarks as evidenced by a pattern or combination of patterns of surface contours. "Sufficient agreement" exists between two toolmarks means that the agreement is of a quantity and quality that the likelihood another tool could have made the mark is so remote as to be considered a practical impossibility.
Q6B2RT	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 tool are not to the absolute exclusion of all other tools because it is not feasible to examine all possible tools. However, observing this amount of agreement from a different source is considered extremely remote.
QBGXBT	It could not be determined if the toolmarks observed on Exhibit 3 were or were not made by the tool in Exhibit 1 due to insufficient agreement or disagreement of individual characteristics observed. Multiple test marks were made using the Exhibit 1 tool to obtain marks from the entire working surface for comparison. Some areas of agreement were observed; however, not enough for an identification.
QLXMAY	Examinations showed that the tool marks present on Item 3 were not produced by the Item 1 tool.
UNUAFX	Disagreement of individual characteristics, but insufficient for an elimination
UVRW3	See notes [Notes not provided by participant].
WLHDL7	Item 3 was determined to be inconclusive as having been cut by the Item 1 cutter because there is agreement in the discernable class characteristics and a lack of agreement/disagreement in the individual characteristics.
XAEMBH	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 reviewed and compared. If the class characteristics of the toolmarks are not clearly different, the examination moves to a second stage using comparative microscopy. A microscopic comparison examination consists of a search of the impressed and striated marks present in two toolmarks to determine if patterns of similarity exist. At the completion of these comparisons, one of the following three opinions is issued: 1) Source Exclusion: 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. 2) Source Identification: 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

TABLE 3

WebCode	Additional Comments
	<p>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. 3) Inconclusive (No Conclusion): 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 variation in substrate, changes in tool working surfaces from wear, corrosion, and damage, or the employment of unusual tool/work piece orientations, 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.</p>
XDDX8H	<p>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 reviewed and compared. If the class characteristics of the toolmarks are not clearly different, the examination moves to a second stage using comparative microscopy. A microscopic comparison examination consists of a search of the impressed and striated marks present in two toolmarks to determine if patterns of similarity exist. At the completion of these comparisons, one of the following three opinions is issued: 1) Source Exclusion: 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. 2) Source Identification: 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. 3) Inconclusive (No Conclusion): 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:</p>

TABLE 3

WebCode	Additional Comments
	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 variation in substrate, changes in tool working surfaces from wear, corrosion, and damage, or the employment of unusual tool/work piece orientations, 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.
YQK2EX	Item 01-03 was compared to test cuts made with the Item 01-01 hose cutter using the Item 01-04 black tubing, and was unable to be identified or eliminated as having been cut by that tool based on agreement of all discernible class characteristics without agreement or disagreement of individual characteristics.
Z2WVZA	microscopic examination have clearly shown a match between the microscopic details between control sample made from item 1 and tool marks on item 2.

-End of Report-  
(Appendix may follow)

## Test No. 22-5281: Toolmarks Examination

DATA MUST BE SUBMITTED BY **June 13, 2022, 11:59 p.m.** TO BE INCLUDED IN THE REPORT

Participant Code: U1234A

WebCode: QBDF9N

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 are investigating the vandalism of an apartment complex's water lines in which two of the hoses were cut inside the maintenance building. Investigators located a suspect and he was apprehended later that day. A hose cutter was recovered from the suspect's backpack. The hose cutter and two questioned pieces of cut hose are being submitted for your examination.

*Please note the following:*

*-Be careful when opening the hose cutter, as the blade is sharp.*

*-Two pieces of tubing have been included for possible test mark purposes.*

*-The item 2 and item 3 tubing have been marked to assist in distinguishing the side of tubing NOT to be examined.*

### Items Submitted (Sample Pack T1):

Item 1: Hose cutter recovered from suspect's backpack.

Item 2: First cut piece of hose recovered from the maintenance building. (gold paint)

Item 3: Second cut piece of hose recovered from the maintenance building. (white paint)

**1.) Did the suspect's hose cutter (Item 1) produce the questioned toolmarks on either of the submitted pieces of hose (Items 2 or 3)?**

	Yes	No	Inconclusive*
<b>Item 2:</b>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<b>Item 3:</b>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

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

*Please note: Any additional formatting applied in the free form space below will not transfer to the Summary Report and may cause your information to be illegible. This includes additional spacing and returns that present your responses in lists and tabular formats.*

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

**3.) Additional Comments**

## 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 ASCLD/LAB, 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 ASCLD/LAB, ANAB, and/or A2LA. (Accreditation Release section below must be completed.)
- This participant's data is **not** intended for submission to ASCLD/LAB, 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.   
(Include ASCLD/LAB Certificate here)

A2LA Certificate No.

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

Authorized Contact Person and Title

Laboratory Name

Location (City/State)