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Toolmarks Examination Test No. 20-5281 Summary Report

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 121 participants and are compiled into the following tables:

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 hose 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. The Item 2 hose piece was cut by the Item 1 hose cutter. The Item 3 hose piece was cut by a different hose cutter that was not provided for examination. Each questioned piece of hose contained a white painted end to assist examiners in determining which side was not intended for examination.

ITEM 2 (IDENTIFICATION MARKS): The Item 2 blue hose was cut by the Item 1 Apollo 1/2 in. to 1 in. hose cutters and packaged into a pre-labeled Item 2 envelope. The corresponding hose cutter was labeled with an Item 1 label and packaged in bubble wrap. Items 1 and 2 were then immediately assembled into the 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 Orbit Poly Pipe Cutters 1 1/4" (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 hose 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 hose 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. The Item 2 hose piece was cut by the Item 1 hose cutter. The Item 3 hose piece was cut by a different hose cutter that was not provided for examination. (Refer to Manufacturer's Information for preparation details.)

Of the 121 responding participants, 114 (94%) identified the Item 1 hose cutter as having cut the Item 2 hose piece and either eliminated (69) or were inconclusive (45) as to it having cut the Item 3 hose piece. Three participants identified both Items 2 and 3 as being cut by the Item 1 hose cutter and three participants either eliminated or were inconclusive for both Items 2 and 3 as being cut by the Item 1 hose cutter. The remaining participant eliminated Item 2 and identified Item 3 as having been 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
2GK3CR	Yes	Inc	BMJGCK	Yes	No
2MAH66	Yes	Inc	BP2Y7P	Yes	No
2R6AD2	Yes	No	BT26QM	Yes	Inc
3E9MHQ	Yes	No	C77PKZ	Yes	Inc
3MNAQU	Yes	Inc	C7RY2V	Yes	No
43CY43	Yes	No	C8XNYX	Yes	No
464XH2	Yes	No	CEGR7Z	Yes	No
4C4GFP	Yes	Inc	CRPPWL	Yes	Inc
4FNART	Yes	No	CYTGJX	Yes	Inc
4FZ2LU	Yes	No	D2RAWT	Yes	No
68LJL9	Yes	Inc	DAMCWJ	Yes	Inc
72E9BT	Yes	No	DCDE6T	Yes	Inc
7JW92P	Yes	Inc	DFCPZT	Yes	Inc
8PVD9Y	Yes	No	DU7ERJ	Yes	Inc
9HFRYV	Yes	No	E4Q6RF	Yes	No
9HVD9W	Yes	No	EM7ERG	Yes	No
9QJ7FM	Yes	No	EQ8HLN	Yes	Inc
9X62LX	Yes	Inc	EYL4VT	Yes	No
A7V7PH	Yes	No	EZTLTN	Yes	Inc
AEBLWU	Yes	Inc	F7VXJT	Yes	No
AKXFUR	Yes	Yes	F93B8M	Yes	No
AXN6TX	Yes	No	FDGQVT	Yes	No
B2EY2J	Yes	Inc	FFLEEP	Yes	Inc
BFZE6H	Yes	No	FHQ74G	Yes	Inc
BL4DHT	Yes	No	FPQLUP	Yes	Inc

TABLE 1

WebCode	Item 2	Item 3	WebCode	Item 2	Item 3
G4M3JM	Yes	Inc	P4GH87	Yes	No
G9G2TC	Yes	Inc	P4W2R3	Yes	No
GDQGZF	Yes	No	PJAAPL	Yes	No
GE6NLW	Yes	Inc	PQUDWN	Yes	Inc
GFFJ9N	Yes	No	Q3F6Y4	No	Yes
GLLJ3Q	Yes	No	QGYUVK	Yes	Yes
GWNFLV	Yes	No	QM6JFD	Yes	Inc
H6WRXJ	Yes	No	QRYHNG	Yes	No
HVM66J	Yes	No	QZAK9H	Yes	No
JXEH9M	Yes	No	R4B3QB	Yes	No
K7X99K	Yes	Inc	RTN7L3	Yes	No
KBDNWQ	Yes	No	RWPAEB	Yes	Inc
KCNQKB	Yes	Inc	TCJY72	Yes	No
KRGGKD	Yes	Inc	TH9EYE	Yes	No
L3H2KK	Yes	No	TUC2KG	Yes	Inc
L6L2EQ	No	No	TZ48KC	No	No
LF3KYM	Yes	No	U4JY8Y	Yes	No
M7CGAK	Yes	No	U7NLNA	Yes	Inc
MC3RKH	Yes	No	UFYNAB	Yes	Inc
MF2BHA	Yes	No	UH6DAY	Yes	Inc
MZ4YA7	Yes	No	UL4P7Y	Yes	No
NA63BL	Yes	No	UQVWN8	Yes	No
NDRKT7	Yes	Inc	V4D4ZX	Yes	Inc
NFGLZF	Yes	Inc	V74798	Yes	No
NMFFRL	Yes	No	VA3N4E	Yes	No
NT294L	Yes	No	VD2YZE	Yes	No
NXV339	Inc	Inc	VK3EMZ	Yes	Inc
NY76P8	Yes	No	VPX7VX	Yes	Inc

TABLE 1

WebCode	Item 2	Item 3	WebCode	Item 2	Item 3
VWG92E	Yes	No			
VY4QJZ	Yes	Inc			
W62YZC	Yes	No			
W9NGHW	Yes	Inc			
WGFW6F	Yes	No			
X3WUZW	Yes	Inc			
X6LV97	Yes	Inc			
XDEBT4	Yes	Yes			
XGVFPD	Yes	No			
XT79UX	Yes	Inc			
XVVA38	Yes	No			
XW7CN7	Yes	No			
Z7Q3N4	Yes	No			
ZNBTM3	Yes	No			
ZRPQT6	Yes	No			

Response Summary

Total Participants: 121

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

		ITEM 2	ITEM 3
Responses	Yes	**117** *(96.7%)*	**4** *(3.3%)*
	No	**3** *(2.5%)*	**71** *(58.7%)*
	Inc	**1** *(0.8%)*	**46** *(38.0%)*

Conclusions

TABLE 2

WebCode	Conclusions
2GK3CR	1. Examination revealed Exhibit 1 as an "Apollo" single bladed cutting tool. 2. Microscopic comparison concluded that the toolmarks observed on Exhibit 2 were made by Exhibit 1 based on an agreement of class characteristics and a sufficient agreement of individual characteristics. 3. Microscopic comparison of the toolmarks on Exhibit 3 could not determine if they
2MAH66	The cut sections of hose in items #2 and #3 were microscopically compared to test cuts made using the hose cutter submitted as item #1. The following conclusion was reached: The hose of item #2 were microscopically identified as having been cut by the cutter of item #1. The hose of item #3 was found to have the same class characteristics and some agreement between individual characteristics was noted. However, the observed agreement is not sufficient for identification and the results of the comparison are inconclusive. This hose could not be identified to or eliminated from having been cut by the cutter of item #1.
2R6AD2	The toolmarks present on Item #2 were made by the tool in Item #1. The toolmarks present on Item #3 could not have been made by the tool in Item #1.
3E9MHQ	1. Exhibit 1 consists of one "APOLLO" brand hose cutter with a blade length of 53.66 mm. 2. Exhibit 1.1 (Test cuts) was created for comparison and is being returned with Exhibit 1. 3. Exhibit 2 consists of one piece of blue colored plastic-like hose with a diameter of 18.52 mm, a length of 43.80 mm, and a thickness of 2.88 mm. Exhibit 2 has suitable toolmarks on one end and is painted white on the other end. 4. Exhibit 3 consists of one piece of black colored plastic-like hose with a diameter of 25.13 mm, a length of 24.56 mm, and a thickness of 3.01 mm. Exhibit 3 has suitable toolmarks on one end and is painted white on the other end. 5. Exhibits 2 and 3 were microscopically compared to Exhibit 1.1, the test cuts from Exhibit 1. A. The toolmarks on Exhibit 2 were made by Exhibit 1, the hose cutter, due to an agreement of class characteristics and a sufficient agreement of individual characteristics. B. The toolmarks on Exhibit 3 were not made by Exhibit 1, the hose cutter, due to an agreement of class characteristics and a sufficient disagreement of individual characteristics. Observing this amount of disagreement from the same source is considered extremely remote. 6. All measurements are approximate. TECHNICAL NOTES Class characteristics are defined as measurable features of a firearm/tool which indicate a restricted group source. They result from design features and are determined prior to manufacture of the firearm/tool. Individual characteristics are defined as marks produced by the random imperfections or irregularities of firearm/tool surfaces. These random imperfections or irregularities are produced incidental to manufacture and/or caused by use, corrosion, or damage, and are unique to that specific tool. Any conclusions indicating that a toolmark was made by a specific firearm/tool are not to the absolute exclusion of all other firearms/tools because it is not feasible to examine all possible firearms/tools. However, observing this amount of agreement from a different source is considered extremely remote.
3MNAQU	There is agreement of all discernible class characteristics and sufficient agreement of individual characteristic to determine that Exhibit 2 was cut by the Exhibit 1 pipe cutter. There is agreement of all discernible class characteristics; however due to insufficient agreement or disagreement of individual characteristics Exhibit 3 could neither be identified nor excluded as having been cut from the Exhibit 1 hose cutter.
43CY43	As a result of the microscopic comparison it is certain, that the toolmarks on the hose marked as "Item 2" have been produced by the hosecutter marked as "Item 1". Furthermore the comparsion showed that it can be excluded, that the toolmarks on the hose marked as "Item 3" have been produced by the hosecutter marked as "Item 1".
464XH2	Item 1 was examined and is an Apollo brand hose cutter. Four (4) tests were produced in laboratory stock material using the Item 1 hose cutter. The tests are being returned as Item 1T in Container 1 and should be maintained for possible future examinations. The toolmark present on the Item 2 piece of hose was microscopically examined and identified as having been cut by the Item 1 tool. The toolmark present on the Item 3 piece of hose was microscopically examined and eliminated as having been cut by the Item 1 tool.

TABLE 2

WebCode	Conclusions
4C4GFP	Tool Mark Analysis: Methodology: Physical (Visual Examination) Microscopy (Comparison Microscope) Test Marks were made with Item 1, the Apollo tube and pipe 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 blue rubber hose, was made with Item 1, the Apollo tube and pipe cutter, based upon corresponding class and individual microscopic characteristics. Comparisons between the tool mark on Item 3, the black rubber hose, and test marks made with Item 1, the Apollo tube and pipe cutter, were inconclusive due to insufficient corresponding individual microscopic characteristics. Comparisons between the tool mark on Item 3, the black rubber hose, and the tool mark on Item 2, the blue rubber hose, were inconclusive due to insufficient corresponding individual microscopic characteristics.
4FNART	1. Examinations showed the tool marks on Item 2 were produced by Item 1. 2. Examinations showed the tool marks on Item 3 were not produced by Item 1.
4FZ2LU	The evidence in items 1, 2, and 3 was analyzed by physical and microscopic examination. The toolmarks present on the first cut piece of hose in item 2 were determined to have been made by the hose cutter in item 1. The toolmarks present on the second cut piece of hose in item 3 were determined not to have been made by the hose cutter in item 1. Further analysis is pending submission of another tool for additional comparison.
68LJL9	Item 1 is a single blade hose cutter marketed under the name Apollo. Toolmarks present on the Item 2 tubing were identified as having been produced by the Item 1 hose cutter. Due to a lack of sufficient corresponding microscopic marks of value, no conclusion could be reached as to whether the toolmarks present on the Item 3 tubing were created by the Item 1 hose cutter.
72E9BT	The evidence in items 1, 2, and 3 was analyzed by physical and microscopic examination. The toolmarks present on the first cut piece of hose in item 2 were determined to have been made by the hose cutter in item 1. The toolmarks present on the second cut piece of hose in item 3 were determined not to have been made by the hose cutter item 1. Further analysis of the second cut piece of hose in item 3 is pending submission of another tool for additional comparison.
7JW92P	Test cuts were made using the 0001-AA tubing cutters at the [Laboratory]; the tests were retained. The 0001-AB section of plastic tubing was microscopically compared to test cuts made using the 0001-AA tubing cutters with POSITIVE RESULTS. The 0001-AB section of plastic tubing was cut using the 0001-AA tubing cutters. The 0001-AC section of plastic tubing was microscopically compared to test cuts made using the 0001-AA tubing cutters with INCONCLUSIVE RESULTS. The 0001-AC section of plastic tubing could neither be identified nor eliminated as having been cut using the 0001-AA tubing cutters due to insufficient agreement or disagreement of individual characteristics.
8PVD9Y	The toolmarks present on the Item 2 and Item 3 cut hoses were microscopically compared to tests made using the Item 1 hose cutter based on the agreement of class characteristics. The Item 1 hose cutter was identified as having made the questioned toolmarks on Item 2 based on sufficient agreement of individual characteristics. The Item 1 hose cutter was eliminated as having made the toolmarks on Item 3 based on significant differences in individual characteristics. The significance of this identification is made to the practical, not absolute, exclusion of all other tools.
9HFRYV	Toolmarks present on Item #2 were made by the tool in Item #1.
9HVD9W	MICROSCOPIC COMPARISON EXAMINATIONS OF THE Q1 AND Q2 PIECES OF CUT HOSE WITH TEST MARKS PRODUCED WITH THE K1 HOSE CUTTER REVEALED THE FOLLOWING: SUFFICIENT AGREEMENT OF INDIVIDUAL CHARACTERISTICS EXISTS TO IDENTIFY THE Q1 PIECE OF CUT HOSE AS HAVING BEEN CUT WITH THE K1 HOSE CUTTER. THE Q2 PIECE OF CUT HOSE WAS ELIMINATED AS HAVING BEEN CUT WITH THE K1 HOSE CUTTER DUE TO SUFFICIENT DIFFERENCES IN INDIVIDUAL CHARACTERISTICS. 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.

TABLE 2

WebCode	Conclusions
9QJ7FM	Item 2 was cut by Item 1. Item 3 was not cut by Item 1.
9X62LX	Lab Item(s)/ Designator(s): 2 Item Type: Toolmark(s) Microscopic Findings: Identification - toolmark Compared to Lab Item(s)/ Designator(s): 1 Item Type: Tool Lab Item(s)/ Designator(s): 3 Item Type: Toolmark(s) Microscopic Findings: Inconclusive Compared to Lab Item(s)/ Designator(s): 1 Item Type: Tool
A7V7PH	I compared cut hose item 2 and 3 with test cuts (both sides of the blade) from Item 1. I found correspondence of individual stria between item 2 and test cuts made by the hose cutter item 1 (mid blade side 2). Item 1 cut the hose item 2. Item 3 cut has similar class marks to test cuts. I made test cuts at different locations on the blade and I found no correspondence of individual marks with Item 3 for either side of the blade. Item 1 did not cut hose 3.
AEBLWU	The Item 01-02 piece of blue 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.
AKXFUR	The submitted sections of blue hose (Item 2) and black hose (Item 3) had both been cut by the hose cutter's recovered from the suspects vehicle (Item 1).
AXN6TX	Using the Hose Cutter labeled Item 1, test toolmarks were produced in the laboratory, for comparison. Under magnification, the test marks were compared with the two questioned hose cut labeled Item 2 and Item 3. Based on these comparative examinations, it was determined that: – There is sufficient agreement to conclude that the toolmarks present on the hose cut labeled Item 2 were produced by the left side of the blade of the Hose Cutter labeled Item 1. – There is sufficient disagreement to conclude that the toolmarks present on the hose cut labeled Item 3 were produced by neither side of the blade of the Hose Cutter labeled Item 1. However, they have similar class characteristics as the test marks produced with Item 1 and can therefore result from a tool equiped with the same kind of blade
B2EY2J	Tool Mark Analysis: Methodology: Physical (Visual Examination) Microscopy (Comparison Microscope) Test marks were made with Item 1, the pipe 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 blue poly tubing, was made with Item 1, the pipe cutter, based upon corresponding class and individual microscopic characteristics. Comparisons between the tool mark on Item 3, the black poly tubing, to Item 2, the blue poly tubing, and test marks made with Item 1, the pipe cutter, were inconclusive due to insufficient class and individual microscopic characteristics.
BFZE6H	Comparison microscope examinations were conducted on the evidence listed above. The findings of this examiner are the following: Item 2 was cut with Item 1 Hose cutter based on sufficient agreement of individual characteristics present. Item 3 was not cut with Item 1 Hose cutter due to differences of individual characteristics present.
BL4DHT	The Item 1 hose cutter was examined. Three (3) tests produced using Item 1 are being returned a Item 1T and should be maintained for future examinations. Toolmarks present on the Item 2 hose were microscopically examined and identified as having been produced by Item 1. Toolmarks present on the Item 3 hose were microscopically examined and eliminated as having been produced by Item 1.
BMJGCK	Examinations showed that the tool marks on Item 2 were produced by Item 1. Examinations showed that the tool marks on Item 3 were not produced by Item 1.
BP2Y7P	I conducted a comparative microscopic examination between the striations in test cuts I made in plastic hose using the hose cutter (Item1), to the striations in the segment of blue hose (Item 2) and the striations in the segment of black hose (Item 3). This revealed that: The hose cutters (Item 1) was responsible for cutting the segment of blue hose (Item 2). The hose cutters (Item 1) was not used to cut the segment of black hose (Item 3).
BT26QM	Test toolmarks were created using the Apollo brand hose cutter, Laboratory Item 1, and macroscopically/microscopically compared to the toolmarks of interest exhibited on the pieces of hose, Laboratory Items 2 and 3. Through macroscopic/microscopic examination and based on

TABLE 2

WebCode	Conclusions
	agreement of discernible class characteristics and sufficient corresponding individual detail, the toolmarks of interest exhibited on the piece of hose, Laboratory Item 2, were identified as having been created by the use of the Apollo brand hose cutter, Laboratory Item 1. Based on macroscopic/microscopic examination the toolmarks of interest exhibited on the piece of hose, Laboratory Item 3, exhibits similar class characteristics as those displayed on test toolmarks created using the Apollo brand hose cutter, Laboratory Item 1. However, due to the lack of sufficient corresponding individual detail, the toolmarks of interest exhibited on Laboratory Item 3, could neither be identified nor eliminated as having been created by the use of the Apollo brand hose cutter, Laboratory Item 1. The results of these examinations are inconclusive.
C77PKZ	The piece of blue hose (Item 2) was cut with the hose cutter recovered from the suspect's vehicle (Item 1). It is inconclusive if the black piece of hose (Item 3) was cut with the hose cutter recovered from the suspect's vehicle (Item 1).
C7RY2V	It was determined utilizing stereomicroscopic examination that Items 2 and 3 each exhibit one partial toolmark impression that is sufficient for comparison to known tools. Item 2 was examined and microscopically compared to the Item 1 tool. It was determined that the partial toolmark impression on Item 2 was positively made by the Item 1 tool. Item 3 was examined and microscopically compared to the Item 1 tool. It was determined that the partial toolmark impression on Item 3 was not made by the Item 1 tool.
C8XNYX	The toolmark of Item 2 is produced by Item 1. (Shape of toolmark and scratch are accord overall). The toolmark of Item 3 is not produced by Item 1. (Shape of toolmark and scratch are discordant overall)
CEGR7Z	The hose cutter (Item 1) was identified as the tool used to cut the blue hose (Item 2). The hose cutter (Item 1) was eliminated as the tool used to cut the black hose (Item 3).
CRPPWL	Test toolmarks were created using the hose cutter, Laboratory Item 1, and macroscopically/microscopically compared to the toolmarks on the piece of blue tubing, Laboratory Item 2, and the piece of black tubing, Laboratory Item 3. Through macroscopic/microscopic examination and based on agreement of discernible class characteristics and sufficient corresponding individual detail, the toolmarks of interest exhibited on the piece of blue tubing, Laboratory Item 2, were identified as having been created by the use of the hose cutter, Laboratory Item 1. Based on macroscopic/microscopic examination the toolmarks of interest exhibited on the piece of black tubing, Laboratory Item 3, exhibit similar class characteristics as those displayed on test toolmarks created using the hose cutter, Laboratory Item 1. However, due to the lack of sufficient corresponding individual detail, the toolmarks of interest exhibited on Laboratory Item 3 could neither be identified nor eliminated as having been created by the use of the hose cutter, Laboratory Item 1. The results of these examinations are inconclusive.
CYTGJX	Test toolmarks were created using the Apollo pipe cutter, Laboratory Item 1, and macroscopically/microscopically compared to the toolmarks of interest exhibited on the polymer hose segments, Laboratory Items 2 and 3. Through macroscopic/microscopic examination and based on agreement of discernible class characteristics and sufficient corresponding individual detail, the toolmarks of interest exhibited on the polymer hose segment, Laboratory Item 2, were identified as having been created by the use of the Apollo pipe cutter, Laboratory Item 1. Based on macroscopic/microscopic examination the toolmarks of interest exhibited on the polymer hose segment, Laboratory Item 3, exhibit similar class characteristics as those displayed on test toolmarks created using the Apollo pipe cutter, Laboratory Item 1. However, due to the lack of sufficient corresponding individual detail, the toolmarks of interest exhibited on Laboratory Item 3 could neither be identified nor eliminated as having been created by the use of the Apollo pipe cutter, Laboratory Item 1. The results of these examinations are inconclusive.
D2RAWT	Item 1 was used to make test marks. Items 2 and 3 have been compared microscopically with tests made with Item 1. Based on the observed agreement of their class characteristics and sufficient agreement of their individual characteristics, Item 2 was identified as having been cut by Item 1. Based on a difference of individual characteristics Item 3 was not cut by Item 1.

TABLE 2

WebCode	Conclusions
DAMCWJ	Item 1 - Hose cutter Item 2 - Cut piece of hose (blue) Item 3 - Cut piece of hose (black) The submitted specimen marked as Item 1 was examined and identified as a hose cutter. The submitted specimens marked as Item 2 and Item 3 are cut pieces of hose. Toolmarks exhibited on Items 2 and 3 were microscopically compared to test marks created using Item 1. As a result of microscopic comparison, Item 2 was identified as having been created by Item 1. Item 3 could not be identified or eliminated as having been created by Item 1 due to a lack of agreement/disagreement of individual characteristics.
DCDE6T	If only silicone tubes can be proven to be cut with the device, then there are some traces on the black that cannot come from the tooth.
DFCPZT	The piece of blue hose (Item 2) was identified as having been cut by the hose cutter (Item 1). Agreement of the characteristics is sufficient to determine that the hose cutter is the source of the toolmarks on the piece of blue hose. The piece of black hose (Item 3) could not be conclusively identified or excluded as having been cut by the hose cutter (Item 1). There was agreement of all discernible class characteristics, but no significant agreement or disagreement of the individual characteristics was noted. The piece of black hose (Item 3) could have been cut by the hose cutter (Item 1) or any other tool with similar characteristics.
DU7ERJ	The toolmarks observed on Item 2 were microscopically identified as having been made by Item 1. The toolmarks observed on Item 3 could not be microscopically identified or eliminated as having been made by Item 1. Agreement of class characteristics however no agreement of individual characteristics observed between the toolmarks present on Item 3 and the test marks generated with Item 1.
E4Q6RF	1.) Item 1 did produce the questioned toolmarks on Item 2. 2.) Item 1 did not produce the questioned tool marks on Item 3.
EM7ERG	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.
EQ8HLN	The submitted piece of blue tubing, Item 01-01, was identified as having been cut by the submitted tube cutter, Item 01-03. The submitted piece of black tubing, Item 01-02, could not be eliminated or identified as having been cut by the submitted tube cutter due to a similarity in class characteristics and a lack of matching marks/pattern areas of individual characteristics.
EYL4VT	The Item 2 hose segment is identified as having been cut by the Item 1 hose cutter. The Item 3 hose segment is eliminated as having been cut by the Item 1 hose cutter.
EZTLTN	Item #1 was examined and tested. The toolmarks present on Item #2 were made by Item #1. The toolmarks present on Item #3 could not be identified or eliminated as having been made by Item #1.
F7VXJT	In my opinion, there are significant differences between the detail recorded on item 3 and the test marks made using item 1. In my opinion, these observed differences are sufficient to exclude item 1 from having cut item 3. There is fine detail recorded on item 2 that corresponds with detail recorded in test cuts made using item 1. In my opinion the level of correspondence observed in terms of style and fine detail are of the utmost significance. I consider the likelihood of obtaining this level of correspondence between these items as a result of coincidence, had item 1 not been responsible for creating the recorded detail, to be so remote that it can be discounted as a practical possibility. It is therefore my opinion, that item 1 was used to cut item 2. In my opinion, the findings show conclusively that item 1 was used to cut item 2.
F93B8M	Item 2 cut piece of hose (blue) was cut with Item 1 hose cutter. Item 3 cut piece of hose (black) was not cut with Item 1 hose cutter.
FDGQVT	1. The tool mark present in the hose described in the item 2, was produced by the hose cutter described in the item 1 (identification). 2. The tool mark present in the hose described in the item 3, was not produced by the hose cutter described in the item 1.
FFLEEP	Item 1B (CTS #2) was identified as having been cut by item 1A (CTS #1) based on the agreement of class and individual characteristics. Item 1C (CTS #3) could not be identified or eliminated as having

TABLE 2

WebCode	Conclusions
	been cut by item 1A (CTS #1) due to insufficient agreement/disagreement of individual characteristics, however, all class characteristics were in agreement.
FHQ74G	Item 1.1 is an Apollo brand pair of tubing cutters. 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 blue section of cut tubing. 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 tubing. 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.
FPQLUP	Item 2 was cur with item 1 based on sufficient agreement of individual characteristics. Test sets from item 1, item 2 and item 3 bear marks having the same class characteristics. Item 3 bears marks having no agreement of individual characteristics with item 1 or item 2. Item 3 cannot be identified or eliminated as having been cut with item 1, inconclusive. This is based on a lack of agreement of individual characteristics.
G4M3JM	The hose cutter (Item 1) is operational with no malfunctions observed during testing. The blue hose (Item 2) was cut by the hose cutter (Item 1). The black hose (Item 3) was neither identified nor eliminated as being cut by the hose cutter (Item 1). There is agreement in the discernable class characteristics; however, there is a lack of agreement or disagreement in the individual characteristics.
G9G2TC	The tool marks on the Item 2 blue hose were microscopically identified as having been made by the Item 1 hose cutter. The Item 1 hose cutter can neither be identified nor eliminated as having caused the tool marks on the Item 3 black hose due to insufficient agreement or disagreement of individual characteristics.
GDQGZF	The toolmark on laboratory evidence item 1.2 was microscopically compared to test marks made with the tube cutter contained in laboratory evidence item 1.1 with the following results. The toolmark on laboratory evidence item 1.2 was identified as having been made with the tube cutter contained in laboratory evidence item 1.1. The toolmark on laboratory evidence item 1.3 was microscopically compared to test marks made with the tube cutter contained in laboratory evidence item 1.1 with the following results. The toolmark on laboratory evidence item 1.3 was eliminated as having been made with the tube cutter contained in laboratory evidence item 1.1.
GE6NLW	Item 1 is an Apollo brand hose cutter that uses a slicing action. Item 2 is a blue colored piece of hose. Toolmarks present on the Item 2 hose were identified as having been produced by the Item 1 hose cutter. Item 3 is a black colored piece of hose. Due to a lack of sufficient corresponding microscopic marks of value, no conclusion could be reached as to whether the toolmarks present on the Item 3 hose were created by the Item 1 hose cutter.
GFFJ9N	SECTIONS OF HOSE WERE CUT WITH K1 SUSPECT HOSE CUTTER (ITEM 1) TO CREATE TEST SAMPLES FOR COMPARISON AGAINST THE TOOLMARKS PRESENT ON EVIDENCE CUT PIECES OF HOSE Q1 AND Q2 (ITEMS 2 AND 3). THE BLADE OF THE HOSE CUTTER WAS MARKED TO ENSURE THAT ALL OF THE CUTTING SURFACE AREA HAD BEEN CAPTURED IN CREATING THE TEST TOOLMARKS FOR COMPARISON. MICROSCOPIC COMPARISONS OF THE FIRST (BLUE) AND SECOND (BLACK) CUT PIECES OF HOSE, Q1 AND Q2 (ITEMS 2 AND 3) WITH TESTS CREATED WITH K1 SUSPECT HOSE CUTTER (ITEM 1) REVEAL THAT SUFFICIENT AGREEMENT EXISTS TO DETERMINE THAT Q1 FIRST CUT PIECE OF HOSE (BLUE - ITEM 2) WAS CREATED WITH K1 SUSPECT HOSE CUTTER (ITEM 1) Q2 SECOND CUT PIECE OF HOSE (BLACK - ITEM 3) IS ELIMINATED AS HAVING BEEN CUT WITH K1 SUSPECT HOSE CUTTER (ITEM 1) DUE TO DIFFERENCES IN INDIVIDUAL MARKINGS PRESENT BETWEEN Q1 AND TESTS FROM K1. SHOULD ANOTHER TOOL BE RECOVERED FOR COMPARISON TO Q2 PLEASE SUBMIT IT IN REFERENCE TO THE ABOVE CC#. 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 evidence by a pattern or combination of

TABLE 2

WebCode	Conclusions
	patterns of surface contours.
GLLJ3Q	The results speak with great certanity that item 2 has been (+3) cut with item 1. The results speak with great certanity that item 3 has not been (-3) cut with item 1.
GWNFLV	In my opinion, the blue piece of hose (item 2) was cut by the submitted hose cutter (Item 1). In my opinion, the black piece of hose (item 3) was not cut by the submitted hose cutter (Item 1.
H6WRXJ	The toolmarks on Item 2 were made by the tool in Item 1. The toolmarks on Item 3 were not made by the tool in Item 1.
HVM66J	Using the 'APOLLO' brand hose cutter, Item 1, and the portions of blue and black hose (test material); I created tests for microscopic examination purposes. This was accomplished by cutting the portions of blue and black hose (test material) with the cutter, Item 1, at a perpendicular angle. The test cuts were marked A and B to indicate which side of the cutting blade created the marks thereon. Forensicsil casts were made of the cutends of the test cuts at both sides as well as the supplied cut portions of pipe, Items 2 and 3 for microscopic examination purposes. I undertook a microscopic comparison of the casts from Item 2, Item 3 and the portions of test hose, and found that the cutter,Item 1, was used to cut the blue hose, Item 2. The black hose, Item 3, were cut using a second cutting implement, not being Item 1.
JXEH9M	Tests made with the submitted tube cutter, Item #1, were compared microscopically with cut areas from the submitted pieces of tubing, Items #2 and #3. There is agreement in all discernible class characteristics. Item #1 to #2. There is sufficient agreement in corresponding individual characteristics for identification. Item #1 made the questioned cut in Item #2. Item #1 to #3. There is sufficient disagreement in individual characteristics for elimination. Item #1 is eliminated from making the questioned cut in Item #3.
K7X99K	Item 1-1 (CTS item 1) is a slicing tool that creates striated toolmarks. Item 1-2-1 (CTS item 2) is a piece of blue tubing that has striated toolmarks that are consistent with having been created by a slicing tool. Item 1-3-1 (CTS item 3) is a piece of black tubing that has striated toolmarks that are consistent with having been created by a slicing tool. Due to agreement of all discernible class characteristics, item 1-2-1 (CTS item 2) blue tubing and item 1-3-1 (CTS item 3) black tubing were microscopically compared to test cuts made using the item 1-1 (CTS item 1) tool. Based on sufficient similarities in the patterns of microscopic markings observed between item 1-2-1 (CTS item 2) blue tubing and the item 1-1 (CTS item 1)tool, item 1-2-1 (CTS item 2) blue tubing was identified as having been cut by the item 1-1 (CTS item 1) tool. This identification conclusion is in the opinion of the laboratory. Based on insufficient similarities and insufficient differences in the patterns of microscopic markings observed between item 1-3-1 (CTS item 3) black tubing and the item 1-1 (CTS item 1) tool, item 1-3-1 (CTS item 3) could not be identified or eliminated as having been cut by the item 1-1 (CTS item 1) tool. This inconclusive conclusion is in the opinion of the laboratory.
KBDNWQ	The mark on item 2 (blue hose) was produced with item 1 (hose cutter). Identification The mark on item 3 (black hose) was not produced with item 1 (hose cutter). Exclusion
KCNQKB	The blue hose of Exhibit 2 was cut by the hose cutter of Exhibit 1. It is inconclusive if the black hose of Exhibit 3 was cut by the hose cutter of Exhibit 1. There is agreement of all discernible class characteristics and disagreement of individual characteristics, but insufficient for an elimination.
KRGGKD	Toolmarks on Item #2 were made by the tool in Item #1. Toolmarks on Item #3 could not be identified or eliminated as having been made by the tool in Item #1.
L3H2KK	The cut hose (Item 2) was microscopically examined and compared with the test cuts made with the hose cutter (Item 1). Based on the observed agreement of their class characteristics and sufficient agreement of their individual characteristics, the hose cutter (Item 1) is identified as having produced the cut on the hose (Item 2). The cut hose (Item 3) was microscopically examined and compared with the test cuts made with the hose cutter (Item 1). Based on the observed disagreement of their individual characteristics, the hose cutter (Item 1) is eliminated as having produced the cut on the hose (Item 3).

TABLE 2

WebCode	Conclusions
L6L2EQ	The examination has been carried out with the microscope "LEICA DFC 495" . The examination gives us to conclude that Item 2 and Item 3 has not been cut by the suspect's cutter.
LF3KYM	[No Conclusions Reported.]
M7CGAK	The Item 2 toolmark was identified as having been produced by Item 1. The Item 3 toolmark was excluded as having been produced by Item 1.
MC3RKH	Test cuts were made with the Conbraco Apollo tubing cutters with the tubing pieces in the center of the cutters. Sufficient agreement of individual characteristics exits to identify the toolmarks on the piece of blue tubing with the white paint on one end, Q1 (Item 2) as having been made with the Conbraco Apollo tubing cutters, K1 (Item 1). The toolmarks on the piece of black tubing with white paint on one end, Q2 (Item 3) can be eliminated as having been made with the Conbraco Apollo tubing cutters K1 (Item 1) due to differences in the individual markings on the test items from K1 (Item 1) and Q2 (Item 3). 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.
MF2BHA	The toolmark on Item 2 (piece of blue hose) was identified* as being produced by Item 1 (hose cutter). Item 1 did not produce the toolmark on Item 3 (piece of black hose). *Source identification is reached when the discernible class and individual characteristics have corresponding detail and the examiner would not expect to see the same arrangement of details repeated in another source.
MZ4YA7	The submitted hose cutter (Item 1) cut the Item 2 hose. The submitted hose cutter (Item 1) did not produce the cut on the item 3 hose based on differences in individual characteristics.
NA63BL	The toolmark of Item 2 (blue hose) is produced by Item 1 (hose cutter recovered from suspect's vehicle). (Shape of toolmark and scratch are accordant overall.) The toolmark of Item 2 (black hose) is not produced by Item 1 (hose cutter recovered from suspect's vehicle). (Shape of toolmark and scratch are disaccordant overall.)
NDRKT7	The hose from Item 2 was identified as having be cut by the Item 1 hose cutter. The hose from Item 3 shared similar class characteristics to those observed on test cuts from the Item 1 hose cutter; however, they lacked sufficient microscopic individual characteristics to either identify or excluded it has having been cut by the Item 1 hose cutter. Therefore, the results were inconclusive
NFGLZF	Item 1 was used to cut Item 2. Item 1 cannot be identified or eliminated as having cut Item 3.
NMFFRL	Item 2: There was sufficient agreement of class and individual characteristics to determine that the hose cutter, Item 1 had been used to cut the hose, Item 2. Item 3: There was some agreement of class characteristics but no agreement of individual characteristics. The hose cutter, Item 1, had not been used to cut the hose, Item 3.
NT294L	1. The overall shape of cutting plane of item2 and cutting plane made by item1 are flat, but cutting plane of item3 have gentle curvature. 2. Striae on cutting plane of item2 match up with striae made by item1, and do not match up with the striae on item3.
NXV339	Examination of the blue and black polymer hoses (Items 2 and 3) revealed damage consistent with that produced by cutting with a sharp bladed instrument. The examination of the damage to the blue and black polymer hoses (Items 2 and 3) failed to reveal sufficient quantity and quality of individual characteristics to determine whether or not they were created by the same tool or by the Apollo pipe cutter (Item 1).
NY76P8	Items 2 and 3 were examined and microscopically compared to tests cut by Item 1. Item 2 was cut by Item 1. Item 3 was not cut by Item 1.
P4GH87	The blue vinyl tube section, item 2, was identified as being cut by the vinyl tube cutter, item 1. The black vinyl tube section, item 3, was not cut by the vinyl tube cutter, item 1.
P4W2R3	Comparison microscope examinations were conducted on the evidence listed above. The findings of

TABLE 2

WebCode	Conclusions
	this examiner are the following: 1. Item 2 was cut by the submitted hose cutter (Item 1) based on sufficient agreement of individual characteristics observed. 2. Item 3 was eliminated as having been cut by the submitted hose cutter (Item 1) based on disagreement of individual characteristics observed.
PJAAPL	Examinations showed Item 1 was used to cut Item 2. Examinations showed Item 1 was not used to cut Item 3 due to the differences in individual marks.
PQUDWN	Toolmarks present on the Item 2 hose were identified as having being produced by the Item 1 hose cutter. Due to a lack of sufficient corresponding microscopic marks of value, no conclusion could be reached as to whether the toolmarks present on the Item 3 hose were created by the Item 1 hose cutter.
Q3F6Y4	Having conducted a comparison between Item 1 (pair of cutters) and items 2 (piece of blue cut hose) and Item 3 (piece of black cut hose) I am of the following opinions: - Item 1 is excluded from having cut the scene cut hose item 2 based on significant disagreement of individual characteristics. - Item 1 is identified as having produced the scene cut hose item 3 based on agreement of a combination of individual characteristics and all discernible class characteristics where the extent of agreement exceeds that which can occur in the comparison of tool marks made by different tools and is consistent with the agreement demonstrated by tool marks known to have been produced by the same tool.
QGYUVK	suspect's hose cutter (Item 1) produce the questioned toolmarks on either of the submitted pieces of hose (Items 2 or 3).
QM6JFD	20-5281: Toolmarks Examination. The following findings reflect the professional opinion of the examiner authoring this report. Examination of Item 1 revealed one (1) hose cutter, yellow in color with black grips. Test cuts were created with Item 1. Examination of Item 2 revealed one (1) cut piece of blue rubber hose. Examination of Item 3 revealed one (1) cut piece of black rubber hose. Microscopic examination of the test cuts created by Item 1 with Item 2 revealed Item 2 was cut by the submitted hose cutter (Item 1). Microscopic examination of the test cuts created by Item 1 with Item 3 revealed a general correspondence in class characteristics; however, Item 3 could not be identified or eliminated as being cut by the submitted hose cutter (Item 1) due to insufficient matching individual characteristics.
QRYHNG	[No Conclusions Reported.]
QZAK9H	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.
R4B3QB	The suspect's hose cutter (Item 1) produce the questioned toolmarks on the submitted pieces of hose - Items 2 and NOT produce the questioned toolmarks on Items 3.
RTN7L3	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.
RWPAEB	Item #2 was made by Item #1. Item #3 could not be identified or eliminated as being made by Item #1.
TCJY72	Reference cuts made with tool Item 1 have been compared with the cut observed on Item 2. Following comparison between these items, numerous striations in agreement have been observed. These features represent imperfections of the blade. 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 unknown tool blade had been used to cut Item 2, the probability of observing such an agreement is extremely low. I assessed that probability to be below 1/10000. Overall these results provide extremely 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 reference material produced by the tool Item 1. Given the circumstances at hand, we have decided to exclude tool Item 1 from having produced the cut on Item 3.
TH9EYE	Item 1 is identified as having cut item 2. Item 1 is eliminated from having cut item 3.

TABLE 2

WebCode	Conclusions
TUC2KG	Item CTS 1 hose cutter was used to cut Item CTS 2. Item CTS 3 black hose can neither be eliminated nor identified as having been cut by Item CTS 1 hose cutter based on a lack of agreeing individual characteristics; however, available class characteristics are similar. Item CTS 3 black hose can neither be eliminated nor identified as having been cut by the same tool as Item CTS 2 blue hose based on a lack of agreeing individual characteristics possibly due to material differences; however, available class characteristics are similar.
TZ48KC	The questioned toolmarks on the Items 2 and 3 cut hoses were not caused by the cutting blade of the Item 1 hose cutter.
U4JY8Y	The following exhibits were visually and microscopically examined: Exhibit 1: Hose cutter Exhibit 2: Cut piece of tubing Exhibit 3: Cut piece of tubing 1. Exhibit 1 is a single blade cutting tool that is designed to cut tubing. Test cuts and silicone casts were created using Exhibit 1, were labeled as Exhibit 1.1, and are being returned with Exhibit 1. 2. Exhibits 2 and 3 are short pieces of tubing. Each piece has a full thickness cut at one end that display characteristics similar to a single blade cutting tool. Exhibits 2 and 3 were microscopically compared to test toolmarks from Exhibit 1. 3. Based on the agreement of all discernible class characteristics and a sufficient agreement of individual characteristics that were observed between the Exhibit 2 toolmark and test toolmarks from Exhibit 1, it was concluded that the Exhibit 2 was identified as being cut by Exhibit 1. 4. Based on the agreement of all discernible class characteristics and a sufficient disagreement of individual characteristics that were observed between the Exhibit 3 toolmark and test toolmarks from Exhibit 1, it was concluded that the Exhibit 3 was not cut by Exhibit 1.
U7NLNA	Tool marks observed on the Items 2 and 3 pieces of synthetic hose are consistent in class characteristics with the Item 1 hose cutter. Item 1 was compared to item 2. The Item 2 tool marks were examined, compared microscopically, and identified as having been produced by the Item 1 hose cutter. Identifications are based on sufficient agreement of the individual characteristics of tool marks. Sufficient agreement, in part, means that the likelihood of another tool producing the same marks is so remote that it is considered a practical impossibility. Item 1 was compared to item 3. Toolmarks present on the Item 3 piece of hose have the same discernible class characteristics as those produced with the Item 1 hose cutter; however, because of the lack of sufficient suitable corresponding microscopic markings, it was not possible to identify or eliminate the Item 1 hose cutter as having produced the toolmarks on the Item 3 piece of hose.
UFYNAB	Item 2 was microscopically examined and identified as having been cut by Item 1. Item 3 was microscopically examined and exhibits similar class and individual characteristics as those produced by Item 1. Due to a lack of sufficient corresponding individual characteristics, it was not possible to identify or eliminate Item 3 as having been cut by Item 1. Therefore, this comparison is inconclusive.
UH6DAY	1) The toolmarks in Item 2 were made by the submitted hose cutter (Item 1). 2) The toolmarks in Item 3 could have been made by the submitted hose cutter (Item 1) based on class characteristics; however, the lack of corresponding individual characteristics precludes a more conclusive finding.
UL4P7Y	The toolmarks on Item 2 were made by the submitted hose cutter (Item 1). The toolmarks on Item 3 were made by a second cutting tool, based on differences in individual characteristics.
UQVWN8	The Item 1 hose cutter was used to make the cut in the Item 2 hose, but not the cut in the Item 3 hose.
V4D4ZX	The Item 1 hose cutter was identified, within the limits of practical certainty1, 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.
V74798	Toolmarks present on Item #2 were made by Item #1. Toolmarks present on Item #3 were not made by Item #1.
VA3N4E	[No Conclusions Reported.]
VD2YZE	We made test marks cut hoses by item 1. The test mark is the same with item 2, these are matched striation. But item 3 was not matched with the test mark. So, item 2 was cut by item 1 but, item 3 was not cut by item 1.

TABLE 2

WebCode	Conclusions
VK3EMZ	Macroscopic and microscopic examination determined that Exhibits 2 and 3 each contains a cut end. These cut ends were cut by an anvil/shear type cutting tool(s) that left toolmarks of value for comparison. Exhibit 1 is an Apollo brand tube cutter. Test impressions were taken from Exhibit 1 and designated as 1.1. Microscopic comparison of Exhibits 2 and 3 with the Exhibit 1 test cut specimens concluded the following: -Exhibit 2 was identified as having been cut by Exhibit 1. -Although similar in all discernible class characteristics, the Exhibit 3 cut end could not be identified nor excluded as having been cut by Exhibit 1 due to the lack of sufficient, corresponding toolmarks of value. The identification listed above is based on the agreement of all discernible class characteristics and the sufficient correspondence of individual characteristics. Additionally, the probability that Exhibit 2 was cut by a different tool is so small as to be considered negligible.
VPX7VX	1) Exhibit 1 (Apollo Brand Hose Cutter) is designed to be used as a single blade opposed jaw cutting tool. Exhibit 1 (Test Standards) was created for comparison and is being returned with Exhibit 1. 2) Exhibits 2 (One Blue Hose Piece) and 3 (One Black Hose Piece) were visually examined and microscopically compared to test toolmarks from Exhibit 1. a) Exhibit 1 caused the damage on Exhibit 2 based on an agreement of all discernible class characteristics and a sufficient agreement of individual characteristics. b) It could not be determined if the damage on Exhibit 3 was or was not made by Exhibit 1 based on an agreement of all discernible class characteristics but an insufficient agreement of individual characteristics. Exhibit 2 does have damage consistent with a single blade opposed jaw cutting tool.
VWG92E	The toolmarks of item 2 is produced by item1 and the toolmarks of item 3 is not produced by item1.
VY4QJZ	EXAMINATIONS AND CONCLUSIONS The pipe/hose cutter (Item 1) was examined. The pipe/hose cutter was used to make test cuts in sections of hose. The toolmarks in these test cuts were then microscopically compared with the toolmarks in the cuts on the pieces of hose of Item 2 and Item 3. Item 2 Sufficient agreement in class and individual characteristics was observed between test cut toolmarks and the toolmarks on Item 2 to conclude that the hose/pipe cutter (Item 1) was used to cut the piece of hose (Item 2). Item 3 Microscopic comparison of the toolmarks on the test cut hoses and Item 3 revealed that they have similar cutting class (tool action), but do not have agreement or disagreement of individual marks. The toolmarks on Item 3 could not be identified or eliminated as having been made by Item 1. The findings are inconclusive.
W62YZC	The cutting surfaces of item 1 (hose cutter) are honed and thus are unique. The marks on item 2 and item 3 are toolmarks. We produced comparison toolmarks with the hose cutter (item 1) on the hoses which were supplied to us. Those toolmarks have been compared to the toolmarks on item 2 and item 3, using 3D Scanning and comparison with Toolscan(c). Comparison between item 2 and the comparison toolmarks from item 1: During the comparison we were able to ascertain a big number of concordances. No unexplainable discordances have been found. It is certain, that the toolmarks on item 2 have been produced by the hose cutter (item 1). Comparison between item 3 and the comparison toolmarks from item 1: During the comparison process, we havn't found any concordances. We can exclude item 1 as beeing the source of the toolmarks found on item 3.
W9NGHW	Exhibit 2 hose fragment presented an agreement of discernible class characteristics and sufficient agreement of individual characteristics when compared to tests created from Exhibit 1. Therefore, Exhibit 2 (hose fragment) was identified as having been cut by the Exhibit 1 Apollo brand pipe cutter. Exhibit 3 hose fragment presented an agreement of discernible class characteristics and insufficient agreement of individual characteristics when compared to tests created from Exhibit 1. Therefore, it could not be determined if Exhibit 3 (hose fragment) was cut by the Exhibit 1 pipe cutter.
WGFW6F	1) Detail present on the cut face of the blue pipe (item 2) correspond with detail within the test cut made by the considered cutter. I consider the correspondence observed to be of the utmost significance, and the chances of obtaining such, as a result of pure coincidence to be so remote, that it can be discounted as a practical possibility. As such, I conclude that the blue pipe (item 2) was severed by the considered cutters. 2) Detail on the cut face of the black pipe (item 3)differs from detail within the test cut, which I consider to be of the utmost significance. As such I conclude that the black pipe (item 3) was not severed by the considered cutters

TABLE 2

WebCode	Conclusions
X3WUZW	Tool Mark Analysis: Methodology: Physical (Visual Examination) Microscopy (Comparison Microscope) Test marks were made with Item 1, the pipe 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 blue poly tubing, was made with Item 1, the pipe cutter, based upon corresponding class and individual microscopic characteristics. Comparisons between the tool mark on Item 3, the black poly tubing, to Item 2, the blue poly tubing, and test marks made with Item 1, the pipe cutter, were inconclusive due to insufficient class and individual microscopic characteristics.
X6LV97	Item #2 was made by Item #1 Item #3 could not be identified or eliminated as being made by Item #1
XDEBT4	The exhibit Items 2 and 3 had been cut by the exhibit tool Item 1.
XGVFPD	Item 2 was identified as having been produced by item 1. Item 3 was eliminated as having been produced by item 1 due to a difference in individual characteristics.
XT79UX	1. Examination of Exhibit 1 revealed one “Apollo” brand hose cutter designed to be used as a single blade slicing tool with a blade measuring 48.55mm long. Test standards, sub-exhibited as Exhibit 1.1, were created and will be returned with Exhibit 1. 2. Examination of Exhibit 2 revealed one blue tube measuring 42.93mm long, 18.54mm in diameter, and 3.09mm thick. a. One end of the tube has damage consistent with being cut by a single blade slicing tool. b. Microscopic comparison revealed Exhibit 2 was cut by Exhibit 1 due to an agreement of class characteristics and sufficient agreement of individual characteristics. 3. Examination of Exhibit 3 revealed one black tube measuring 31.52mm long, 23.97mm in diameter, and 3.17mm thick. a. One end of the tube has damage consistent with being cut by a single blade slicing tool. b. Microscopic comparison revealed it could not be determined if Exhibit 3 was cut by Exhibit 1 due to an agreement of class characteristics and insufficient disagreement of individual characteristics. Please note all measurements are approximate.
XVVA38	Observed toolmarks on Item 2 have been produced by Item1. Observed toolmarks on Item 3 have not been produced by Item1.
XW7CN7	Toolmarks present on Item 2 were microscopically examined and identified as having been produced by the Item 1 Apollo brand tool. Toolmarks present on Item 3 were microscopically examined and eliminated as having been produced by the Item 1 tool due to sufficient differences in individual characteristics.
Z7Q3N4	The section of hose Item 2 was identified as having been cut by the hose cutter Item 1. The section of hose Item 3 could not have been cut by the hose cutter of Item 1 due to significant differences in class characteristics.
ZNBTM3	Hypothesis H1: The piece of hose is cut by the hose cutter in the current state. Hypothesis H2: The piece of hose is cut by another hose cutter of the same type. The results of the comparison of the piece of hose (item2) are extremely more probable when hypothesis H1 is true, then when hypothesis H2 is true. The results of the comparison of the piece of hose (item3) are extremely more probable when hypothesis H2 is true, then when hypothesis H1 is true.
ZRPQT6	The questioned toolmarks on Item 2 was made by the suspect’s hose cutter. The questioned toolmarks on Item 3 was not made by the suspect’s hose cutter.

Additional Comments

TABLE 3

WebCode	Additional Comments
2MAH66	The inconclusive resulted from the lack of sufficient agreement or disagreement of individual characteristics between test cuts and item #3.
43CY43	The comparsion has been performed with a comparative microscope using the original material.
7JW92P	Reason for Item 3 Inconclusive Result: Insufficient agreement or disagreement of individual characteristics.
9HFRYV	Toolmarks present on Item #3 were not made by the tool in Item #1.
AEBLWU	The piece of black tubing was unable to be identified or eliminated as having been cut by the tool based on agreement of all discernible class characteristics without agreement or disagreement of individual characteristics.
BP2Y7P	There were sufficient dissimilarities in the pattern of marks on the segment of black hose (Item 3) to enable it to be eliminated as having been cut by the hose cutters (Item 1).
BT26QM	Item 3 exhibited insufficient differences for elimination.
CYTGJX	Inconclusive due to similar class characteristics yet not enough disagreement or agreement of striated individual detail to make an elimination or identification. No patterns of corresponding detail were present.
DAMCWJ	Item 3 could not be identified or eliminated as having been created by Item 1 due to a lack of agreement/disagreement of individual characteristics.
DFCPZT	The piece of black hose (Item 3) could not be conclusively identified or excluded as having been cut by the hose cutter (Item 1). There was agreement of all discernible class characteristics, but no significant agreement or disagreement of the individual characteristics was noted. The piece of black hose (Item 3) could have been cut by the hose cutter (Item 1) or any other tool with similar characteristics.
EZTLTN	An inconclusive finding was made between the toolmarks on Item #3 to the tool in Item #1 because there is insufficient detail of the class and/or individual characteristics for an identification or elimination finding.
FPQLUP	Item 1 shows signs of having been sharpened at some time in the past. Whether during manufacture or between cutting item 2 and item 3. This action could mask or alter the individual characteristics left by item 1.The only result is inconclusive.
G4M3JM	Item 3 was found to be inconclusive because there is agreement in the discernable class characteristics and a lack of agreement or disagreement in the individual characteristics.
GE6NLW	Item 3 is a black colored piece of hose. Due to a lack of sufficient corresponding microscopic marks of value, no conclusion could be reached as to whether the toolmarks present on the Item 3 hose were created by the Item 1 hose cutter.
KCNQKB	Could not eliminate based on class characteristics.
KRGGKD	Class characteristics (specifically the directionality of the striae) of the striated cut marks on both Item #3 and test marks made by Item #1 were examined and compared. Not enough difference in the directionality of some of the test marks (especially the proximal test marks) to render an elimination.
NDRKT7	Test cuts made by the item 1 hose cutter showed sufficient agreement of numerous striations, both coarse and fine. The striations stayed in phase for large segments of the cut. This same agreement was observed on the identification to Item 2. When compared to Item 3, while there was some agreement observed, this was not consistent with what was observed on test to test, or test to Item 2. Additionally, when observing agreement, there were other striations not in agreement in a short distance and quickly out of phase. This was not observed on test to test cuts.
NFGLZF	Although the individual characericts of Item 1 are not reproduced on Item 3, elimination of Item 1 cannot be done without knowledge of how Item 1 has been used over time.

TABLE 3

WebCode	Additional Comments
NXV339	The pipes share similar class characteristics and the marks appear to have been created in a similar way. However, comparison failed to reveal sufficient quantity and quality of individual characteristics to conclude whether or not they were created with the same tool or the same tool that created the test-cuts. This could be due to different resistance/pressure with the hose at time of cutting and/or placement of the hose in the cutting device.
PJAAPL	The individual marks on Item 3 were blurred as if the blade that was used to make the cut was not as sharp. No consecutive matching striated sets of marks were observed.
PQUDWN	Inconclusive (No Conclusion): Inconclusive is an Examiner's conclusion that all observed class characteristics are in agreement but there is insufficient quality and 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. The basis for an inconclusive conclusion is an Examiner's decision 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.
QM6JFD	Item 3 inconclusive to Item 1 due to insufficient matching individual characteristics.
RWPAEB	Item #3 could not be identified or eliminated as being made by Item #1. A microscopic comparison was performed; however, there is insufficient detail of the class and/or individual characteristics for an identification or elimination finding.
TUC2KG	No gross differences in striae and similar tool action; therefore, cannot eliminate.
TZ48KC	The elimination was based on the significant differences in individual characteristics. The questioned toolmarks on Items 2 and 3 have finer details than the test cuts produced by the Item 1 hose cutter. The test cuts from Item 1 could easily be identified to each other. These test cuts have possible presence of subclass characteristics, which were crude and equally spaced.
U4JY8Y	Technical Note: 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.
V4D4ZX	Firearms/Toolmark Identification is an empirical science that relies on objective observations and a subjective interpretation of microscopic marks of value. Subsequent use, misuse, improper handling or preservation of a tool or marked object may result in changes to the individual characteristics of the tool or marked surfaces, as imparted at the time of use, which may affect the possibility of future identification.
VPX7VX	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 firearms/tools. Inconclusive was made because while the class characteristics match and there was some agreement of individual characteristics, reproducibility of Exhibit 3 could not be established. While test marks and Exhibit 2 demonstrate reproducibility of the tool's individual characteristics, there was no second Exhibit that matches with Exhibit 3 to demonstrate that the individual characteristics observed on Exhibit 3 are repeating. For that reason, inconclusive was given.
W9NGHW	Item 3 was designated 'inconclusive' because there is no reasonable way to eliminate based on the observed similar class characteristics of the cut hose and the similar (but different)nature of the

TABLE 3

WebCode	Additional Comments
	individual markings found on the cut portion. Without having any additional suspect specimens available for comparison the most logical conclusion is inconclusive.
X6LV97	A microscopic comparison was performed; however, there is insufficient detail of the class and/or individual characteristics for an identification or elimination finding.
XT79UX	Inconclusive conclusion for Exhibit 3 based on agreement of class characteristics and insufficient disagreement of individual characteristics. Some similarities and differences present. Not enough for identification or elimination.
Z7Q3N4	It appears one side of the toolmarks on Item 3 curves the opposite direction from the toolmarks produced on the test marks made with Item 1. The toolmarks have been cut by a tool with two cutting edges that either come together or pass each other (shear) instead of a single blade cutting tool like Item 1.
ZNBTM3	The term 'extremely more probable' is part of a standard verbal scale (the left column in the table below). This scale is used when the scientist has no or insufficient numerical data to explicitly substantiate a numerical conclusion. The selection of the specific verbal term is based on expert knowledge, experience in research and casework, etc. To promote the transparency for the reader and the uniformity among the different experts our institute has defined the verbal terms numerically. These definitions are expressed in orders of magnitude and are listed in the right column in the table below. For example, the term 'slightly more probable' means that the probability of observing the results of the investigation is 2 to 10 times larger when one hypothesis is true than when the other hypothesis is true. Verbal equivalent Order of magnitude of evidential strength approximately equally probable 1-2 slightly more probable 2-10 more probable 10-100 appreciably more probable 100-10.000 far more probable 10.000-1.000.000 extremely more probable >1.000.000 The conclusion expresses the evidential strength of the results regarding the hypotheses. The conclusion does not represent the probability that a particular hypothesis is true. That probability depends on other evidence and information outside the domain of forensic expertise and falls outside the scope of this report. [Participant submitted manually formatted data that was not transferrable into the final report, therefore, data is presented as is.]
ZRPQT6	The questioned toolmarks on Item 2 was found to have sufficient agreement of individual characteristics with those made using the suspect's hose cutter. The questioned toolmarks on Item 3 was found to have significant disagreement of individual characteristics with those made using the suspect's hose cutter.

-End of Report-
(Appendix may follow)

Collaborative Testing Services ~ Forensic Testing Program

Test No. 20-5281: Toolmarks Examination

DATA MUST BE SUBMITTED BY **June 29, 2020, 11:59 p.m.** TO BE INCLUDED IN THE REPORT

Participant Code: U1234A WebCode: 4U62FY

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 a business' heating oil line. Two of the pressurized heating oil supply hoses were cut. Investigators have a suspect in custody. Later that day, the investigators recovered a hose cutter from the suspect's vehicle. The hose cutter and the sections 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.
-To assist in distinguishing the side of tubing NOT to be examined, the ends of the Item 2 and Item 3 tubing have been marked with white paint.

Items Submitted (Sample Pack T1):
Item 1: Hose cutter recovered from suspect's vehicle.
Item 2: First cut piece of hose. (blue)
Item 3: Second cut piece of hose. (black)

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*
Item 2:	○	○	○
Item 3:	○	○	○

*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.

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only if your laboratory is accredited in this testing/calibration discipline
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Step 1: Provide the applicable Accreditation Certificate Number(s) for your laboratory

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(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)