Collaborative Testing Services, Inc

Forensic Testing Program

P.O. Box 650820
Sterling, VA 20165-0820
e-mail: forensics@cts-interlab.com
Telephone: +1-571-434-1925
Web site: www.cts-forensics.com

Toolmarks Examination Test No. 19-528 Summary Report

Each sample set contained a knife (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 133 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 knife (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 and Item 3 hose pieces were both cut by the Item 1 knife.

ITEMS 1, 2 and 3 (IDENTIFICATION MARKS): Each knife was opened and inspected for defects. The knives were then stabbed into scrap tubing in a downward motion to remove manufacturing residue. The Item 2 blue hose was inserted into the jig and the Item 1 knife was inserted straight downward into the center of the hose and then the knife was pulled straight upward back out. The piece of blue hose was packaged into a pre-labeled Item 2 envelope. The Item 3 red hose was inserted into the jig and the Item 1 knife was inserted straight downward into the center of the hose and then the knife was pulled straight upward back out. The piece of red hose was packaged into a pre-labeled Item 3 envelope. The knife was packaged into a pre-labeled Item 1 envelope. Items 1, 2 and 3 were then immediately assembled into the sample pack box as described below. The above process was repeated until all identification toolmarks had been prepared.

SAMPLE PACK ASSEMBLY: The corresponding Item 1 knife along with the Items 2 and 3 hose were packaged into a pre-labeled sample pack box and 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, 10 randomly selected sample sets were examined by a qualified toolmark examiner who also confirmed the expected results.

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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 knife (Item 1) and two pieces of hose (Items 2 and 3) containing the questioned toolmarks. Participants were requested to determine if the knife could have punctured either of the questioned pieces of hose. Both the Item 2 and Item 3 hoses were punctured by the Item 1 knife. (Refer to Manufacturer's Information for preparation details.)

Of the 133 responding participants, 126 (95%) identified the Item 1 knife as having punctured both the Item 2 and Item 3 hoses. Five participants either eliminated or were inconclusive as to whether the Item 2 and Item 3 hoses had been punctured by the Item 1 knife and two participants eliminated Item 2 and identified Item 3 as having been punctured by the Item 1 knife.

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Examination Results

Were the suspect toolmarks on either hose (Items 2 and 3) produced by the questioned knife (Item 1)?

TABLE 1

WebCode	Item 2	Item 3	WebCode	Item 2	Item 3
29HLGB	Yes	Yes	8TU2NJ	Yes	Yes
2NYJKQ	Yes	Yes	8U8TF2	Yes	Yes
2WTK6B	Yes	Yes	92W2CB	Yes	Yes
2ZAGJ8	Yes	Yes	99F4JE	Yes	Yes
34AFK6	Yes	Yes	9EAWX3	Yes	Yes
38NZLY	Yes	Yes	9KAK9E	Yes	Yes
3U4KHY	Yes	Yes	9NBNXG	Yes	Yes
3W6KHW	Yes	Yes	9XXMNL	Inc	Inc
3W98XP	Yes	Yes	9XZA7Z	Yes	Yes
46ECLY	Yes	Yes	9YXK7A	Yes	Yes
48ZD7D	Yes	Yes	A4FCNL	Yes	Yes
49U4CR	Yes	Yes	AVPU8T	Yes	Yes
49VRXC	Yes	Yes	BA8WB3	Yes	Yes
4B3AV9	Yes	Yes	BWX4ZP	Yes	Yes
4BG7B9	No	No	C73NKX	Yes	Yes
4GBFRE	Yes	Yes	C8CHK4	Yes	Yes
4P4NC6	Yes	Yes	C8F6YW	Yes	Yes
677RB2	Yes	Yes	CFKEZU	Yes	Yes
68FXQB	Yes	Yes	CHWUUV	Yes	Yes
6B3CEK	Yes	Yes	CHYGB9	Yes	Yes
6D4HUQ	Yes	Yes	CHYJZD	Yes	Yes
6FA3JC	Yes	Yes	D66MCK	Yes	Yes
6T7CN9	Yes	Yes	DETEZX	Yes	Yes
72648Y	Yes	Yes	E869K3	Yes	Yes
729QLR	Yes	Yes	EKCNFT	Yes	Yes
7EVQL8	Yes	Yes	EKXR2T	Yes	Yes
7NGWE6	Yes	Yes	ERCFVV	Yes	Yes
7PEAWQ	Yes	Yes	EVA4BG	Yes	Yes
8HNGXW	Yes	Yes	F83ZPN	Yes	Yes

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TABLE 1

WebCode	Item 2	Item 3	WebCode	Item 2	Item 3
FB479Z	Yes	Yes	PVZPDK	Yes	Yes
FBMPFT	Yes	Yes	Q2XNHE	Yes	Yes
FN986P	Yes	Yes	Q8M498	Yes	Yes
GQ78F8	Yes	Yes	QELFZG	Yes	Yes
H33BLL	No	Yes	QRBPRA	Yes	Yes
HPTVDV	Yes	Yes	QRVFME	Yes	Yes
HQAR6V	Yes	Yes	QT6BML	No	No
HX8CXX	Yes	Yes	QU3N78	Yes	Yes
JJKPGP	Yes	Yes	QUGAGU	Yes	Yes
JT9PTT	Yes	Yes	QX4LHL	Yes	Yes
K3VBPX	Yes	Yes	RAQ98D	Yes	Yes
K4NYR7	Yes	Yes	RNA3DB	Yes	Yes
K6MYZJ	Yes	Yes	T78HFM	Yes	Yes
KB832U	Yes	Yes	T7QK4B	Yes	Yes
KBBPGM	No	Yes	TD69XD	Yes	Yes
KBKQ3L	Yes	Yes	TUW4EA	Yes	Yes
KQ2KXJ	Yes	Yes	U3393K	Yes	Yes
KRRZPV	Yes	Yes	UC6UL4	Yes	Yes
L3P92H	Yes	Yes	UQBNHM	Yes	Yes
LE3D9D	Yes	Yes	UTG4VK	Yes	Yes
LUTFQ3	Yes	Yes	UYMAJJ	Yes	Yes
MBZR3T	Yes	Yes	V6M98D	Yes	Yes
MJT39H	Yes	Yes	VBCQRW	Yes	Yes
MMPTET	Yes	Yes	VEVBJJ	Yes	Yes
N7339L	Yes	Yes	VHMKL6	Yes	Yes
ND74EM	Yes	Yes	VLRFMF	Yes	Yes
NHGMHM	Yes	Yes	WAXLPC	Yes	Yes
NHVJXM	Yes	Yes	WBLMFD	Yes	Yes
NLV8JG	Yes	Yes	WDWXLC	Yes	Yes
NURZUW	Yes	Yes	WXWQCU	Yes	Yes
PL4YMH	Yes	Yes	X6DGJ8	Yes	Yes
PQQCWL	Yes	Yes	XATYTB	Inc	Inc

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TABLE 1

WebCode	Item 2	Item 3	WebCode	Item 2	Item 3
XVACMK	Yes	Yes			
XVNXY8	Yes	Yes			
Y2R2MK	Yes	Yes			
YLGBQ8	Yes	Yes			
YQD3WH	Yes	Yes			
YQRYBH	Yes	Yes			
YU87GA	Yes	Yes			
YVJXAQ	Yes	Yes			
Z7KK2N	Inc	Inc			
Z7Y6RC	Yes	Yes			
Z9UXYC	Yes	Yes			

Response Summary

Total Participants: 133

Were the suspect toolmarks on either hose (Items 2 and 3) produced by the questioned knife (Item 1)?

		ITEM 2	ITEM 3
Responses	Yes	**126** *(94.7%)*	**128** *(96.2%)*
	No	**4** *(3.0%)*	**2** *(1.5%)*
	Inc	**3** *(2.3%)*	**3** *(2.3%)*

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Conclusions

TABLE 2

WebCode	Conclusions
29HLGB	The Item 1 knife has no apparent damage, missing parts, and sign of wear and tear. The knife was functional as received. The questioned toolmarks on the submitted Items 2 and 3 hoses were caused by the bladed edge of the Item 1 knife.
2NYJKQ	Exhibit 1 is a folding knife that measures approximately 4 ½ inches in length. With the blade extended, the approximate total length is 8 inches. The blade length by itself is approximately 3 ½ inches. Exhibit 2 is a section of a blue hose approximately 2 inches in length that has a puncture measuring approximately 3/4th inches in length in the middle of the hose. Exhibit 3 is a section of a red hose approximately 2 inches in length that has a puncture measuring approximately 11/16th inches in length in the middle of the hose. Using laboratory supplied casting material, casts were made of the punctures on Exhibits 2 and 3. The casts were labeled Exhibits 2.T1 and 3.T1 and were microscopically compared to each other. Based on an agreement of class characteristics and sufficient agreement of individual characteristics, Exhibits 2.T1 and 3.T1 were made by the same tool. Using Exhibit 1 and the additional hose substrates that were submitted, a puncture was made in the additional hose. A test cast was made of the puncture and labeled Exhibit 1.T1 and was microscopically compared to Exhibit 2.T1. Based on an agreement of class characteristics and sufficient agreement of individual characteristics, Exhibits 2.T1 and 3.T1 were made by the Exhibit 1 knife. The probability that another knife was used to puncture Exhibits 2 and 3 is so remote as to be considered negligible. These conclusions conform with the relevant [Department] policy available at [Website].
2WTK6B	The cuts in the Item 2 and Item 3 rubber tubes were microscopically compared to test cuts made using the Item 1 folding knife with POSITIVE RESULTS. The two tubes were cut with the Master USA folding knife.
2ZAGJ8	Item 1 is a "MASTER USA" brand folding knife. Toolmarks present on the Item 2 and Item 3 pieces of hose were identified as having been produced by the Item 1 folding knife.
34AFK6	As a result of my examination, I formed the opinion that the two sections of hose had been punctured by the exhibit knife.
38NZLY	Items 1, 2 and 3 were examined and analyzed using microscopy. Toolmarks present on Items 2 and 3 were identified as having been produced by Item 1.
3U4KHY	The two cut hoses (1-02 and 1-03) were identified as having been cut by the knife due to consistent and repeatable marks.
3W6KHW	Items A1-1, A1-2, and A1-3: Toolmarks observed on the items A1-2 and A1-3 pieces of hose are consistent in class characteristics with the item A1-1 submitted knife. Item A1-1 was compared to items A1-2 and A1-3. Toolmarks present on the items A1-2 and A1-3 pieces of hose were examined, compared microscopically and identified as having been produced by the item A1-1 knife.
3W98XP	Item 1.1 is a Master USA brand knife. Items 1.2 and 1.3 are two punctured pieces of hose. The damage to Items 1.2 and 1.3 were microscopically examined to the tests made using Item 1.1. Based on agreement of all discernable class characteristics and sufficient corresponding individual detail, Item 1.1 was identified as having caused the damage to Items 1.2 and 1.3.
46ECLY	The submitted hoses, items 2 and 3, were punctured by the submitted knife, item 1.
48ZD7D	A hole was made in the extra hose using the item No. 1 knife, and the seal was used to make the pattern. The cross section of the traces in the hole and the cross sections of the traces in the holes in the items 2 and 3 were compared . As a result, it was confirmed that stripe marks match.
49U4CR	Test toolmarks created using Item 1 were microscopically examined with the toolmarks on Items 2 and 3. Based on these examinations it, was determined that the knife in Item 1 created the marks on Items 2 and 3.
49VRXC	An agreement of class characteristics and a sufficient agreement of individual characteristics were observed between Exhibits 2 and 3 (hoses) and Exhibit 1 (knife). Thus, it was concluded that the

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TABLE 2

WebCode	Conclusions
	toolmarks on Exhibits 2 and 3 were made by Exhibit 1.
4B3AV9	Item 1 was used to make test marks for comparison to Items 2 and 3. The test marks were returned to the agency. Items 2 and 3 were identified as having been cut by Item 1. All of the unused hose from Item 1 was also returned to the agency.
4BG7B9	The examination of the represented Item 2 and Item 3 (hose) was carried out with the comparison microscope "Leica FS C" and : National". the differences where identified between the toolmark arrangements, which gives us thought to conclude that the represented items 2 and 3 where not cut by the knife recovered from the suspect.
4GBFRE	A hole was made in the extra hose using the item No. 1 knife, and the seal was used to make the pattern. The cross section of the traces in the hole and the cross sections of the traces in the holes in the items 2 and 3 were compared . As a result, it was confirmed that stripe marks match.
4P4NC6	Test toolmarks were created using the Master USA knife, Item 1, and microscopically compared to the punctured polymer hose segments, Items 2 and 3. Based on agreement of discernible class characteristics and sufficient corresponding individual detail, the punctured polymer hose segments, Items 2 and 3, were identified as having been punctured by the Master USA knife, Item 1.
677RB2	The cuts in items #2 and 3 were microscopically identified as having been cut by the submitted Master USA knife item #1.
68FXQB	The known pocket knife, item 1, is identified as the source of the questioned toolmark impressions on items 2 and 3, based on macro and microscopic examinations.
6B3CEK	Item 1 was examined and used to produce test specimens for comparative analysis. Items 2 and 3 were microscopically inter-compared and compared with test specimens produced by the Item 1 tool, revealing correspondence of class characteristics and individual distinguishing characteristics. It was concluded that Items 2 and 3 were made by the Item 1 tool.
6D4HUQ	Visual examination of the blue and red PVC hoses (Items 2 and 3) revealed damage consistent with that produced by a sharp bladed instrument. Microscopic examination and comparison of the blue and red PVC hoses (Items 2 and 3) revealed sufficient agreement of individual characteristics to conclude that the damage was created by the Master USA knife (Item 1).
6FA3JC	The toolmark impressions in “ITEM2” and “ITEM 3” were found to show agreement in class characteristics and individual characteristics with a test impression made with “ITEM 1 knife” such that, in our opinion, both of the suspect toolmark impressions (“ITEM 2” and “ITEM 3”) were made by the submitted “ITEM 1 knife”.
6T7CN9	The portion of blue hose (Item 2) displayed an area of damage consistent with having being punctured by a blade. The portion of red hose (Item 3) displayed an area of damage consistent with having being punctured by a blade. Using the knife (Item 1)and the supplied portions of blue and red hose, I created four tests for microscopic comparison purposes. Based on a microscopic examination I determined that the knife (Item 1) was used to puncture the blue hose (Item 2) and the red hose (Item 3).
72648Y	A visual examination of Item#01.01 revealed it is commercially marketed and commonly called a "Spring Assisted Knife." Microscopic examination and comparison of the test puncture toolmarks (Made with the submitted knife, Item 01.01) with the questioned submitted toolmarks (On item #01.02 and #01.03) revealed sufficient agreement of individual characteristics to conclude that they had been cut/punctured by Item 01.01, the submitted knife.
729QLR	Test toolmark cuts from item 1 were microscopically examined with the toolmarks present on Item 2 and Item 3. Based on these comparative examinations, it was determined that the toolmarks present on Item 2 and Item 3 had been produced by Item 1.
7EVQL8	The puncture toolmarks noted in the two pieces of tubing (Items 2 and 3) were identified as having been made by the knife (Item 1).
7NGWE6	The evidence in items 1, 2, and 3 was analyzed by physical and microscopic examination. The toolmarks present on the first and second punctured hoses in items 2 and 3 were determined to have

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TABLE 2

WebCode	Conclusions
	been made by the knife in item 1.
7PEAWQ	Test toolmarks made by the knife in Item 1 were microscopically examined in conjunction with the toolmarks present on the hoses in Items 2 and 3. Based on these comparative examinations, it was determined that the toolmarks on the hoses in Items 2 and 3 were made by the knife in Item 1.
8HNGXW	As a result of the microscopic comparison it is certain, that the toolmarks on the hoses marked as "Item 2" and "Item 3" have been produced by the knife marked as "Item 1".
8TU2NJ	The toolmarks exhibited in the punctures in Item 2 and Item 3 were microscopically compared to test toolmarks made with the Item 1 knife, and the Item 1 knife was identified as having made the punctures in Item 2 and Item 3.
8U8TF2	The item 1 knife is identified as having cut the item 2 and the item 3 hoses.
92W2CB	Due to corresponding characteristics found on the punctured surfaces of the item 2 (blue) and characteristics on punctured surface of the questioned knife (item 1) the first punctured hose (item 2, blue) was produced by questioned knife. Due to corresponding characteristics found on the punctured surfaces of the item 3 (red) and characteristics on punctured surface of the questioned knife (item 1) the second punctured hose (item 3, red) was produced by questioned knife.
99F4JE	In my opinion, the findings show conclusively that Item 1 was used to cause damage to Item 2 and Item 3.
9EAWX3	The knife in Item 1 was used to puncture the hose in Item 2 and Item 3.
9KAK9E	1. The toolmark present on the piece of hose (blue)described in item 2, was produced by the tool(knife)described in Item 1. 2. The toolmark present on the piece of hose (red) described in item 3 (red), was produced by the tool(knife)described in item 1.
9NBNXG	The hoses submitted as Items 2 and 3 were examined and microscopically compared to tests made with the knife submitted as Item 1. Items 2 and 3 were punctured by Item 1.
9XXMNL	Puncture marks on Items 2 and 3 were microscopically examined in conjunction with one another and with test toolmarks produced using Item 1. Based on these comparative examinations and observed class and individual characteristics, it was determined that: A. The puncture marks on Items 2 and 3 were produced by the same tool as one another. B. The puncture marks on Items 2 and 3 bear similar class and individual characteristics as the test toolmarks produced using Item 1; however, these similarities are insufficient for a conclusive determination.
9XZA7Z	Test toolmarks were created using the Master USA folding knife, Item 1, and microscopically compared to the sections of punctured tubing, Items 2 and 3. Based on agreement of discernible class characteristics and sufficient corresponding individual detail, the sections of punctured tubing, Items 2 and 3, were identified has having been created using the Master USA folding knife, Item 1.
9YXK7A	The toolmarks in Item 2 and Item 3 were made by the submitted knife (Item 1).
A4FCNL	Examination of the rubber tubing submitted in Items 2 and 3 revealed the presence of toolmarks. The toolmarks present on Items 2 and 3 were microscopically compared in conjunction with test cuts produced by the knife submitted in Item 1. Based on these microscopic comparisons, it was determined that the rubber tubing submitted in Items 2 and 3 had been cut by the knife submitted in Item 1.
AVPU8T	The submitted blue hose, Item 01-02,and the submitted red hose, Item 01-03, were punctured by the submitted tool, Item 01-01.
BA8WB3	Exhibit 2 and 3 consist of two pieces of cut hoses that were visually and microscopically examined for the presence of toolmarks, and toolmarks of value for comparison were found. A microscopic comparison was conducted between Exhibits 2 and 3 and test cuts from Exhibit 1. There is agreement of all discernible class characteristics and sufficient agreement of individual characteristics to determine that the Exhibits 2 and 3 hoses were cut by the Exhibit 1 knife.
BWX4ZP	Toolmarks present on Items 2 and 3 were microscopically examined and identified as having been produced by Item 1. Four (4) tests produced using Item 1 are being returned as Item 1T in Container

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TABLE 2

WebCode	Conclusions
	1 and should be maintained for possible future examinations.
C73NKX	The cut on Laboratory Item (001.B) (Item 2) first punctured hose recovered from the construction site (blue) is identified as having been made by Laboratory Item (001.A) (Item 1) Master brand knife recovered from the suspect. The items are identified as to sharing a common source because there is agreement of all discernible class characteristics and sufficient agreement of a combination of individual characteristics where the extent of agreement exceeds that which can occur in the comparison of toolmarks made by different tools and is consistent with the agreement demonstrated by toolmarks known to have been produced by the same tool. The cut on Laboratory Item (001.C) (Item 3) second punctured hose recovered from the construction site (red) is identified as having been made by Laboratory Item (001.A) (Item 1) Master brand knife recovered from the suspect. The items are identified as to sharing a common source because there is agreement of all discernible class characteristics and sufficient agreement of a combination of individual characteristics where the extent of agreement exceeds that which can occur in the comparison of toolmarks made by different tools and is consistent with the agreement demonstrated by toolmarks known to have been produced by the same tool.
C8CHK4	Item CTS 1 knife was used to puncture Items CTS 2 and CTS 3 hoses.
C8F6YW	The laboratory examinations of the one knife (item 1) and two punctured hoses (item 2 and item 3) were analysed with the application of the comparison microscope Leica FSC. The enclosed evidence materials (item 1) as well as the comparative material obtained with the punctured hoses (item 2 and 3) were examined in order to find the presence of individual characteristics on their surfaces. Our laboratory found only a few similar individual characteristics in the evidence knife and on the blue and red punctured hoses marked item 2 and 3. It was not enough for a categorical answer. Our answer is “probably yes” but in the survey only three options are given, “yes”, “no” or “inconclusive”.
CFKEZU	this is the tool that produced this marks
CHWUUV	The findings of the examination of the knife (Item 1) and both punctured hoses (Items 2 and 3) are extremely more probable if the punctures were caused by the knife (Item 1) than if the punctures were caused by another knife.
CHYGB9	(Item 1) the Knife recovered from the suspect was used in puncturing (item 2 and 3) the blue, and the red hose recovered from the construction site.
CHYJZD	Examinations showed that the puncture marks found on Item 2 and Item 3 were made by Item 1.
D66MCK	1. Examinations showed the tool marks on Item 2 were made by Item 1. 2. Examinations showed the tool marks on Item 3 were made by Item 1.
DETEZX	Test toolmarks created using the folding knife, Item 1, were microscopically compared to the toolmarks exhibited on the sections of tubing, Items 2 and 3. Based on agreement of discernible class characteristics and sufficient corresponding individual detail, the toolmarks exhibited on the sections of tubing, Items 2 and 3, were identified as having been created using the folding knife, Item 1.
E869K3	The toolmarks on the submitted blue and red hoses (Item 2 and Item 3) were made by the submitted knife (Item 1).
EKCNFT	Item 1 is a single edge folding knife marketed under the name Master USA. Toolmarks present on the Item 2 and Item 3 hoses were identified as having been produced by the Item 1 knife.
EKXR2T	I compared the cut hoses item 2 and 3 with each other and found sufficient agreement of individual marks for identification. The cuts in items 2 and 3 were both made by the same blade. I compared cut hoses item 2 and Item 3 with test cut (both sides of the blade) made by the knife item 1. I found sufficient agreement of individual stria between item 2, Item 3 and test cuts made by the knife item 1 (left side and right side) for identification. Item 1 cut both the hoses item 2 and 3.
ERCFVV	After making a hole in the hose given extra by using the item No. 1 knife, I compared between the toolmark in the cross-section of the hole made by the knife and the toolmarks in the cross-section of hole in the item No. 2 and No. 3 hose. As a result, it was confirmed that tool marks match.
EVA4BG	Item 1 contains a Master USA model MU-A005 stainless steel folding blade knife with a Nylon Fiber

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TABLE 2

WebCode	Conclusions
	handle. Test toolmarks produced by Item 1 were microscopically examined in conjunction with the toolmarks on the hoses in Item 2 and Item 3. Based on these comparative examinations and observed class and individual characteristics, it was determined that the toolmarks on Items 2 and 3 had been produced by the knife in Item 1.
F83ZPN	MICROSCOPIC COMPARISONS OF EVIDENCE TOOLMARKS ITEMS 2 AND 3 (BLUE AND RED CUT PORTIONS OF HOSE) WITH TEST TOOLMARKS CREATED WITH K1 SUSPECT KNIFE (ITEM 1) REVEAL THAT TOOLMARKS ON BOTH CUT PORTIONS OF HOSE (ITEMS 2 AND 3) WERE CREATED BY K1 SUSPECT KNIFE (ITEM 1).
FB479Z	1. Examination of Exhibit 1 revealed one "Master USA" brand folding blade knife. Exhibit 1.1 was created in the provided tubing and is being returned with Exhibit 1. 2. Examination of Exhibit 2 revealed one blue colored tube measuring 50.23mm long, 25.33mm in diameter, and 2.56mm thick with a cut in the approximate middle of the tube consistent with damage caused by a single blade slicing tool. 3. Examination of Exhibit 3 revealed one red colored tube measuring 50.51mm long, 25.78mm in diameter, and 3.41mm thick with a cut in the approximate middle of the tube consistent with damage caused by a single blade slicing tool. 4. Microscopic comparison revealed the damage on Exhibits 2 and 3 was caused by Exhibit 1 due to an agreement of class and sufficient agreement of individual characteristics. Please note all measurements are approximate. TECHNICAL NOTES: Class characteristics are defined as measurable features of a tool which indicate a restricted group source. The result from design features and are determined prior to manufacture of the tool. Individual characteristics are defined as marks produced by the random imperfections or irregularities of 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 toolmark was made by specific tool are not to the absolute exclusion of all other tools because it is not feasible to examine all a possible tools. However, observing this amount of agreement form a different source is considered extremely remote.
FBMPFT	The puncture marks in Items 001-2 and 001-3 were produced by the submitted knife (Item 001-1).
FN986P	Item 1-1-1 (CTS item 1) folding knife is a single bladed tool with two cutting sides. Item 1-1-1 (CTS item 1) was used to produce puncture defects for test toolmarks in item 1-4 (CTS item 4) plastic tubing. Item 1-2-1 (CTS item 2) and item 1-3-1 (CTS item 3) are pieces of plastic tubing each having one puncture defect. Both puncture defects were made by a single bladed tool having two cutting sides. Due to agreement of all discernible class characteristics, toolmarks observed in the puncture defects on item 1-2-1 (CTS item 2) and item 1-3-1 (CTS item 3) were microscopically compared to the test toolmarks produced with item 1-1-1 (CTS item 1). The puncture defects in item 1-2-1 (CTS item 2) and item 1-3-1 (CTS item 3) were identified as having been produced by the item 1-1-1 (CTS item 1) folding knife. These identification conclusions are based on sufficient similarities in the patterns of microscopic markings observed among the compared items.
GQ78F8	1) Examinations showed the tool marks on Item 2 and Item 3 were produced by Item 1.
H33BLL	Microscopic comparison examinations were conducted between Q-1/Q-2 and test tool marks made with K-1, resulting in the conclusions: Q-1 was not made with K-1. This elimination was due to sufficient disagreement of individual characteristics. Q-2 was made with K-1. This identification was based on sufficient agreement of individual characteristics.
HPTVDV	The knife is in all probability used for cutting both hoses.
HQAR6V	The toolmark on the hose (item 2) was caused by the knife (item 1). The toolmark on the hose (item 3) was caused by the knife (item 1).
HX8CXX	1-By conducting technical tests and microscopic comparisons between the effects on the two pieces (item (2)&(3)), the correlation between the effects was shown, indicating that one tool was used in cutting the two pieces. 2-The technical analysis and microscopic comparisons between the effects on the two pieces of the hoses (item (2)&(3)) and the effects of the shear experiments using the incoming knife (item 1) showed the correlation between the effects, indicating that the incoming knife is used for cutting Item (2) and (3).
JJKPGP	Comparison microscope examinations were conducted and it is the finding of this examiner that the

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TABLE 2

WebCode	Conclusions
	toolmarks found in the submission 001-2 and 001-3 tubing were made by the submission 001-1 knife.
JT9PTT	The toolmarks present in the cutting area of the either hose (Items 2 and 3) are identified as produced by the knife identifies as Item 1.
K3VBPX	Item 1 is a knife manufactured by Master USA. The Item 1 knife was identified as having created the toolmarks present on the Item 2 and Item 3 pieces of plastic hose.
K4NYR7	Item 1 (knife) made the toolmarks on Items 2 and 3 (two pieces of punctured hose).
K6MYZJ	Tool Mark Analysis: Methodology - Comparison Microscopy: Test marks were made with Item 1, the lock-blade knife, 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 Items 2 and 3, the hoses, was made with Item 1, the single lock-blade knife, based upon corresponding class and individual microscopic characteristics.
KB832U	A microscopic examination and comparison of the questioned cuts on item #2 and item #3 was made with test cuts produced on the full supply hoses by item #1 (knife). Items #2 and #3 were identified as being cut by the submitted knife, item #1 due to the significant agreement seen in the class and individual characteristics during comparison.
KBBPGM	The pocket knife (Item 1) was opened and inspected as to any defects. Afterwards test cuts were made. These test cuts were compared to Item 2 and Item 3. Both hoses (Item 2 + Item 3) were punctured by knifes. The suspects knife (Item 1) was not used to puncture the submitted hose (Item 2). The suspects knife (Item 1) was used to puncture the submitted hose (Item 3).
KBKQ3L	The Item 3 toolmark was identified as having been produced by Item 1. The Item 2 toolmark was identified as having been produced by Item 1.
KQ2KXJ	The puncture toolmark in the Item 2 blue hose was produced, within the limits of practical certainty1, by the Item 1 knife. The puncture toolmark in the Item 3 red hose was produced, within the limits of practical certainty1, by the Item 1 knife.
KRRZPV	Examination of the two sections of hose labeled Item 2 and Item 3 revealed, on each of them, the presence of a puncture type toolmark. This mark has general characteristics compatible with the knife labeled Item 1. For comparison purpose, we produced test toolmarks using Item 1 and hose samples of similar size, shape and flexibility to those of Item 2 and Item 3. These test toolmarks were examined and compared with the toolmarks on Item 2 and Item 3 under a comparison microscope. There is sufficient agreement of discernible class characteristics and individual characteristics to determine that Item 1 produced the toolmarks on Item 2 and Item 3.
L3P92H	Comments: MICROSCOPIC COMPARISON OF EVIDENCE CUT PIECES OF HOSE ITEM 2 Q1 AND ITEM 3 Q2 WITH TEST CUTS FROM ITEM 1 K1 KNIFE REVEALED SUFFICIENT AGREEMENT OF INDIVIDUAL CHARACTERISTICS EXISTS TO IDENTIFY ITEM 2 Q1 AND ITEM 3 Q2 AS HAVING BEEN CUT WITH ITEM 1 K1. “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 .
LE3D9D	2019-528: Toolmarks Examination: The following findings reflect the professional opinion of the examiner authoring this report. Examination of Item 1 revealed one (1) Master USA brand, folding knife with belt clip. Test punctures were created by Item 1. Examination of Item 2 revealed one (1) punctured blue rubber hose. Examination of Item 3 revealed one (1) punctured red rubber hose. Microscopic examination of the test punctures created by Item 1 with the punctures on Items 2 & 3 revealed the punctures observed on Items 2 & 3 were created by the submitted knife (Item 1).
LUTFQ3	1. Examinations showed that the tool marks present on Item 2 were produced by Item 1. 2. Examinations showed that the tool marks present on Item 3 were produced by Item 1.
MBZR3T	1. Exhibit 1 is a Master USA brand folding knife which was used to create test standards, Exhibit 1.1, which will be retained in the laboratory. 2. Exhibit 2 is a blue colored tube that is 2 inches long, 1 inch

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TABLE 2

WebCode	Conclusions
	in diameter, and 1/8 inch thick with damage present in the approximate center. 3. Exhibit 3 is a pink colored tube that is 2 inches long, 1 inch in diameter, and 1/8 inch thick with damage present in the approximate center. 4. Microscopic comparison identified Exhibit 1 as the cause of the damage on Exhibits 2 and 3 based upon agreement of class characteristics and sufficient agreement of individual characteristics. Please note that all measurements are approximate. TECHNICAL NOTES: Class characteristics are defined as measurable features of a tool which indicate a restricted group source. The result from design features and are determined prior to manufacture of the tool. Individual characteristics are defined as marks produced by the random imperfections or irregularities of 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 toolmark was made by specific tool are not to the absolute exclusion of all other tools because it is not feasible to examine all a possible tools. However, observing this amount of agreement form a different source is considered extremely remote.
MJT39H	The toolmarks on the sections of hose marked "Item 2" and "Item 3" were made by the knife marked "Item 1".
MMPTET	A hole was made in the extra hose using the item No. 1 knife, and the seal was used to make the pattern. The cross section of the traces in the hole and the cross sections of the traces in the holes in the items 2 and 3 were compared . As a result, it was confirmed that stripe marks match.
N7339L	Results of Examinations: Item 1 is a single bladed knife marketed by Master. The Item 1 knife was identified as having created the toolmarks present on the Item 2 and Item 3 hoses.
ND74EM	I conducted a microscopic comparison examination of exhibit Items 2 & 3 with test cuts (puncture) produced in exemplar material using Item 1. A comparison of casts from Item 2 with those of Item 1 resulted in an identification. A comparison of casts from Item 3 with those of Item 1 also resulted in an identification. In my opinion the knife (Item 1) created the toolmarks observed in the damaged hoses of both Items 2 & 3.
NHGMHM	The knife (Item 1) was used to make test cuts (punctures) in the supplied blue hose material. The toolmarks in these test cuts were then microscopically compared with the toolmarks in the cuts (punctures) in Item 2 and Item 3. These microscopic comparisons revealed that the cuts have the same class of knife-produced marks and sufficient corresponding individual marks to conclude that the knife (Item 1) produced the puncture toolmarks in the blue hose (Item 2) and the red hose (Item 3).
NHVJXM	The blue and red hoses (Items 2 and 3) were punctured by the Master brand knife (Item 1).
NLV8JG	The toolmarks on Items 2 and 3 hoses and test toolmarks made using the Item 1 knife were examined and microscopically compared to each other. The results are that the toolmarks on Items 2 and 3 were identified as having been made by the Item 1 knife.
NURZUW	I consider the correspondence observed between the cut faces on both fuel hoses and the test cuts produced by the recovered knife (in terms of random characteristic features) to be of utmost significance. As such, it is my opinion that both of the fuel hoses were punctured by the recovered knife
PL4YMH	The toolmarks observed on Items 2 and 3 were produced by the tool in Item 1, based on agreement observed in individual characteristics.
PQQCWL	Item 1 was identified as having cut Item 2 and Item 3. Test cuts made using Item 1 were assigned Property ID "Test1" and were transferred to the Firearms Unit non-case storage.
PVZPDK	The tool marks on the Item 2 and Item 3 hose, were identified as having been made by the Item 1 knife.
Q2XNHE	The test toolmarks produced with the knife (Item 1) and the toolmarks exhibited by the tubing (Items 2 & 3) were microscopically examined and compared. Based on the observed agreement of their class characteristics and sufficient agreement of their individual characteristics, the knife (Item 1) is identified as being the tool that produced the toolmarks in the tubing (Items 2 & 3).
Q8M498	Comparative microscopic examination of the toolmarks located on Item #2 and Item #3 and test punctures from the knife in Item #1 revealed that both Item #2 and Item #3 had been punctured by

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TABLE 2

WebCode	Conclusions
	Item #1.
QELFZG	Results of Examinations: Item 1 is a Master folding knife that uses a slicing action. Toolmarks present on the Item 2 and Item 3 hoses were identified as having been produced by the Item 1 knife.
QRBPRA	The folding knife, item 1, was examined and tests were created in the submitted exemplar tubing. The test stab areas were cast and microscopically compared to the casts made from the stab marks in the tubing in items 2 and 3. The folding knife, item 1, was identified as having made the stab marks in items 2 and 3.
QRVFME	Having conducted a tool mark comparison between items 1 (knife) and items 2 and 3 (Piece of stabbed pipe) I formed the following opinion: Item 1 (knife) was responsible for producing the cuts in the pipe, item 2 and item 3 as there was 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 toolmarks made by different tools and is consistent with the agreement demonstrated by toolmarks known to have been produced by the same tool.
QT6BML	Item 2 and Item 3 could be created by the same tool.
QU3N78	Examinations showed the tool marks present on Item #2 were produced by Item #1. Examinations showed the tool marks present on Item #3 were produced by Item #1.
QUGAGU	Item 1, the submitted folding pocket knife, was examined. The knife has a single blade with a smooth cutting edge. No potential subclass characteristics were observed along the working surfaces (cutting edges) of the blade. The knife was used to make test puncture marks in the plastic 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 punctured tubing, were examined. The puncture marks of both items had class characteristics similar to the test cuts produced using Item 1. Silicone rubber casts were made of the test puncture marks and the puncture marks in Items 2 and 3. The test marks from Item 1 were microscopically compared to Items 2 and 3. Sufficient agreement was observed between the individual striae on the test cuts from Item 1 and those on Items 2 and 3 to conclude that Items 2 and 3 were cut by Item 1.
QX4LHL	The punctures present in the two pieces of tubing (item 2 and 3) were identified as having been produced by the Master USA brand knife (item 1). Agreement of the characteristics is sufficient to determine that the knife is the source of the toolmarks.
RAQ98D	Toolmark Analysis: Methodology: Physical (Visual Examination), Microscopy (Comparison Microscope): Test marks were made with Item 1, the Master knife, using submitted standard testing media. The tool marks on Items 2 and 3, the rubber hoses, were made with Item 1, the Master knife, based upon corresponding class and individual microscopic characteristics. Item 1A, the test marks, was sealed in a manila envelope and will be retained in the laboratory for possible future analysis.
RNA3DB	The Item 01-01 knife was identified as having made the punctures in both the Item 01-02 blue tubing and the Item 01-03 red tubing. A portion of the Item 01-04 blue tubing was used in the generation of test toolmarks. No analysis was performed on the Item 01-05 red tubing.
T78HFM	Test marks made with the knife, Item 1, were compared to the toolmarks in hoses, Items 2 & 3, using a comparison microscope. There were sufficient agreement of class and individual characteristics to determine that the marks had been caused by the knife.
T7QK4B	The puncture on the blue hose in item 2 and the puncture on the red hose in item 3 were made by the knife in item 1.
TD69XD	Observed toolmarks on item2 and item3 have been produced by item1.
TUW4EA	Tool Mark Analysis: Methodology - Comparison Microscopy: Test marks were made with Item 1, the folding knife, using submitted testing media. The tool mark on Item 2, the blue PVC hose, was made with Item 1, the folding knife, based upon corresponding class and individual microscopic characteristics. The tool mark on Item 3, the red PVC hose, was made with Item 1, the folding knife, based upon corresponding class and individual microscopic characteristics. Items 1A, 2A and 3A, the test marks and casts, were each sealed in a manila envelope and will be returned with the evidence to the submitting agency.

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TABLE 2

WebCode	Conclusions
U3393K	Macroscopic examination and microscopic comparison of Exhibits 1 through 3 determined the following: Exhibit 1 is a folding, lock back knife with a single-edged blade that employs a slicing action. Test toolmarks were produced using the Exhibit 1 knife and designated 1-T1 through 1-T3. The Exhibit 2 blue hose and Exhibit 3 red hose were examined for the presence of comparable toolmarks, and each was found to contain a puncture cut, indicative of a slicing action tool, with toolmarks of value for comparison. Microscopic comparisons were conducted between the Exhibit 1 test toolmarks and the toolmarks observed on Exhibit 2 and Exhibit 3. Based on agreement of all discernible class characteristics and sufficient correspondence of individual characteristics, the Exhibit 1 knife was identified as having produced the toolmarks located on the Exhibit 2 blue hose and the Exhibit 3 red hose. An identification conclusion indicates the probability that Exhibits 2 and 3 were cut by a different tool is so small that it is negligible.
UC6UL4	Toolmarks present on Items 2 and 3 were microscopically examined and identified as having been cut by the Item 1 knife.
UQBNHM	A hole was made in the extra hose using the item No. 1 knife, and the seal was used to make the pattern. The cross section of the traces in the hole and the cross sections of the traces in the holes in the items 2 and 3 were compared . As a result, it was confirmed that stripe marks match.
UTG4VK	1) Exhibit 1 (One Master USA Brand Knife) is designed to be used as a single blade slicing tool. Exhibit 1.1 (Test Standards) was created for comparison and is being returned with Exhibit 1. 2) Exhibits 2 (One Blue Polymer Tube) and 3 (One Red Polymer Tube) were visually examined and microscopically compared to test toolmarks from the Exhibit 1 knife. The Exhibits 2 and 3 tubing were altered to facilitate microscopic comparisons. a) It was concluded that the Exhibit 1 knife caused the damage on the Exhibits 2 and 3 tubing based on an agreement of class characteristics and a sufficient agreement of individual characteristics.
UYMAJJ	In my opinion, there is conclusive support for the proposition that both pieces of pipe, Items 2 and 3, were cut by the submitted knife, Item 1.
V6M98D	The toolmarks on the two pieces of hose from the construction site (items 2 and 3) were made with the knife recovered from the suspect (Item 1). Test marks made by puncturing the hose substrate with the knife (Item 1) were microscopically compared to each of the toolmarks on the two pieces of hose (items 2 and 3) and identifications were made based on sufficient corresponding individual characteristics observed.
VBCQRW	Tests were made with the submitted knife, Item #1. These tests were compared microscopically with the defects in the submitted pieces of tubing, Items #2 and #3. There is agreement in all discernible class characteristics and sufficient agreement in corresponding individual characteristics for identification. The defects in Item #2 and #3 were made by the submitted knife, Item #1.
VEVBJJ	1. Exhibit 1 is a Master brand model MU-A005, folding knife. a. Exhibit 1 was used with the supplied fuel hose test material to create the Exhibit 1.1 test standards, which are being returned with Exhibit 1. 2. Exhibit 2 and Exhibit 3 are two cut fuel hoses which were microscopically compared to the Exhibit 1 test standards. a. Microscopic comparison disclosed sufficient agreement of class and individual characteristics to conclude that Exhibit 2 and Exhibit 3 were both cut by the Exhibit 1 knife. 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.
VHMKL6	EVIDENCE SUBMITTED: Lab Item # Agency Item # Description 1 T1 One (1) cardboard box containing: 1.1 T1 One (1) Master brand folding knife. 1.2 T1 One (1) section of blue tubing 1.3 T1 One (1) section of red tubing. CONCLUSIONS OF ANALYSIS: The two (2) toolmarks in the tubing,

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TABLE 2

WebCode	Conclusions
	items 1.2 and 1.3, were each identified as having been made by the Master brand folding knife, item 1.1. [Participant submitted manually formatted data that was not transferrable into the final report, therefore, data is presented as is.]
VLRFMF	Identification: Item 2 and Item 3 were punctured by Item 1.
WAXLPC	Results of Examinations: Item 1 is a Master USA brand single edge folding knife. Item 2 and Item 3 are sections of hose containing toolmarks that were produced with a puncture-type action. The Item 2 and Item 3 hoses were identified as having been punctured by the Item 1 knife.
WBLMFD	The evidence in items 1, 2, and 3 was analyzed by physical and microscopic examination. The toolmarks present on the two (2) punctured hoses in items 2 and 3 were determined to have been made by the knife in item 1.
WDWXLC	Results of Examinations: Item 1 is a Master folding knife that uses a slicing action. Toolmarks present on the Item 2 and Item 3 hoses were identified as having been produced by the Item 1 knife.
WXWQCU	Known toolmarks were obtained from Item 1 Knife and were compared to the suspect toolmarks present on Items 2 and 3. The suspect toolmarks were Identified as having been made by Item 1 Knife.
X6DGJ8	Tool Mark Analysis: Methodology - Comparison Microscopy: Test marks were made with Item 1, the Master USA knife, 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 Items 2 and 3, the hoses, were made with Item 1, the Master USA knife, based upon corresponding class and individual microscopic characteristics.
XATYTB	Items 1B and 1C were inconclusive as to having been pierced by Item 1A due to a lack of disagreement of individual characteristics within the marked surfaces; however, all observable class characteristics were in agreement.
XVACMK	Item #2 was identified as having been made by item #1. Item #3 was identified as having been made by item #1.
XVNXY8	The questioned toolmarks on Item 2 and Item 3 were made by Item 1.
Y2R2MK	A hole was made in the extra hose using the item No. 1 knife, and the seal was used to make the pattern. The cross section of the traces in the hole and the cross sections of the traces in the holes in the items 2 and 3 were compared . As a result, it was confirmed that stripe marks match.
YLGBQ8	IDENTIFICATION: The exhibit knife (Item one) was identified, within the limits of practical certainty, as having caused the damage to the punctured blue hose exhibit (item two) and to the punctured red hose exhibit (item three).
YQD3WH	Comparison microscope examinations were conducted and it is the finding of this examiner that the toolmarks found on the submitted first and second punctured hose, Items 2 and 3, were made by the submitted Master folding knife, Item 1.
YQRYBH	Results of Examinations: Item 1 is folding knife manufactured for/by Master USA. Item 2 and Item 3 are segments of hose, each bearing a toolmark from a puncture/slicing action. The toolmarks on Item 2 and Item 3 were identified as having been produced by the Item 1 knife.
YU87GA	Item 2 and Item 3 hoses were punctured with Item 1 knife.
YVJXAQ	1) The folding knife (Exhibit 1) sliced the two pieces of synthetic tubing (Exhibit 2 & 3).
Z7KK2N	Item 2 and 3 was produced the same tool.
Z7Y6RC	[No Conclusions Reported.]
Z9UXYC	1 Examinations showed sufficient agreement of striated marks in Item 2 compared to TC-1 for identification. 2 Examinations showed sufficient agreement of striated marks in Item 3 compared to TC-2 for identification. 3 Examinations showed Item 1 was used to puncture Item 2 and Item 3.

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Additional Comments

TABLE 3

WebCode	Additional Comments
38NZLY	Six (6) tests produced using Item 1 are being returned as Item 1T and should be maintained for possible future examinations.
68FXQB	The "results" section of the lab report would contain details about the individualizing characteristics.
6FA3JC	A technical introduction would be included in the report as detailed below; 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.
8HNGXW	The comparsion has been performed with a comparative microscope and accutrans casting material.
9XXMNL	Test marks could be identified to one another and the marks on Items 2 & 3 could be identified to one another; some similar individual characteristics could be identified between test marks and Items 2 & 3, however these were not sufficient for a conclusive determination.
HX8CXX	knife which found with suspect used to cut both of hoses (red & blue)
K3VBPX	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. Toolmark Examination: Toolmarks, whether they are present on two evidence items or on one evidence item and one test-mark created in the Laboratory, undergo two stages of comparison. First, the toolmarks are examined to determine and compare their class characteristics. The class characteristics of toolmarks include type of cutting action and the size and orientation of gripping or cutting surfaces. 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. The basis for a source exclusion conclusion is an Examiner's decision that two toolmarks can be differentiated by their class characteristics. A source exclusion based on general differences does not require a verification. However, a source exclusion based on a minor difference in a measured class characteristic requires a verification. 2) Identification: Source Identification is an Examiner's conclusion that two toolmarks originated from the same source. Conditions for a source identification include the degree of similarity being greater than the Examiner has ever observed in previous evaluations of toolmarks known to have been created by different tools; and the degree of similarity being equivalent to that normally observed in toolmarks known to have been created by the same tool. The basis for a source identification conclusion is an Examiner's decision that the observed class characteristics and corresponding individual characteristics provide extremely strong support for the proposition that the two toolmarks came from the same source and extremely weak support for the proposition that the two toolmarks came from different sources. Before being reported, a source identification requires a verification to be completed. 3) 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

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TABLE 3

WebCode	Additional Comments
	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. 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. Toolmark Examination: Firearms/Toolmark Identification is an empirical science that relies on objective measurements and a subjective comparison of microscopic marks of value. Due to changes in tool working surfaces from wear, corrosion and abuse or the employment of unusual tool/work piece orientations, toolmarks created by the same tool are not always identifiable as such.
KQ2KXJ	1Practical 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. 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.
QELFZG	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 Laboratory's Firearms/Toolmarks Unit 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. Toolmark Examination: Toolmarks, whether they are present on two evidence items or on one evidence item and one test-mark created in the Laboratory, undergo two stages of comparison. First, the toolmarks are examined to determine and compare their class characteristics. The class characteristics of toolmarks include type of cutting action and the size and orientation of gripping or cutting surfaces. 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. The basis for a source exclusion conclusion is an Examiner’s decision that two toolmarks can be differentiated by their class characteristics. A source exclusion based on general differences does not require a verification. However, a source exclusion based on a minor difference in a measured class characteristic requires a verification. 2) Source Identification: Source Identification is an Examiner’s conclusion that two toolmarks originated from the same source. Conditions for a source identification include the degree of similarity being greater than the Examiner has ever observed in previous evaluations of toolmarks known to have been created by different tools; and the degree of similarity being equivalent to that normally observed in toolmarks known to have been created by the same tool. The basis for a source identification conclusion is an Examiner’s decision that the observed class characteristics and corresponding individual characteristics provide extremely strong support for the proposition that the two toolmarks came from the same source and extremely weak support for the proposition that the two toolmarks came from different sources. Before being reported, a source identification requires a verification to be completed. 3) 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. Limitations: Tool: The results of

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TABLE 3

WebCode	Additional Comments
	tool examinations describe type and/or operating condition of the tool as it was received in the Firearms/Toolmarks Unit. Toolmark Examination: Firearms/Toolmark Identification is an empirical science that relies on objective measurements and a subjective comparison of microscopic marks of value. Due to changes in tool working surfaces from wear, corrosion and abuse or the employment of unusual tool/work piece orientations, toolmarks created by the same tool are not always identifiable as such.
QUGAGU	Identifications of toolmarks with a specific tool are made to the practical, not absolute, exclusion of all other tools. This is because it is not possible to examine all tools in the world, a prerequisite for absolute certainty. The conclusion that sufficient agreement for identification exists between two toolmarks means that the likelihood another firearm or tool could have made the questioned mark is so remote as to be considered a practical impossibility.
UTG4VK	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. However, observing this amount of agreement from a different source is considered extremely remote.
UYMAJJ	I am intrigued as to how the marks were made by the test setters. I could not stab the provided hose with the knife as the hose just compressed. I had to stick dowl in both end of the pipe to stiffen it to prevent this happening. I think this led to a different type of cut resulting in differences in spacing of striations between the scene and test marks. However, I did not consider the differences sufficient to affect my opinion.
V6M98D	The test marks were made by puncturing the hose substrate with Item 1.
WAXLPC	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. Toolmark Examination: Toolmarks, whether they are present on two evidence items or on one evidence item and one test-mark created in the Laboratory, undergo two stages of comparison. First, the toolmarks are examined to determine and compare their class characteristics. The class characteristics of toolmarks include type of cutting action and the size and orientation of gripping or cutting surfaces. 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 toolmarksto 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. The basis for a source exclusion conclusion is an Examiner's decision that two toolmarks can be differentiated by their class characteristics. A source exclusion based on general differences does not require a verification. However, a source exclusion based on a minor difference in a measured class characteristic requires a verification. 2) Source Identification: Source Identification is an Examiner's conclusion that two toolmarks originated from the same source. Conditions for a source identification include the degree of similarity being greater than the Examiner has ever observed in previous evaluations of toolmarks known to have been created by different tools; and the degree of similarity being equivalent to that normally observed in toolmarks known to have been created by the same tool. The basis for a source identification conclusion is an Examiner's decision that the observed class characteristics and corresponding individual characteristics provide extremely strong support for the proposition that the two toolmarks came from the same source and extremely weak support for the proposition that the two toolmarks came from different sources. Before being reported, a source identification requires a verification to be completed. 3) Inconclusive (No Conclusion): Inconclusive is

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TABLE 3

WebCode	Additional Comments
	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. 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. Toolmark Examination: Firearms/Toolmark Identification is an empirical science that relies on objective measurements and a subjective comparison of microscopic marks of value. Due to changes in tool working surfaces from wear, corrosion and abuse or the employment of unusual tool/work piece orientations, toolmarks created by the same tool are not always identifiable as such.
WDWXLC	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 Laboratory's Firearms/Toolmarks Unit 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. Toolmark Examination: Toolmarks, whether they are present on two evidence items or on one evidence item and one test-mark created in the Laboratory, undergo two stages of comparison. First, the toolmarks are examined to determine and compare their class characteristics. The class characteristics of toolmarks include type of cutting action and the size and orientation of gripping or cutting surfaces. 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. The basis for a source exclusion conclusion is an Examiner's decision that two toolmarks can be differentiated by their class characteristics. A source exclusion based on general differences does not require a verification. However, a source exclusion based on a minor difference in a measured class characteristic requires a verification. 2) Source Identification: Source Identification is an Examiner's conclusion that two toolmarks originated from the same source. Conditions for a source identification include the degree of similarity being greater than the Examiner has ever observed in previous evaluations of toolmarks known to have been created by different tools; and the degree of similarity being equivalent to that normally observed in toolmarks known to have been created by the same tool. The basis for a source identification conclusion is an Examiner's decision that the observed class characteristics and corresponding individual characteristics provide extremely strong support for the proposition that the two toolmarks came from the same source and extremely weak support for the proposition that the two toolmarks came from different sources. Before being reported, a source identification requires a verification to be completed. 3) 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. Limitations: Tool: The results of tool examinations describe type and/or operating condition of the tool as it was received in the Firearms/Toolmarks Unit. Toolmark Examination: Firearms/Toolmark Identification is an empirical science that relies on objective measurements and a subjective comparison of microscopic marks of value. Due to changes in tool working surfaces from wear, corrosion and abuse or the employment of unusual tool/work piece orientations, toolmarks created by the same tool are not always identifiable as such.
XATYTB	Per [Laboratory] policy we are not allowed to eliminate tool marks based on individual characteristics. we can only eliminate based on class characteristics.

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TABLE 3

WebCode	Additional Comments
YQRYBH	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. Toolmark Examination: Toolmarks, whether they are present on two evidence items or on one evidence item and one test-mark created in the Laboratory, undergo two stages of comparison. First, the toolmarks are examined to determine and compare their class characteristics. The class characteristics of toolmarks include type of cutting action and the size and orientation of gripping or cutting surfaces. 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 toolmarksto 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. The basis for a source exclusion conclusion is an Examiner's decision that two toolmarks can be differentiated by their class characteristics. A source exclusion based on general differences does not require a verification. However, a source exclusion based on a minor difference in a measured class characteristic requires a verification. 2) Source Identification: Source Identification is an Examiner's conclusion that two toolmarks originated from the same source. Conditions for a source identification include the degree of similarity being greater than the Examiner has ever observed in previous evaluations of toolmarks known to have been created by different tools; and the degree of similarity being equivalent to that normally observed in toolmarks known to have been created by the same tool. The basis for a source identification conclusion is an Examiner's decision that the observed class characteristics and corresponding individual characteristics provide extremely strong support for the proposition that the two toolmarks came from the same source and extremely weak support for the proposition that the two toolmarks came from different sources. Before being reported, a source identification requires a verification to be completed. 3) 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. 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. Toolmark Examination: Firearms/Toolmark Identification is an empirical science that relies on objective measurements and a subjective comparison of microscopic marks of value. Due to changes in tool working surfaces from wear, corrosion and abuse or the employment of unusual tool/work piece orientations, toolmarks created by the same tool are not always identifiable as such.
Z9UXYC	TC-1 was created using Item 1 and puncturing a section of blue hose. TC-2 was created using Item 1 and puncturing a section of red hose.

-End of Report-
(Appendix may follow)

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Collaborative Testing Services ~ Forensic Testing Program

Test No. 19-528: Toolmarks Examination

DATA MUST BE SUBMITTED BY **June 10, 2019, 11:59 p.m.** TO BE INCLUDED IN THE REPORT

Participant Code: U1234A WebCode: PTG6NH

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 at a construction site in which two fuel hoses were punctured. A suspect was apprehended later that day and a knife was recovered from his possession. Investigators are submitting the knife along with the sections of punctured hose and are requesting that you examine the toolmarks on the submitted hose sections to determine if either could have been cut using the knife recovered from the suspect.

Please note the following:
-The knife is a sharp object, and all precautions should be taken to handle it in a safe manner.
-For the sections of hose, the mark for examination is located in the center, the two ends were cut using a hose cutter and are not for comparison.
-Each Item is in a labeled envelope, it is suggested that when the Items are removed from their labeled envelopes, they be marked sufficiently using laboratory procedure.
-Two additional sections of both hose substrates are included for test mark purposes.

Items Submitted (Sample Pack T1):
Item 1: Knife recovered from the suspect.
Item 2: First punctured hose recovered from the construction site.(blue)
Item 3: Second punctured hose recovered from the construction site.(red)

1.) Were the suspect toolmarks on either hose (Items 2 and 3) produced by the questioned knife (Item 1)?

	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.

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)