



Toolmarks Examination Test No. 15-528 Summary Report

This test was sent to 225 participants. Each sample set contained a hose cutter (Item 1) and two pieces of tubing containing questioned toolmarks (Items 2 and 3). Participants were requested to examine these items and report their findings. Data were returned from 191 participants (85% response rate) and are compiled into the following tables:

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

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

Manufacturer's Information

Each sample set contained one mini hose cutter (Item 1) and two pieces of tubing containing questioned toolmarks (Items 2 and 3). An additional 5" piece of tubing was included for possible test mark purposes. The Item 3 red tubing (with blue painted end) was cut by the Item 1 hose cutter. The Item 2 red tubing (with green painted end) was cut by a hose cutter that was not provided for examination. Participants were requested to determine which, if any, of the questioned toolmarks were made by the submitted tool.

SAMPLE PREPARATION: The hose cutter is a Mini Hose and Tube Cutter, 1/8" to 3/4" OD capacity, 3" length. The red tubing is "Choose-A-Color PVC Tubing Red, 7/16" ID, 5/8" OD, 3/32" Wall Thickness". The elimination tool used is a "KwikCut 100 Plastic Pipe and Tubing Cutter 1/8" to 1 1/8"OD capacity". The Item 2 tubing was painted with green paint on the end of the tubing not to be examined. The Item 3 tubing was painted with blue paint on the end of the tubing not to be examined. The Mini Hose and Tube Cutters were used to cut spare tubing several times to remove manufacturing residue. This process was done to break in the tools.

ITEM 2 (ELIMINATION MARK): The Item 2 tubing (with green painted end) was cut using the KwikCut tubing cutter and packaged into a pre-labeled Item 2 envelope. The above process was repeated until all elimination toolmarks had been prepared.

ITEMS 1 and 3 (IDENTIFICATION MARKS): The Item 3 tubing (with blue painted end) was cut and packaged into a pre-labeled Item 3 envelope. The corresponding Mini Hose and Tubing Cutter was packaged into a pre-labeled Item 1 envelope. Item 1 and 3 were then immediately assembled into the sample pack as described below. The above process was repeated until all identification toolmarks had been prepared.

SAMPLE SET ASSEMBLY: The corresponding Item 1 Mini Hose and Tube Cutter and the Item 3 tubing were packaged into a pre-labeled sample pack box along with the Item 2 tubing and a 5" piece of tubing for testing purposes. This process was repeated until the required number of sample sets were produced. Once verification was completed, the sample sets were sealed with evidence tape and initialed "CTS".

VERIFICATION: In addition to the sets examined by predistribution laboratories and an AFTE representative, 10 sample sets were examined by a qualified toolmark examiner who confirmed the expected identification between Items 1 and 3.

Summary Comments

This test was designed to allow participants to assess their proficiency at a toolmark examination involving striated type toolmarks. Each sample set consisted of one hose cutter (Item 1) and two pieces of tubing (Items 2 and 3) containing the questioned toolmarks. Participants were requested to determine if the recovered hose cutter had cut either of the questioned pieces of tubing. The Item 3 piece of tubing was cut by the Item 1 hose cutter. The Item 2 piece of tubing was cut by a hose cutter that was not provided for examination. [Refer to Manufacturer's Information for preparation details.]

Of the 191 responding participants, 189 (99%) identified the Item 1 hose cutter as having cut the Item 3 tubing and either eliminated (143) or were inconclusive (46) as to it having cut the item 2 tubing. One participant was inconclusive for both Items 2 and 3 having been cut by the Item 1 hose cutter and one participant provided no response for both items.

Several participants commented that the toolmarks produced by the Item 1 hose cutter and the questioned toolmarks on the Item 2 tubing shared class characteristics, but insufficient corresponding individual characteristics were observed. [As a matter of policy, many labs will not eliminate without access to the tool or when class characteristics match.]

Examination Results

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

TABLE 1

WebCode	Item 2	Item 3	WebCode	Item 2	Item 3
24CNBK	Inc	Yes	6BPRW4	No	Yes
2APHEW	No	Yes	6FZPJQ	No	Yes
2BFL84	No	Yes	6HQV32	No	Yes
2GLF2Y	No	Yes	6LMKJ9	Inc	Yes
32A7RH	No	Yes	6RTBNZ	Inc	Yes
34AGLW	No	Yes	6UW783	No	Yes
3DZ3RV	No	Yes	7FDUET	No	Yes
3EUP7K	No	Yes	7FYATB	No	Yes
3LV37M	No	Yes	7GTVNM	No	Yes
3PEYUD	No	Yes	7HK2WZ	No	Yes
3WVDXJ	Inc	Yes	7KNR3F	No	Yes
4BBV8Y	No	Yes	7NPZ8Q	No	Yes
4FPLGZ			7UURH9	No	Yes
4GYTH8	No	Yes	7XYHPN	Inc	Yes
4R3JL4	No	Yes	7ZNNAL	No	Yes
66J3BP	No	Yes	88G93Z	No	Yes
6AD4AH	No	Yes	8WWYE7	No	Yes

TABLE 1

WebCode	Item 2	Item 3	WebCode	Item 2	Item 3
8X77EE	No	Yes	BGF3PN	No	Yes
94WQ72	Inc	Yes	BH89TL	Inc	Yes
9DMCCY	No	Yes	BNDR9D	Inc	Inc
9HXAZL	No	Yes	BUJE4M	Inc	Yes
9VZZEY	No	Yes	BWMCDV	No	Yes
A6H2CJ	No	Yes	CATMHW	No	Yes
A9P7GT	No	Yes	CL6448	Inc	Yes
AC4MQX	No	Yes	CMGNZN	No	Yes
AWRF7L	No	Yes	CN9WZR	Inc	Yes
AXL7CZ	No	Yes	CQX4H3	No	Yes
AYGMPX	Inc	Yes	CR7DAZ	Inc	Yes
AZPWJF	No	Yes	CW4MQU	No	Yes
B44WCZ	No	Yes	CZZH7M	No	Yes
B4LLX2	No	Yes	D3NE8L	No	Yes
B4MJ9X	No	Yes	DFVZW7	No	Yes
B7B6PR	No	Yes	DJBNDW	No	Yes
B87QFX	No	Yes	DJPY6A	No	Yes
B8MPRA	Inc	Yes	DQTZ8P	No	Yes
BFY38K	No	Yes	DR7QGT	No	Yes

TABLE 1

WebCode	Item 2	Item 3	WebCode	Item 2	Item 3
EBXZVF	No	Yes	HMXYEW	No	Yes
ECRQ2U	No	Yes	HYT6AF	No	Yes
EDY9X6	Inc	Yes	J3PXY6	No	Yes
EMPREY	Inc	Yes	JAMP6D	No	Yes
EWVC2Z	No	Yes	JCTATD	No	Yes
F4AQ6H	Inc	Yes	JGMZKH	No	Yes
F6N6R7	Inc	Yes	JLH43P	No	Yes
FAFAKA	No	Yes	JTHHQB	No	Yes
FMH3QD	No	Yes	JU9LJH	No	Yes
FR3HQK	Inc	Yes	JXBKRP	Inc	Yes
G4PJBK	No	Yes	KAHUWR	Inc	Yes
G6J2E7	No	Yes	KBCDZD	No	Yes
GH87M4	No	Yes	KG4KL8	No	Yes
GKA8HU	Inc	Yes	KGFGQC	No	Yes
GKXBFB	No	Yes	KHDNFJ	No	Yes
GQYP2C	No	Yes	KHY7CD	No	Yes
GRTF66	No	Yes	KJ6QZD	No	Yes
GYUR3M	Inc	Yes	KRM7XG	No	Yes
HEZ9Q2	No	Yes	KUUBPK	Inc	Yes

TABLE 1

WebCode	Item 2	Item 3	WebCode	Item 2	Item 3
KVY6XP	No	Yes	P2HMR3	Inc	Yes
KXRUPX	No	Yes	PDNWW4	No	Yes
KY26XL	No	Yes	PFBL94	No	Yes
L7YZUY	Inc	Yes	PMBVNA	Inc	Yes
L99XD9	No	Yes	PMQYDU	No	Yes
LH69BG	No	Yes	PTZD2K	Inc	Yes
LRFAY4	Inc	Yes	PWW7QA	Inc	Yes
LTELMJ	No	Yes	Q4T4CQ	No	Yes
LUMUHW	Inc	Yes	QA3GWB	No	Yes
LX8NQJ	No	Yes	QTX6BD	No	Yes
M3CQ96	No	Yes	R3F77D	No	Yes
M7T3XU	No	Yes	R3UHXQ	No	Yes
MGAP8U	No	Yes	R3XXGH	No	Yes
MGTTGF	Inc	Yes	RM4B6Y	No	Yes
MJH2PW	Inc	Yes	RNGAXM	Inc	Yes
MTPU6H	No	Yes	RNYVW6	No	Yes
N3QL3B	No	Yes	RQ8YT2	No	Yes
NLL8R9	Inc	Yes	RXK3QM	Inc	Yes
NZK2DQ	No	Yes	T23U42	Inc	Yes

TABLE 1

WebCode	Item 2	Item 3	WebCode	Item 2	Item 3
T3TXUN	No	Yes	WGH4FE	Inc	Yes
T93YAZ	No	Yes	WJNRTH	Inc	Yes
T9HGRC	No	Yes	WQRJ98	No	Yes
TAEZTD	No	Yes	X87E6M	No	Yes
TERQ6Z	No	Yes	XAEH46	Inc	Yes
THNHBB	No	Yes	XBTWG7	No	Yes
TMYFYX	No	Yes	XDC6CY	No	Yes
TPMRVH	No	Yes	XGHJ4Y	No	Yes
UG9DEY	No	Yes	XMJPF	Inc	Yes
UP6DPK	Inc	Yes	XMRKP3	No	Yes
V2YUEL	No	Yes	XTBUT6	No	Yes
VDMXD6	No	Yes	XXMZ7Q	No	Yes
VGBHD8	No	Yes	Y6YHYP	No	Yes
VKMJ4J	No	Yes	YAEYE9	No	Yes
W3CTE	No	Yes	YKUXZ4	Inc	Yes
VY8QMZ	No	Yes	YMLPJ2	No	Yes
W3MMQF	No	Yes	YP9DV2	No	Yes
WBBK8M	Inc	Yes	YPRA82	No	Yes
WBX7P7	No	Yes	YW73C7	No	Yes

TABLE 1

WebCode	Item 2	Item 3	WebCode	Item 2	Item 3
Z2VZFM	No	Yes			
Z3PT9K	Inc	Yes			
Z6XZFK	Inc	Yes			
Z6ZG74	No	Yes			
ZLZKCM	No	Yes			

Response Summary		Total Participants: 191	
<i>Did the suspect's hose cutter (Item 1) produce the questioned toolmarks on either of the submitted pieces of tubing (Items 2 or 3)?</i>			
Responses		<u>ITEM 2</u>	<u>ITEM 3</u>
	Yes	0 (0.0%)	189 (99.0%)
	No	144 (75.4%)	0 (0.0%)
	Inc	46 (24.1%)	1 (0.5%)

Conclusions

TABLE 2

WebCode	Conclusions
24CNBK	The toolmarks on the tubing, item T1-3, were identified as having been made by the hose cutter, item T1-1. The toolmarks on the tubing, item T1-2, are consistent in all observable class characteristics (slicing action) as the hose cutter, item T1-1. While there is some disagreement of microscopic markings, the markings present are insufficient for an elimination. The results are inconclusive.
2APHEW	Item 01-1 was microscopically identified as having cut the piece of tubing, Item 01-03. Item 01-01 was microscopically eliminated as having cut the piece of tubing, Item 01-02, based on dissimilar individual characteristics.
2BFL84	1. Exhibits 2 and 3 (Tubing) were visually and microscopically examined and compared to test toolmarks from Exhibit 1 (Tubing cutter). a. Exhibit 1 did not cause the damage on Exhibit 2. b. Exhibit 1 caused the damage on Exhibit 3.
2GLF2Y	Item 1.1 is a hose cutter. Tests were made using Item 1.1 and the submitted test tubing. Item 1.2 is a piece of tubing having damage consistent with being cut. It was microscopically compared to the tests made using Item 1.1. Item 1.1 was eliminated as having caused the damage to Item 1.2. Item 1.3 is a piece of tubing having damage consistent with being cut. It was microscopically compared to the tests made using Item 1.1. Item 1.1 was identified as having caused the damage to Item 1.3.
32A7RH	Item#1/K1 Hose Cutter recovered from Suspect. Item#2/Q1 First cut piece of tubing (painted green). Item#3/Q2 Second cut piece of tubing (painted blue). K1 was used to make test sample cuts from the submitted PVC tubing. Q1 was compared against test cut tubing from K1. There is sufficient microscopic individual detail remaining on Q1 to determine it was NOT cut by K1. Q2 was compared against test cut tubing from K1. There is sufficient microscopic individual detail remaining on Q2 to determine it was cut by K1.
34AGLW	1. Compression shape and the scratch pattern of the toolmarks on the Item 2 cut piece of tubing different from the shape and pattern of the toolmarks produced by Item 1 hose cutter. 2. Compression shape and the scratch pattern of the toolmarks on the Item 3 cut piece of tubing correspond to the shape and pattern of the toolmarks produced by Item 1 hose cutter.
3DZ3RV	we cut the red tubing using item 1. It's a test toolmark. We made a comparison between test mark and item 2, item 3. Test mark is the same with item 3. But test mark is different with item 2.
3EUP7K	Items 2 and 3 were microscopically examined. Item 3 was identified as having been cut by Item 1. Due to differences in individual characteristics, Item 2 was eliminated as having been cut by Item 1. Tests produced using Item 1 and laboratory stock material are being returned as item 1T in sample pack T1 and should be maintained for possible future examinations.
3LV37M	Item 1-1, the submitted "Coilhose Pneumatics" brand hose cutter, was examined. The cutter is comprised of a single blade that is designed to cut through a hose using a slicing action. The edge profile of the blade is angled, forming an apex in the center. No potential subclass characteristics were observed along the working surfaces (edges) of the blade. The cutter was used to make test marks in the plastic tubing provided for this purpose. No trace evidence was observed on the blade prior to making the test cuts. Items 1-2 and 1-3, the questioned pieces of cut tubing, were examined. The cut ends of both items had class characteristics similar to the test cuts made by Item 1-1. Silicone casts were made of the test cuts and the cut ends of Items 1-2 and 1-3. The test marks from Item 1-1 were microscopically compared to Items 1-2 and 1-3. Sufficient agreement was observed between the individual striae on the test cuts from one side of the blade of Item 1-1 and those on the cut end of Item 1-3 to conclude that Item 1-3 was cut by Item 1-1. Due to the observed consistent reproduction of copious individual striae in the test marks produced by Item 1-1, it is reasonable to expect that any marks produced with these cutters will exhibit extensive agreement of striae, as demonstrated by the

TABLE 2

WebCode	Conclusions
	agreement observed with Item 1-3. However, a careful microscopic comparison of the test marks produced by blade of Item 1-1 with the toolmarks on Item 1-2 revealed no significant agreement. Therefore, it was determined that Item 1-2 was not cut by Item 1-1.
3PEYUD	Items #1, 2, & 3. The submitted "Coil Hose Pneumatics PXC058" brand tubing cutter was utilized to generate known test cut specimens for comparison purposes. Microscopic examination and comparison of the known test cut specimens with the questioned toolmarks on the two (2) pieces of submitted tubing revealed the following: -Item #2 displayed sufficient disagreement of individual characteristics to conclude that it had not been cut with Item #1. Item #3 displayed a sufficient quantity of individual characteristics to conclude that it had been cut with Item #1.
3WVDXJ	Unable to identify or eliminate the submitted tubing cutter as having been used to cut the submitted tubing with one end painted green due to an agreement of class characteristics but a lack of consistent and reproducible individual marks. Unable to identify or eliminate if the same tool was used to cut the submitted tubing with one end painted green as the submitted tubing with one end painted blue due to an agreement of class characteristics but a lack of consistent and reproducible individual marks. The submitted tubing cutter was identified as having been used to cut the tubing with one end painted blue due to consistent and reproducible marks.
4BBV8Y	Test cuts made with Item 1 were compared to Item 3 using a comparison microscope. There is sufficient agreement of discernible class and individual characteristic markings to determine that the questioned tool mark on Item 3 had been produced by the known tool, Item 1. Test cuts made with Item 1 were compared to Item 2 using a comparison microscope. There is some agreement of discernible class characteristics but significant disagreement of individual characteristic markings. The questioned tool mark on Item 3[sic] had not been produced by the known tool Item 1.
4FPLGZ	[No Conclusions Reported].
4GYTH8	The plastic tubing submitted as Item 001-2 was not cut by the hose cutter (Item 001-1). The plastic tubing submitted as Item 001-3 was cut by the hose cutter (Item 001-1).
4R3JL4	1. Examination of Exhibit 1 (Coilhose Pneumatics PXC058 tube cutter) disclosed that it is designed as a single bladed cutting tool. Exhibit 1.1 (Test toolmark standards) was created for comparison purposes and is being returned along with Exhibit 1. 2. Visual and microscopic examination of Exhibits 2 and 3 (cut tubing) disclosed toolmarks consistent with a single bladed cutting tool such as a tube cutter or knife. Exhibits 2 and 3 were microscopically compared to test toolmarks from Exhibit 1. a. Exhibit 1 (tube cutter) did not cause the damage on Exhibit 2. b. Exhibit 1 (tube cutter) caused the damage on Exhibit 3.
66J3BP	3. On 2015-06-24 during the performance of my official duties I received a sealed evidence bag with number PA4001257946 from Case Administration of the Ballistics Section, containing the following: 3.1 One (1) sealed cardboard box marked "Test No. 15-528: Toolmark Examination", containing the following: 3.1.1 One (1) small brown envelope marked "Test No. 15-528 Item 1", containing the following exhibit: 3.1.1.1 One (1) Coilhose Pneumatics PXC058 hose cutter, marked by me "140118/15 1". 3.1.2 One (1) small brown envelope marked "Test No. 15-528 Item 2" containing the following exhibit: 3.1.2.1 One (1) cut piece of tubing (painted green), marked by me "140118/15 2". 3.1.3 One (1) small brown envelope marked "Test No. 15-528 Item 3", containing the following exhibit: 3.1.3.1 One (1) cut piece of tubing, (painted blue), marked by me "140118/15 3". 4. The intention and scope of this forensic examination comprise of the following: 4.1 Examination of tools and toolmark related materials. 4.2 Microscopic individualization of toolmarks. 5. I examined the hose cutter mentioned in paragraph 3.1.1.1 and made replications for test purposes, marked 118T1 and 118T2 respectively. 6. I compared the individual and class characteristic markings on the pieces of tubing mentioned in paragraphs 3.1.2.1 and 3.1.3.1 and the tests mentioned in paragraph 5 using a comparison microscope and found: 6.1 The marks on the cut piece of tubing mentioned in 3.1.3.1 were produced by the hose cutter mentioned in paragraph 3.1.1.1. 6.2 The marks on the cut piece of

TABLE 2

WebCode	Conclusions
	tubing mentioned in paragraph 3.1.2.1 were not produced by the hose cutter mentioned in paragraph 3.1.1.1.
6AD4AH	Toolmarks present on Item 3 were microscopically examined and identified as having been produced using Item 1. Toolmarks present on Item 2 were microscopically examined, compared and eliminated as having been produced by the Item 1 hose cutter due to differences in individual characteristics.
6BPRW4	The one cut section of tubing, item 2 was not cut by the submitted hose cutter, item 1. The one cut section of tubing, item 3, was cut by the submitted hose cutter, item 1.
6FZPJQ	3. On 2015-06-24 during the performance of my official duties I received a sealed evidence bag with number PA4001257948 from Case Administration of the Ballistics section, containing the following item: 3.1 One (1) sealed white cardboard box, marked "2015 CTS Forensic Testing Program Test No. 15-528: Toolmark Examination Sample Pack: T1", containing the following items: 3.1.1 One (1) sealed envelope marked "Test No. 15-528 Item 1", containing the following exhibit: 3.1.1.1 One (1) Coilhose pneumatics PXC058 hose cutter, marked by me "140104/15 1". 3.1.2 One (1) sealed envelope marked "Test No. 15-528 Item 2", containing the following exhibit: 3.1.2.1 One (1) piece of red PVC tubing, painted green on one (1) end, marked by me "140104/15 2". 3.1.3 One (1) sealed envelope marked "Test No. 15-528 Item 3", containing the following exhibit: 3.1.3.1 One (1) piece of red PVC tubing, painted blue on one (1) end, marked by me "140104/15 3". 3.1.4 One (1) red PVC tube, not marked by me. 4. The intention and scope of this forensic examination comprise the following: 4.1 Examination of tools and toolmark related materials. 4.2 Microscopic individualization of toolmarks. 5. I examined the hose cutter mentioned in paragraph 3.1.1.1 and made replications for test purposes using the PVC tube mentioned in paragraph 3.1.4, which I marked "140104/15T1" and "140104/15T2" respectively. 6. I compared the individual and class characteristic markings on the pieces of PVC tubing mentioned in paragraphs 3.1.2.1 and 3.1.3.1 with the test replications mentioned in paragraph 5 using a comparison microscope, and found: 6.1 The marks on the piece PVC tubing mentioned in 3.1.3.1 were produced by the hose cutter mentioned in paragraph 3.1.1.1. 6.2 The marks on the piece PVC tubing mentioned in paragraph 3.1.2.1 were not produced by the hose cutter mentioned in paragraph 3.1.1.1
6HQV32	The Item 2 tubing was not cut by the Item 1 hose cutter in its current condition. The Item 3 tubing was cut by the Item 1 hose cutter.
6LMKJ9	The tubing cutter in Item #1 could not be identified as or excluded from having cut the end of the tubing in Item #2 based on class characteristic similarities (type of cut and striated marks). The tubing cutter in Item #1 was identified as having cut the end of the tubing in Item #3.
6RTBNZ	The Item 3 tubing was identified as having been cut by the Item 1 hose cutter. Differences in individual characteristics indicate that the Item 2 tubing was probably not cut by the Item 1 hose cutter.
6UW783	TOOL (ITEM 1) HAS PRODUCED THE SIGNS TO OBSERVE IN THE TUBE WITH BLUE BORDER (ITEM 3).
7FDUET	The tool marks on the piece of cut red tubing, item 3, were microscopically compared and identified as having been made by the Coilhose Pneumatics tube cutter in item 01 by sufficient corresponding individual markings. The tool marks on the other piece of red tubing, item 2, were microscopically compared and excluded as having been made by the Coilhose Pneumatics tube cutter in item 01 by differences observed microscopically. Further comparison of these tool marks to another single blade cutting tool can be done pending submittal of a suspect tool.
7FYATB	Microscopic examination and comparison revealed that the toolmark on item 3 was identified as having been made by the item 1 tool. Microscopic examination and comparison revealed that the toolmark on item 2 was not made by the item 1 tool.

TABLE 2

WebCode	Conclusions
7GTVNM	1. Examinations showed that the tool marks on Item 3 were made by Item 1. 2. Examinations showed that the tool marks on Item 2 were not made by Item 1.
7HK2WZ	The Exhibit 2 tubing was not cut by the Exhibit 1 tool. The Exhibit 3 tubing was cut by the Exhibit 1 tool.
7KNR3F	Item #1 is a Coilhose Pneumatics rubber tubing cutter, model PXC058, serial number unknown. Toolmarks present on the Item #3 red tubing were identified as having been produced by the Item #1 tubing cutter. Toolmarks present on the Item #2 red tubing were not produced by the Item #1 tubing cutter.
7NPZ8Q	I compared the individual and class characteristics markings on the pieces of tubing marked Item 2 and Item 3 with tests I cut with the hose cutter marked Item 1 using a comparison microscope and found that: - the marks on the piece of tubing painted blue marked Item 3 were produced by the hose cutter marked Item 1. -the marks on the piece of tubing painted green marked Item 2 were not produced by the hose cutter marked Item 1.
7UURH9	Test toolmarks were produced by Item 1 and microscopically examined in conjunction with the cut tubing in Items 2 and 3. Based on these comparative examinations the following was determined: A. The toolmarks present on Item 2 were not produced by Item 1. B. The toolmarks present on Item 3 were produced by Item 1.
7XYHPN	Examination of the toolmarks present on the tubing in Items 2 and 3 revealed them to be consistent with having been cut by a single bladed tool. Test toolmarks produced using Item 1 cutter were microscopically examined in conjunction with the questioned ends of the tubing in Items 2 and 3. Based on these comparative examinations it was determined that: A. Item 3 had been cut by Item 1. B. Item 2 bears the same class characteristics as test toolmarks from Item 1. However, no corresponding individual characteristics were found to link Item 2 to test cuts from Item 1.
7ZNNAL	The item 1 tubing cutter was eliminated as having cut the Item 2 piece of tubing based on differences in their individual characteristics observed during a microscopic comparison. The Item 1 tubing cutter was identified as having cut the Item 3 piece of tubing based on agreement of their individual characteristics observed during a microscopic comparison.
88G93Z	The Item 1 hose cutter was identified as having made the toolmarks on Item 3. The toolmarks on Item 2 were not made by the Item 1 hose cutter.
8WWYE7	Item 3 tubing (blue) was cut with Item 1 hose cutter. Item 2 tubing (green) was not cut with Item 1 hose cutter.
8X77EE	Toolmarks present on item 3 were examined microscopically and identified as having been produced with item 1. Toolmarks present on item 2 were examined microscopically and eliminated as having been produced with item 1 because of differences in individual characteristics. Two (2) tests produced using item 1 are being returned as item 1T and should be maintained for possible future examinations.
94WQ72	The cut end of the 01-AC (Item 3) section of tubing was microscopically compared to test cuts made using the 01-AA (Item 1) tubing cutters with POSITIVE RESULTS. The 01-AC (Item 3) section of tubing was cut by the 01-AA (Item 1) tubing cutters. The cut end of the 01-AB (Item 2) section of tubing was microscopically compared to test cuts made using the 01-AA (Item 1) tubing cutters with INCONCLUSIVE RESULTS. Due to the insufficient agreement or disagreement of individual characteristics, the 01-AB (Item 2) section of tubing could neither be identified nor eliminated as having been cut by the 01-AA (Item 1) tubing cutters.
9DMCCY	Tool Mark Analysis: Methodology - Comparison Microscopy Test marks were made with Item 1, the

TABLE 2

WebCode	Conclusions
	hose cutter, using submitted testing media. The tool mark on Item 2, the PVC tube with green paint, was not made with item 1, the hose cutter, based upon different individual microscopic characteristics. The tool mark on Item 3, the PVC tube with blue paint, was made with Item 1, the hose cutter, based upon corresponding class and individual microscopic characteristics.
9HXAZL	1. The tool mark present in the plastic tubing described in item 2, was not produced by the hose cutter described in item 1. 2. The tool mark present in the plastic tubing described in item 3, was produced by the hose cutter described in item 1.
9VZZEY	The evidence in items 1, 2, and 3 was analyzed by physical and microscopic examination. The toolmarks present on the cut piece of tubing in item 2 were determined not to have been made by the hose cutter in item 1. Further analysis of the toolmarks present on the cut piece of tubing in item 2 is pending submission of another tool for additional comparison. The toolmarks present on the cut piece of tubing in item 3 were determined to have been made by the hose cutter in item 1.
A6H2CJ	3. On 2015-06-24 during the performance of my official duties I received a sealed evidence bag with number PA4001257945 from Case Administration of the Ballistics Section, containing the following: 3.1 One (1) black Coilhose Pneumatics- manufactured hose cutter with number PXC058 marked by me "140125/15". 3.2 Three (3) lengths of red PVC-tubing, two (2) of which marked by me "140125/15 Item 2" and "140125/15 Item 3" respectively. 4. The intention and scope of this forensic examination comprise the following: 4.1 The examination of tools and toolmark related materials. 4.2 Microscopic individualization of toolmarks. 5. I examined the marked PVC-tubing mentioned in paragraph 3.2 using a comparison microscope and found microscopic comparable marks which can be utilized for individualization. 6. I examined the hose cutter mentioned in paragraph 3.1 and made a test replication using the third (3rd) length of PVC-tubing which I marked 125T1. 7. I examined the marked PVC-tubing mentioned in paragraph 3.2 and the test replication mentioned in paragraph 6 and compared the individual and class characteristic markings transferred on them during the cutting process using a comparison microscope and found: 7.1 The marks on the PVC-tubing marked "140125/15 ITEM3" were caused by the tool mentioned in paragraph 3.1. 7.2 The marks on the PVC-tubing marked "140125/15 ITEM2" were not caused by the tool mentioned in paragraph 3.1.
A9P7GT	The hose cutter (item 1) had cut the unpainted end of item 3. The unpainted end of item 2 had been cut by a different tool other than item 1.
AC4MQX	Tool marks were made with Item 1, the Coilhose Pneumatic tubing cutter, using submitted and laboratory standard testing media. Item 1A, the tool marks, was sealed in the manila envelope and will be retained in the laboratory for possible future analysis. Methodology - Comparison Microscopy The tool marks on Item 3, the red PVC tubing (one end painted blue), was made with Item 1, the the[sic] Coilhose Pneumatic tubing cutter, based upon corresponding class and individual microscopic characteristics. The tool marks on Item 2 the red PVC tubing (one end painted green) was not made with Item 1, the the[sic] Coilhose Pneumatic tubing cutter, based upon different individual microscopic characteristics.
AWRF7L	I examined the hose cutter marked by me as 146209/15 A (Item 1) and made replications of tests marked by me as 209T1-T3 respectively. I compared the individual and class characteristics on the cut pieces of tubing marked by me as 146209/15 B, C (Item 2 and 3) to the tests marked 209T1 - T3 and found: 2.1 The marks on the cut piece of tubing marked by me as 146209/15 C (Item 3) was produced by the tool marked by me as 146209/15 A (Item 1). 2.2 The marks on the cut piece of tubing marked by me as 146209/15 B (Item 2) was not produced by the tool marked by me as 146209/15 A (Item 1).
AXL7CZ	Toolmarks were "cut" with the tubing cutter (Item 1) using the provided PVC tubing material and labeled as reference specimens. These reference cuts (Item 1) were then used for microscopic comparison. Toolmarks on the cut end of the pink soft PVC tubing opposite the green paint (Item 2) were microscopically compared to, and can be eliminated as being cut by, the tubing cutter (Item 1).

TABLE 2

WebCode	Conclusions
	Toolmarks on the cut end of the pink soft PVC tubing opposite the blue paint (Item 3) were microscopically compared to, and determined to have been cut by, the tubing cutter (Item 1).
AYGMPX	Identification: Based on the comparison of class and individual characteristics of test tool marks created using the hose cutters (Item 1) with the tool marks exhibited on the piece of tubing (Item 3), the tool marks on the piece of tubing (Item 3) were identified as having been created by the use of the hose cutters (Item 1). Inconclusive: The tool marks exhibited on the piece of tubing (Item 2) display similar class characteristics and there is disagreement of individual detail as those displayed on the test tool marks created using the hose cutters (Item 1) and the tool marks displayed on the piece of tubing (Item 3), but the disagreement is insufficient for an elimination. The tool marks exhibited on the piece of tubing (Item 2) could neither be identified, nor eliminated as having been created by the use of the hose cutters (Item 1).
AZPWJF	1. The marks on the piece of PVC tubing marked as 147172/15 3 were produced by the hose cutter marked as 147172/15 1. 2. The marks on the piece of PVC tubing marked as 147172/15 2 were not produced by the hose cutter marked as 147172/15 1.
B44WCZ	As a result of the comparative macroscopic examination it is certain that the toolmarks present on the tubing Item 3 (painted blue) have been produced by the hose cutter (Item 1). The hose cutter (Item 1) has been excluded to have produced the toolmarks present on the tubing Item 2 (painted green).
B4LLX2	The cut ends of the pieces of tubing marked "Item 2" and "Item 3" were compared with those of the test cuts made using the hose cutter marked "Item 1": (a) Based on sufficient differences in individual characteristics, the tubing marked "Item 2" was not cut by the hose cutter marked "Item 1". (a) Based on agreement of class characteristics and sufficient agreement of individual characteristics, the tubing marked "Item 3" was cut by the hose cutter marked "Item 1".
B4MJ9X	[No Conclusions Reported].
B7B6PR	The recovered hose cutter (Item 1) was used to cut the second piece of hose (Item 3). The recovered hose cutter (Item 1) was not used to cut the first piece of hose (Item 2).
B87QFX	Tool Mark Analysis: Methodology- Comparison Microscopy Test marks were made with Item 1, the hose/tubing cutter, using submitted and laboratory testing media. Item 1A, the test cuts was sealed in a manila envelope and will be retained in the laboratory for possible future analysis. The tool mark on Item 2, the tubing was not made with Item 1, the hose/tubing cutter, based upon different individual microscopic characteristics. The tool mark on Item 3, the tubing, was made with Item 1, the hose/tubing cutter, based upon corresponding class and individual microscopic characteristics.
B8MPRA	The toolmarks on Item 3 were made with the Item 1 tool. The toolmarks on Item 2 cannot be identified or eliminated as having been made with the Item 1 tool.
BFY38K	a) The marks on the tubing mentioned in 3.3 were produced by the hose cutter in 3.1. b) The marks on the tubing mentioned in 3.2 were not produced by the hose cutter mentioned in 3.1.
BGF3PN	The evidence in items 1, 2, and 3 was physically and microscopically examined. The toolmarks present on the first cut piece of tubing in item 2 were determined not to have been made by the hose cutter in item 1. The toolmarks present on the second cut piece of tubing in item 3 were determined to have been made by the hose cutter in item 1. Further analysis of the first cut piece of tubing in item 2 is pending submission of another tool for additional comparison.
BH89TL	Test cuts were made with Item 1 for comparison to Items 2 and 3. Item 3 was identified as having been cut by Item 1. Comparison of toolmarks found on Item 2 to test cuts from Item 1 failed to reveal enough information to either identify or eliminate Item 2 as having been cut by Item 1.

TABLE 2

WebCode	Conclusions
BNDR9D	TUBING ARE INCONCLUSIVE TO HOSE CUTTER
BUJE4M	Item 2 was neither identified nor eliminated as having been cut by Item 1. A significant agreement of individual characteristics was not observed. Item 3 was identified as having been cut by Item 1.
BWMCDV	The cut end of the red plastic hose with the green painted end (Item 2) was examined, compared and determined NOT to have been cut with the black hose cutter (Item 1). The cut end of the red plastic hose with the blue painted end (Item 3) was examined, compared and identified as having been cut with the black hose cutter (Item 1). Casts of the toolmarks on the cut ends of the hoses (Items 1, 2, and 3) will be retained in the Firearms/Toolmarks section's open case files pending future comparisons. The submitted items will be retained in the training files of the Firearms/Toolmarks section.
CATMHW	The toolmarks present on item 2 were eliminated as having been produced by item 1 based on the sufficient disagreement of individual characteristics. The toolmarks present on item 3 were identified as having been produced by item 1 based on the sufficient agreement of class and individual characteristics.
CL6448	Item 01-03 was cut by the submitted tool, item 01-01. Item 01-02 could not be eliminated or identified as having been cut by the submitted tool, item 01-01 due to a similarity in class characteristics and a lack of matching marks/pattern areas. Item 01-04 was used for creating test cuts.
CMGNZN	The hose cutter submitted Item 1 and the two pieces of hose submitted Items 2 & 3 were examined. Test marks made with Item 1 were microscopically compared to the marks present on the cut ends of Items 2 & 3. Item 2 was not cut by Item 1. Item 3 was cut by Item 1.
CN9WZR	Item 1 is a Coilhose Pneumatics tube cutter that uses a slicing type of action. Toolmarks present on the Item 3 tube were identified as having been produced by the Item 1 tube 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 2 tube were created by the Item 1 tube cutter.
CQX4H3	The hose (tubing) cutter Exhibit 1 was used to make tests. Those tests were used for comparison to the toolmarks on the cut tubings Exhibits 2 and 3. The Exhibit 3 tubing was identified as having been cut by the hose cutter Exhibit 1. Significant differences in individual character of the toolmarks on the tubing Exhibit 2 indicated it was cut by another tool.
CR7DAZ	The Item 3 tubing was identified as having been cut by the Item 1 hose cutter. The Item 2 has toolmarks present with class characteristics similar to those produced by the Item 1 hose cutter. However, due to a lack of sufficient corresponding microscopic marks of value, no conclusion could be reached as to whether the tool marks present on the Item 2 tubing were created by the Item 1 hose cutter.
CW4MQU	Item #2: The non-painted cut end of the red-colored tubing was compared to test exemplars obtained from the tubing cutter, Item #1. Differences in class and individual tool mark signatures were observed to conclude that the tubing was not cut with the tubing cutter. Item #3: The non-painted cut end of the red-colored tubing was compared to test exemplars obtained from the tubing cutter, Item #1. Sufficient corresponding individual tool mark signatures were observed to conclude that the tubing was cut with the tubing cutter.
CZZH7M	[No Conclusions Reported].
D3NE8L	(1) There is a difference in the roughness of the tube. Item2 (Green painted tube) is smoother than Item3 (Blue painted tube). A sample tube (that is cut by the suspected cutter)'s roughness is similar with Item3 (Blue painted tube). (2) There is a difference in the direction of the wrinkle (on the cutting face of

TABLE 2

WebCode	Conclusions
	the tube). The direction of the wrinkle on a sample tube (that is cut by the suspected cutter) is similar with Item3 (Blue painted tube). (3) When we used the Item1 (suspected cutter) for the cutting tube, a singularity remains on the tube. There are a singularity on the tube cut with Item1 (suspected cutter). Because of the blade shape, when the blade of cutter enter to the tube, the triangle shapes (same to blade shade) are remain on the tube. (4) Comparing trace is scratched on the cutting face of the tube. The sample tube (that is cut by the suspected cutter)'s trace scratched by Item1 (suspected cutter) is similar with Item3 (Blue painted tube). In conclusion, Item3 (Blue painted tube) is cut by the Item1 (suspected cutter).
DFVZW7	1. Microscopic examination of Exhibit 2 (Piece of Cut Tubing) disclosed that it was not cut by Exhibit 1 (Hose Cutter). 2. Microscopic examination of Exhibit 3 (Piece of Cut Tubing) disclosed that it was cut by Exhibit 1 (Hose Cutter).
DJBNDW	The Item 3 hose was cut by the Item 1 hose cutter. The Item 2 hose was not cut by the Item 1 hose cutter.
DJPY6A	Item 1 side A was identified as having made the toolmark observed on Item 3. Item 1 side A and B was eliminated as having made the toolmark observed on Item 2.
DQTZ8P	The suspect's hose cutter (Item 1) did produce the toolmarks on the tube Item 3 but not the ones on tube Item 2.
DR7QGT	Item #2: The questioned cut end of the red plastic tubing was compared to the test exemplars obtained from the Coilhose Pneumatics tubing cutter. Significant differences of the class and individual tool mark signatures were observed to conclude that the blade of the tubing cutter did not cut the tubing. Item #3: The questioned cut end of the red plastic tubing was compared to the test exemplars obtained from the Coilhose Pnuematics[sic] tubing cutter. Sufficient corresponding individual tool mark signatures were observed to conclude that the blade of the tubing cutter had cut the tubing.
EBXZVF	I compared the individual and class characteristics marks on the Items identified as Item 2 and Item 3 respectively with tests cut from the tool identified as Item 1 and found: 2.1 The marks on the Item 3 were produced by the tool identified as Item 1. 2.2 The marks on the Item 2 were not produced by the tool identified as Item 1.
ECRQ2U	The laboratory examinations of the two pieces of tubing (item 2 and 3) and hose cutter (item 1) by of the comparison microscope Leica FS C. The enclosed evidence material (item 2 and 3) as well as the comparative material obtained with the hose cutter (item 1) were examined in order to find individual characteristics presented on their surfaces. With regard to the results obtained due to performed comparative analysis with the use of above-mentioned methods we conclude that the hose cutter (item 1) was used to cut the piece of tubing marked item 3. On piece of tubing marked as "item 3" we found some features similar to these characteristics for hose cutter (item 1). Piece of tubing marked as "item 2" was different than item 1 and 3.
EDY9X6	The submitted tubing, item #3 was cut by the submitted cutter, item #1. Due to matching class characteristics and the lack of repeatable individual mark/pattern areas, we were unable to identify or eliminate the submitted tubing, item #2 as being cut by the submitted tubing cutter, item 1.
EMPREY	The Item 3 tubing was identified as having been cut by the Item 1 hose cutter. The Item 2 has toolmarks present with class characteristics similar to those produced by the Item 1 hose cutter. However, 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 2 tubing was created by the Item 1 hose cutter.
EWVC2Z	The toolmark on item 2 was not made by the hose cutter, item 1. The toolmark on item 3 was made by the hose cutter, item 1.

TABLE 2

WebCode	Conclusions
F4AQ6H	The toolmarks displayed on the cut end of Item 2 could neither be identified nor eliminated as having been produced by the Item 1 hose cutters. An insufficient correspondence of individual characteristics was observed. The toolmarks displayed on the cut end of Item 3 were identified as having been produced by the Item 1 hose cutters.
F6N6R7	Toolmarks present on the Item #3 tubing (blue) was identified as having been produced by the Item #1 hose cutter. Toolmarks present on the Item #2 tubing (green) could not be identified or eliminated as having been produced by the Item #1 hose cutter.
FAFAKA	I compared the class and individual characteristic markings on the exhibits mentioned in 3.2, 3.3 and 5 using a comparison microscope and found: 6.1 The marks on the rubber tubing mentioned in 3.3 were produced by the hose cutter mentioned in 3.1. 6.2 The marks on the rubbing[sic] tubing mentioned in 3.2 were not produced by the hose cutter mentioned in 3.1
FMH3QD	3. On 2015-06-22 during the performance of my official duties I received a sealed evidence bag with number PA4001257949 from Case Administration of the Ballistics section, containing the following exhibits: 3.1 One pipe cutter marked by me 140099/15 item 1. 3.2 Two pieces of PVC pipe marked by me 140099/15 each and item 2 and item 3 individually. 4. The intention and scope of this forensic examination comprise the following: 4.1 Examination of tools and toolmark related materials. 5. I compared the individual and class characteristic markings on the exhibit material in paragraph 3.2 with the pipe cutter mentioned in 3.1 using a comparison microscope and found: 5.1 The marks on the PVC pipe marked Item 3 mentioned in 3.2 were produced by the pipe cutter mentioned in 3.1. 5.2 The marks on the PVC pipe marked Item 2 mentioned in 3.2 were not produced by the pipe cutter mentioned in 3.1
FR3HQK	Item 1 (a hose cutter) produced the toolmark on Item 3 (a piece of tubing). It could not be determined if Item 1 produced the toolmark on Item 2 (a piece of tubing).* *The comparative examinations showed disagreement of individual characteristics, but insufficient for an elimination. The comparative examinations were inconclusive.
G4PJBK	The questioned toolmark on item 2 was not produced by the known tool, item 1. The questioned toolmark on item 3 was produced by the known tool, item 1.
G6J2E7	[No Conclusions Reported].
GH87M4	Item #1 (hose cutter) was examined and test marks were made on the provided media being a piece of red PVC tubing, similar to items #2 and #3. Microscopic examination and comparison identified the cut on item #3 as having been made by item #1. However, item #1 did not make the cut on item #2.
GKA8HU	Item 2 cannot be identified or eliminated as having been cut using item 1. Item 3 bears marks consistent with having been cut using item 1.
GKXBFB	Item 2: Due to the differences found in characteristics on the cut surface of the item 2 and characteristics on cut surface of the questioned hose cutter (item 1) the first cut piece of tubing (item 2) was not cut with the questioned hose cutter. Item 3: Due to corresponding characteristics found on the cut surfaces of the Item 3 and characteristics on cut surface of the questioned hose cutter (item 1) the second cut piece of tubing (item 3) was cut with questioned hose cutter.
GQYP2C	1) In my opinion the submitted hose/tube cutter (item 1) has not been used to cut the piece of tubing (item 2). 2) In my opinion, the submitted hose/tube cutter (item 1) has been used to cut the piece of tubing (item 3).
GRTF66	The piece of red plastic tubing with green paint on one end (2) was not cut with the submitted tubing cutter (1). The piece of red plastic tubing with blue paint on omne[sic] end (3) was cut with the

TABLE 2

WebCode	Conclusions
	submitted tubing cutter (1).
GYUR3M	The hose cutter (item 1) was identified as having cut the piece of tubing (item 3). Agreement of the characteristics is sufficient to identify the hose cutter as the source of the toolmarks. The hose cutter (item 1) could not be identified or excluded as having cut the piece of tubing (item 2). There was agreement of all class characteristics, but no agreement or disagreement of thee[sic] individuals characteristics was noted. The tubing (item 2) could having been cut by the hose cutter (item 1) or any other tool capable of producing similar toolmarks.
HEZ9Q2	The Item 1 hose cutter has been identified as having cut the Item 3 tubing. The Item 2 tubing has been cut by a single edge of a bladed tool and was not cut by the Item 1 hose cutter.
HMXYEW	Using the tubing cutter in Item 1, test toolmarks were produced and microscopically examined in conjunction with the tubing in Items 2 and 3. Based on these comparative examinations and observed class and individual characteristics, it was determined that: A) No similar individual characteristics could be found to link the tubing cutter in Item 1 to the toolmarks on the tubing in Item 2. B) The toolmarks on the tubing in Item 3 had been made by the tubing cutter in Item 1.
HYT6AF	Item 2 was eliminated as having been cut using Item 1. Item 3 was identified as having been cut using Item 1.
J3PXY6	2.1 The cut pipe marked item 3 was cut (produced) by the hose cutter marked item 1. 2.2 The cut pipe marked item 2 was cut (produced) by a second (different) hose cutter.
JAMP6D	1. Piece of tubing marked by me as 146219/15 Item 3 was positive to hose cutter marked by me as 146219/15 Item 1 (Positive to test (T1 and T2). 2. Piece of tubing marked by me as 14619/15 Item 2 was negative to hose cutter.
JCTATD	The marks on the piece of tubing marked 128857/15 I3 (blue) were produced by the hose cutter marked 128857/15I1 striation marks correspond. The marks on the piece of tubing marked 128857/15 I2 were not produced by the hose cutter marked 128857/15I1. The conclusion arrived as were based on facts, established by means of an examination and process which require a knowledge and skill in Forensic Ballistics.
JGMZKH	Item 001-3 was cut by the submitted hose cutter, item 001-1. Item 001-2 was not cut by the submitted hose cutter, item 001-1, based on differences in individual characteristics. Possible suspect tools include hose cutters similar in function to that of item 001-1; however, any suspect tool should be submitted to the laboratory for analysis.
JLH43P	Two groups of cut samples were prepared with Item 1 (hose cutter) and a piece of PVC tubing. Each group was marked by one specific side of the cutting blade. On subsequent comparisons with Item 2 and Item 3, it was found that: The micro-characteristics (micro-striae patterns) on Item 3 are significantly similar to those of all the samples from one group whereas Item 2 bears different characteristics. Therefore we conclude that Item 3 was cut by Item 1 and Item 2 was not cut by Item 1.
JTHHQB	3. On 2015-06-24 during the performance of my official duties I received a sealed evidence bag with number PA4001257947 from Case Administration of the Ballistics Section, containing the following exhibits: 3.1 One (1) Taiwanese black hose cutter, marked by me "140114/15 1". 3.2 One (1) piece of tubing (painted green), marked by me "140114/15 2". 3.3 One (1) piece tubing (painted blue), marked by me "140114/15 3". 3.4 One (1) piece of tubing not marked. 4. The intention and scope of this forensic examination comprise the following: 4.1 Examination of tools and toolmark related materials. 4.2 Microscopic individualization of toolmarks. 5. I examined the piece of tubing mentioned in paragraph 3.4 and made replications for test purposes with the hose cutter mentioned paragraph 3.1, marked by me as 114T1 and 114T2 respectively. 6. I compared the individual and class characteristics markings on the pieces of tubing mentioned in paragraph 3.2, 3.3 and 5, using a

TABLE 2

WebCode	Conclusions
	comparison microscope, and found: 6.1 The marks on the piece of tubing mentioned in paragraph 3.3 was produced by the hose cutter mentioned in paragraph 3.1. 6.2 The marks on the piece of tubing mentioned in paragraph 3.2 was not produced by the hose cutter mentioned in paragraph 3.1.
JU9LJH	Item no.3 (painted blue) was cut by the hose cutter.
JXBKRP	Item 1 (a black colored tubing cutter) was used to create multiple test marks in PVC tubing. Comparative examination of these test marks showed that the blade of Item 1 created reproducible patterns of matching features in PVC tubing. Comparative examinations of Item 3 (a cut piece of tubing with blue paint) against test marks made with Item 1 showed the presence of matching features. This means that Item 1 was used to cut Item 3. It could not be determined if Item 1 was used to cut Item 2 (a cut piece of tubing with green paint). The comparative examination showed disagreement of individual characteristics, but insufficient for an elimination. The comparative examinations were inconclusive.
KAHUWR	The item 1 hose cutter was used to make test cuts in the submitted reference tubing. The test cuts from item 1 were microscopically compared to cuts on items 2 and 3. The cut on item 2 could neither be identified nor eliminated as having been made by the item 1 hose cutter. The inconclusive results are due to an insufficient agreement or disagreement of individual characteristics between item 2 and test cuts from item 1 for an identification or elimination. The cut on item 3 was identified as having been made by the item 1 hose cutter.
KBCDZD	Striation on hose using item 1 is different from striation on item 2 and same as striation on item 3.
KG4KL8	1. Microscopic examination of Exhibit 2 (Piece of cut tubing) revealed it was not cut with Exhibit 1 (Hose Cutter). 2. Microscopic examination of Exhibit 3 (Piece of cut tubing) revealed it was cut with Exhibit 1 (Hose Cutter).
KGFQQC	I examined the two pieces of tubing marked Item 2 and Item 3 using a comparison microscope and found microscopic comparable marks which can possibly be utilized for individualization. I examined the cutter marked Item 1 and cut tests (using tubing supplied for test purposes) with it for comparison purposes. I compared the individual and class characteristic markings on the items and tests using a comparison microscope and found: 7.1 The marks on the tubing marked Item 3 were produced by the cutter marked Item 1. 7.2 The marks on the tubing marked Item 2 were not produced by the cutter marked Item 1.
KHDNFJ	Item 3 was cut by Item 1. Item 2 was cut by a second cutting tool based on differences in individual characteristics[sic].
KHY7CD	After checking both pieces of tubing against the tests that were cut by hose cutter, I came to a conclusion that: piece of tubing marked item 3 was cut by a hose cutter marked item 1 and piece of tubing marked item 2 was not cut by a hose cutter marked item 1.
KJ6QZD	The shape and striation marks in the section of the test hose produced by the knife (item 1) are different with these on the section of the hose (Item 2). The shape and striation marks in the section of the test hose produced by the knife (item 1) are the same as these on the section of the hose (Item 3).
KRM7XG	I marked the one side of the blade on Item 1 with 'A' and the opposite side 'B'. I then utilised the portion of provided test hose and made a cut through the hose with the cutter. I then made an examination of the two question hoses (blue and green) using a comparison microscope. This type of examination allows two objects to be viewed simultaneously so that microscopic marks left behind on the damaged surfaces of two objects can be compared and assessed. I then performed a similar comparison between the toolmarks available on the severed ends of the test hoses and the severed ends of the two questioned hoses, Item 2 and Item 3. As a result of this examination I formed the

TABLE 2

WebCode	Conclusions
	following opinion: Damaged hose 3 was severed using the hose cutter Item 1. Damaged hose 2 was not severed using the hose cutter Item 1.
KUUBPK	1) The submitted piece of cut PVC tubing (Item 3) was cut by the submitted hose cutter (Item 1). 2) The submitted piece of cut PVC tubing (Item 2) could have been cut by the submitted hose cutter (Item 1) based on class characteristics; however, there are no individual characteristics to suggest that it was.
KVY6XP	The item 2 cut tubing is eliminated as having been cut by the item 1 tubing cutter. The item 3 cut tubing is identified, with practical certainty, as having been cut by the item 1 tubing cutter.
KXRUPX	Marks present on the Item 2 and Item 3 sections of hose were compared to test marks made using the Item 1 hose cutter. The Item 2 section of hose was not cut with the Item 1 hose cutter due to differences in individual characteristics. The Item 3 section of hose was cut using the Item 1 cutter.
KY26XL	With the questioned hose cutter (item 1) test marks were made in the extra piece of PVC tubing. Casts of the mentioned test marks were made and compared with casts of the questioned marks on item 2 and item 3 to investigate similarities and dissimilarities of the toolmarks. The microscopical examination revealed that the surface structures of the test marks caused by item 1 correspond with the surface structures of the toolmarks on item 3 and are different from the toolmarks on item 2. On the active surface of the hose cutter are grooves from various shape cutting manufacturing processes. The alignment and combination of the different manufacturing marks are unique in their shape, position and size. Therefore the hose cutter labeled as item 1 is identified as the tool that caused the toolmarks on item 3. The toolmarks on item 2 were caused by a different tool.
L7YZUY	The first cut piece of tubing (01-02) was compared to cuts made by the hose cutter (01-01). There was agreement in discernible class characteristics and disagreement in pattern areas of individual characteristics, but insufficient[sic] for an elimination. The result of the comparisons was inconclusive. The second cut piece of tubing (01 - 03) was cut by the hose cutter (01-01).
L99XD9	1. Examinations showed that the tool marks present on Item 2 are eliminated as having been produced by the Item 1 tubing cutter. 2. Examinations showed that the tool marks present on Item 3 are identified as having been produced by the Item 1 tubing cutter.
LH69BG	The investigation was carried out by using a comparison light microscope. The toolmarks on the submitted tubing Item 3 were caused by the hose cutter Item 1 recovered from suspect. The toolmarks on the submitted tubing Item 2 were not caused by the hose cutter Item 1 recovered from suspect.
LRFAY4	I compared the individual and class characteristic markings on the tubing marked Item 2 and Item 3 using a comparison microscope and found: 6.1 The marks on the tubing (mentioned in 3.2) marked 147227/15Item 3 were produced by the hose cutter (mentioned in 3.1). 6.2 It cannot be determined if the marks on the tubing (mentioned in 3.2) marked 147227/15Item 2 were or were not produced by the hose cutter (mentioned in 3.1).
LTELMJ	Examination of Item 1 (Cutting Tool) and Items 2 and 3 (Cut Lengths of Tubing) was carried out by using the cutting tool to make sample cuts in the supplied tubing. These sample cuts were then compared with the exhibit tubing (Items 2 and 3). Comparison between the test cuts and Item 2 showed that the tubing (Item 2) was not cut by the exhibit cutting tool (Item 1). Comparison between the test cuts and Item 3 showed that there was sufficient agreement within the accidentally occurring striae imparted during the cutting process to say that the cutting tool (item 1) was used to cut the section of tubing (Item 3).
LUMUHW	Inconclusive that the cut in Item 2 was made by the submitted cutter (Item 1) due to similarities in class characteristics and lack of reproducible individual characteristics. The submitted cut tubing (Item 3) was cut by the submitted hose cutter (Item 1).

TABLE 2

WebCode	Conclusions
LX8NQJ	I observed an excellent correspondence of striae between the cut surface of the second cut piece of tubing (item 3) and the cut surface of a piece of tubing cut using the hose cutter (item 1) recovered from the suspect. In my opinion, this correspondence means that the hose cutter recovered from the suspect was used to cut the second cut piece of tubing. I did not observe any correspondence of striae between the cut surface of the first cut piece of tubing (item 2) and the cut surface of a piece of tubing cut using the hose cutter (item 1) recovered from the suspect. In my opinion, this means that the hose cutter recovered from the suspect was not used to cut the first cut piece of tubing.
M3CQ96	Examinations showed Item 3 was cut by Item 1. Examinations showed Item 2 was not cut by Item 1.
M7T3XU	As a result of the macroscopic and microscopic comparison it is certain that the toolmarks present on the second cut piece of tubing (Item 3, painted blue) have been produced by the hose cutter recovered from suspect (Item 1). The hose cutter Item 1 has been excluded to have produced the toolmarks present on the first cut piece of tubing (Item 2, painted green).
MGAP8U	Tests from #1 & #2 & 3 were compared microscopically with each other. There is agreement of all discernable class characteristics. #3 & 1 also have sufficient agreement of individual characteristics for identification. #1 cut #3. #1.2; due to differing individual characteristics is eliminated as having been cut by #1.
MGTTGF	A MICROSCOPIC COMPARISON OF CUT PIECES OF HOSE Q1 AND Q2 ITEMS #'S 2 AND 3 WITH TEST CUT PIECES OF HOSE FROM K1 CUTTER HAS RESULTED IN THE FOLLOWING CONCLUSIONS: ITEM 3 Q2 WAS CUT WITH K1 CUTTER. DUE TO INSUFFICIENT AGREEMENT OF INDIVIDUAL MICROSCOPIC MARKINGS, Q1 ITEM 2 COULD NOT BE IDENTIFIED OR ELIMINATED AS HAVING BEEN CUT WITH K1 CUTTER.
MJH2PW	The Item 01-02 cut piece of red tubing with green paint was unable to be identified or eliminated as having been cut by the Item 01-01 hose cutter or the same tool as the Item 01-03 cut piece of red tubing with blue paint due to a lack of reproducible marks. The Item 01-03 cut piece of red tubing with blue paint was identified as having been cut by the Item 01-01 hose cutter.
MTPU6H	The submitted tool mark on Item #3 was made by the submitted hose cutter, Item #1. The submitted tool mark on Item #2 was not made by the submitted hose cutter, Item #1, based on differences in individual characteristics.
N3QL3B	The cut surface of the hose in item 3 (blue end) was examined when its general characteristics were noted. The cut surface was compared to test impressions made by the hose cutter Item 1 when they were found to show agreement in class, sub-class and individual characteristics such that Item 1 was responsible for cutting the hose in Item 3. The cut surface of the hose in item 2 (green end) was examined when its general characteristics were noted. The cut surface was compared to test impressions made by the hose cutter Item 1 when they were found to be different such that Item 1 was not responsible for cutting the hose in Item 2.
NLL8R9	The cut end on item 1.2 was microscopically compared to test cuts made with the tube cutter contained in item 1.1 with the following results. The cut end on item 1.2 could have been made by the tube cutter contained in item 1.1 it has similar class characteristics, however failed to retain sufficient individual characteristics required for an identification or elimination. The cut end on item 1.3 was microscopically compared to test cuts made with the tube cutter contained in item 1.1 with the following results. The cut end on item 1.3 was positively made with the tube cutter contained in item 1.1.
NZK2DQ	I have found a match between the toolmarks found on the 2nd cut piece of tubing (Item 3), and the marks produced by House cutter (Item 1). This House cutter (Item 1) left its marks on the 2nd cut piece of tubing (Item 3). No match was found between the toolmarks found on the 1st cut piece of tubing (Item 2). The House cutter (Item 1) was not used for cutting the piece of tubing (Item 2).

TABLE 2

WebCode	Conclusions
P2HMR3	Test toolmarks made using the hose cutter (Item 1) and provided tubing, were microscopically examined in conjunction with the evidence tubing. Based on these comparative examinations, the following was determined: The tubing (Item 3) had been cut by the hose cutter (Item 1). The tubing (Item 2) bears the same general characteristics as the toolmarks made by the hose cutter (Item 1). However, there are insufficient microscopic details for a conclusive identification. The hose cutter could not be identified nor eliminated as having cut this evidence tubing.
PDNWW4	Examinations showed that the tool marks present on Item 3 are identified as having been produced by Item 1. Examinations showed that the tool marks present on Item 2 have been eliminated as having been produced by Item 1.
PFBL94	1. The tool mark present in the tubing described in item 2, was not produced by the hose cutter described in item 1. 2. The tool mark present in the tubing described in item 3, was produced by the hose cutter described in item 1.
PMBVNA	Item 2 could neither be identified nor eliminated as having been cut by Item 1 due to insufficient correspondence of individual microscopic marks of comparative value. Item 3 was identified as having been cut by Item 1.
PMQYDU	Examinations showed Item 2 was not cut with Item 1 due to differences in individual characteristics. Examinations showed Item 3 was cut with Item 1.
PTZD2K	The tubing cutter was tested using the supplied PVC test material. These tests were compared using the comparison microscope to the cut ends of item 2 and 3, based on these comparisons it is the opinion of this examiner that item 3 was cut by the tubing cutter in item 1. The cut on item 2 exhibits similar class characteristics to the cuts made by item 1, however, no similar individual characteristics were observed; therefore, no identification or elimination was made.
PWW7QA	The damaged area on the tubing (item #3) was identified as having been made by the hose cutter (item #1). The damaged area on the tubing (item #2) exhibits similar class characteristics as those produced by the hose cutter (item #1). However, due to the lack of corresponding individual characteristics, it is not possible to identify that hose cutter (item #1) as having made the damage.
Q4T4CQ	The tubing cutter Exhibit 1 was used to make test cuts in the submitted tubing. The section of tubing Exhibit 2 was not cut by the tubing cutter Exhibit 1; it was cut by a different single bladed tool. The section of tubing Exhibit 3 was cut by the tubing cutter Exhibit 1.
QA3GWB	Item 2 (green painting) is not cut by the hose cutter (item 1). Item 3 (blue painting) is cut by the hose cutter (item 1).
QTX6BD	Tests were made with the Exhibit 1 hose cutter and the Exhibit 4 tubing. The Exhibit 2 tubing was not cut with the Exhibit 1 hose cutter. The Exhibit 3 tubing was cut with the Exhibit 1 hose cutter.
R3F77D	The findings of this examiner are as follows: 1. The toolmarks found on the submitted second piece of red tubing, Item 3, were made by the submitted hose cutter, Item 1. 2. The toolmarks found on the submitted first piece of red tubing, Item 2, were not made by the submitted hose cutter, Item 1, based on differences in individual characteristics.
R3UHXQ	Test cuts from the cutter (Item 1) and the cut end of the tubing (Item 3) were microscopically examined and compared. Based on the agreement of their class characteristics and sufficient agreement of their individual characteristics, the cutter (Item 1) is identified as having been used to cut the tubing (Item 3). Test cuts from the cutter (Item 1) and the cut end of the tubing (Item 2) were microscopically examined and compared. Based on the disagreement of both their class and individual characteristics, the cutter (Item 1) is eliminated as having been used to cut the tubing (Item 2).

TABLE 2

WebCode	Conclusions
R3XXGH	The tool marks present on the Item 2 piece of tubing were not made by the Item 1 hose cutter tool. The tool marks present on the Item 3 piece of tubing were identified as having been made by the Item 1 hose cutter tool.
RM4B6Y	The suspect's hose cutter (ITEM1) produced the questioned toolmark ITEM3 (pointed blue). The suspect's hose cutter (ITEM1) didn't produce the questioned toolmark ITEM2 (pointed green)
RNGAXM	Item 1C (item #3) was identified as having been cut by Item 1A (item #1) based on the agreement of class and individual characteristics. Item 1B (item #2) could not be identified or eliminated as having been cut by item 1A (item #1) due to insufficient agreement/disagreement of individual characteristics. However, similar class characteristics were noted.
RNYVW6	I examined the hose cutter mentioned in 3.2 marked as 146204/15 (Item 1) and made replications of tests marked by me as 146204/15 (TC1 - TC3). I compared the exhibits mentioned in 3.2 and 3.3 marked 146204/15 (Item 2) and 146204/15 (Item 3) with the test mentioned in 5.1 marked 146204/15 (TC1 - TC3) respectively and found: 2.1 The marks on exhibit marked 146204/15 (Item 2) was not produced by the tool marked 146204/15 (Item 1). 2.2 The marks on exhibit marked 146204/15 (Item 3) was produced by the tool marked 146204/15 (Item 1).
RQ8YT2	The piece of red hose (Item 2) was excluded from having been cut by the hose cutter (Item 1) based upon differing individual characteristics. The piece of red hose (Item 3) was identified as having been cut by the hose cutter (Item 1) based upon sufficient agreement of individual characteristics.
RXK3QM	The toolmarks observed on the tubing in Item 3 was produced by the cutter in Item 1. The toolmarks observed on the tubing in Item 2 bear class characteristics consistent with the cutter in Item 1. However, due to insufficient reproducible individual characteristics, Item 2 could not be positively included or excluded as having been cut by Item 1.
T23U42	Test tool marks produced by Item 1 were microscopically examined in conjunction with those found on Item 2 and Item 3. Based on these comparative examinations, it was determined that: A) The tool marks present on Item 3 had been produced by Item 1 (side "B"). B) The tool marks present on Item 2 bear the same class characteristics as those present on tests produced by Item 1; however, no similar individual characteristics were found to link Item 2 with Item 1.
T3TXUN	Item 1 (hose cutter) and Items #2 & 3 (cut tubing pieces) were examined and microscopically compared on 07/09/2015. Item #1 (hose cutter) was eliminated as the source of the toolmarks on Item #2 (green painted cut tubing) because of a significant disagreement in individual characteristics. Item #1 (hose cutter) was positively identified as the source of the toolmark on Item #3 (blue painted cut tubing).
T93YAZ	An examination of the questioned cut ends of the two lengths of hose, Items 2 and 3, revealed striated toolmarks useful for comparison and identification purposes. After examining each of these cut ends for trace evidence, with negative results, a silicone rubber cast was prepared of each of them. A detailed examination of the submitted tool, Item 1, revealed no trace evidence and no indication that that[sic] the cutting blade has ever been changed. This hose cutter is in like-new condition. Test marks were prepared using the submitted hose cutter, Item 1, by designating one side of the blade as side A and the other side as side B, and cutting off a length of hose from the hose standard, Item 4. Both sides of the test cut were retained and designated Items 1A (side A) and 1B (side B). A silicone rubber cast was prepared of each test cut end. A microscopic comparison of the cast of test cut 1A with the cast of the questioned cut end of hose #3 revealed sufficient agreement of individual hose cutter produced marks to establish that this questioned cut end was cut using the submitted hose cutter, Item 1. A microscopic comparison of the casts of both test cut surfaces, Items 1A and 1B, with the cast of the questioned cut end of hose #2 revealed sufficient differences in individual toolmarks to establish that this questioned cut end was not cut with the submitted hose cutter, Item 1. Representative digital images were taken of most of the microscopic comparisons. All of these images were depicted in the

TABLE 2

WebCode	Conclusions
	case notes and will be stored on the laboratory's digital image server. The identification of toolmarks is 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 unknown tool could have made the questioned marks is so remote as to be considered a practical impossibility.
T9HGRC	The Item 1 hose cutter was functional as received. The cutter has a single cutting blade with a cutting edge beveled on both sides and was designed to cut by shearing. Test cuts were made from the cutter using the submitted rubber tube, similar to the Item 2 and 3 tubes. The questioned toolmarks on the Item 2 tube were not caused by the cutting blade of the Item 1 hose cutter. The questioned toolmarks on the Item 3 tube were caused by the cutting blade of the Item 1 hose cutter.
TAEZTD	Item 2 - The toolmark on the Item 2 piece of tubing was not made by the Item 1 hose cutter. Item 3 - The toolmark on the Item 3 piece of tubing was made by the Item 1 hose cutter.
TERQ6Z	Examinations showed the tool marks present on Item 3 were made by Item 1. Examinations showed the tool marks present on Item 2 were not made by Item 1.
THNHBB	1. Exhibits 2 and 3 (Two pieces of hose) were visually examined and cut damage was noted consistent with that produced by a single bladed instrument. 2. Exhibit 1 (Hose cutter) was visually examined and used to create Exhibit 1.1 (Test toolmarks). The cut damage on the pieces of hose of Exhibits 2 and 3 was microscopically compared to the Exhibit 1.1 tests. 3. Exhibit 1 cut the Exhibit 3 hose. 4. Exhibit 1 did not cut the Exhibit 2 hose. 5. The two pieces of hose of Exhibits 2 and 3 were altered by cutting to facilitate microscopic comparison.
TMYFYX	6.1 The marks on the cut red rubber tubing mentioned in 3.3 were produced by the pair of coilhose pneumatic tube cutters mentioned in 3.1. 6.2 The marks on the cut red rubber tubing mentioned in 3.2 were not produced by the coilhose pneumatic tube cutters mentioned in 3.1
TPMRVH	Microscopic examination and comparison reveal that the second cut piece of tubing (painted blue) (Item 3) were made by the hose cutter (Item 1). Microscopic examination and comparison reveal that the first cut piece of tubing (painted green) (Item 2) were not made by the hose cutter (Item 1).
UG9DEY	Examinations showed the tool marks on Item 3 were made by Item 1. Examinations showed the tool marks on Item 2 were not made by Item 1.
UP6DPK	Test tool marks produced by Item 1 were microscopically examined in conjunction with the tool marks found on Items 2 and 3. Based on these comparative examinations, it was determined that: A. The tool marks present on Item 3 had been produced by Item 1. B. The tool marks present on Item 2 bear the same class characteristics as test tool marks from Item 1, however, no individual characteristics were found to link Item 2 as having been cut by Item 1.
V2YUEL	The Item 2 and Item 3 questioned toolmarks were compared to test toolmarks produced using the Item 1 hose cutter. The Item 3 questioned toolmark was made using the Item 1 hose cutter. The Item 2 question toolmark was not made using the Item 1 hose cutter.
VDMXD6	Toolmarks on Item #2 and Item #3 were microscopically examined and compared with test cuts from Item #1, the hose cutter recovered from the suspect. Item #3 was identified as being cut by the submitted hose cutter, Item #1. Item #2 is eliminated as being cut by the submitted hose cutter based on differences in cutting design.
VGBHD8	Having compared the tool marked as item 1, to the two pieces of cut plastic tube marked item 2 and item 3, I am of the opinion that: - Item 1 was responsible for producing the scene marks on item 3. - Item 1 was not responsible for producing the scene marks on item 2.

TABLE 2

WebCode	Conclusions
VKMJ4J	The Exhibit 1 tubing cutter was used to make tests in suitable materials. The Exhibit 2 section of tubing was not cut by the Exhibit 1 tubing cutter. The Exhibit 3 section of tubing was identified as having been cut by the Exhibit 1 tubing cutter.
WV3CTE	Item 3 had class and individualizing characteristics that were compared to test marks made with Item 1. Sufficient matching striae were found to reach the conclusion that Item 1 was used to cut Item 3. Item 2 had primarily class and some individualizing characteristics that were compared with test marks made with Item 1. Matching striae were not found, leading to the conclusion that Item 1 was not used to cut Item 2.
VY8QMZ	Examinations showed the tool mark on Item 3 was created by Item 1. Examinations showed the tool mark on Item 2 was not created by Item 1.
W3MMQF	Item 1 cut hose item 3. Differences in individual marks between Item 1 test cuts and item 2 were sufficient for elimination, item 2 was not cut by item 1.
WBBK8M	The submitted hose cutter, Item 1, produced the severing toolmark present on the submitted rubber tubing, Item 3. Due to the lack of corresponding pattern of individual characteristics the submitted cutter, Item 1, was unable to be eliminated or identified as having produced the severing toolmark present on the submitted rubber tubing, Item 2.
WBX7P7	The hose cutter (Item 1) did not produce the questioned toolmarks on the first cut piece of tubing (Item 2). The hose cutter (Item 1) did produce the questioned toolmarks on the second cut piece of tubing (Item 3).
WGH4FE	In the opinion of the examiner, it is inconclusive as to whether Laboratory Item 001.B (item 2) one piece of cut hose with a green painted tip was made by Laboratory Item 001.A (item 1) coilhose brand hose cutter. An inconclusive finding resulted from agreement between all discernible class characteristics, and disagreement between individual characteristics but insufficient for elimination. It is the opinion of the examiner that Laboratory Item 001.C (item 3) one piece of cut hose with a blue painted tip is identified as having been made by Laboratory Item 001.A (item 1) coilhose brand hose cutter. 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.
WJNRTH	Examination of the cut hoses in Item #2 and Item #3 revealed the presence of toolmarks that had been produced by a shearing action tool. Test toolmarks from the cutter in Item #1 were microscopically examined in conjunction with the toolmarks on Items #2a and #3. Based on these comparative examinations, and observed class and individual characteristics, it was determined that: A) The toolmark on Item #3 had been produced by the blade of Item #1. B) No similar individual characteristics could be found to link the toolmark on item #2 to having been produced by the blade of Item #1.
WQRJ98	The toolmarks on the second cut piece of tubing in Item 3 were made with the hose cutter in Item 1 while the toolmarks on the first cut piece of tubing in Item 2 were not made with the hose cutter in Item 1.
X87E6M	The green painted tubing (#2) was not cut by the tubing (hose) cutter (#1). This elimination is based on observed differences in topographical marks (class characteristics) and a lack of matching patterns of toolmarks (individual characteristics). The blue painted tubing (#3) was cut by the tubing (hose) cutter (#1).
XAEH46	The second cut piece of tubing (Item 3) was cut with the hose cutter recovered from the suspect (Item

TABLE 2

WebCode	Conclusions
	1). It was inconclusive if the first cut piece of tubing (Item 2) was cut with the hose cutter recovered from the suspect (Item 1).
XBTWG7	1. Item 2 was eliminated from having been cut by Item 1 (cutters). 2. Item 3 was identified as having been cut by Item 1 (cutters).
XDC6CY	a) The marks on the tubing in 3.3 were produced by the hose cutter in 3.1. b) The marks on the tubing in 3.2 were not produced by the hose cutter mentioned in 3.1.
XGHJ4Y	Test toolmarks created using the tubing cutter, Lab Item 1, were microscopically compared to the toolmarks exhibited on the cut portions of tubing, Lab Items 2 and 3. Identification: The toolmarks exhibited on the cut portion of tubing, Lab Item 3, were created by the tubing cutter, Lab Item 1, based on microscopic comparison and agreement of discernible class characteristics and sufficient matching individual detail. Elimination: The toolmarks exhibited on the cut portion of tubing, Lab Item 2, were not created by the tubing cutter, Lab Item 1, based on microscopic comparison and significant disagreement of individual characteristics.
XMJPF	The hose cutter in Item #1 could not be identified as or excluded from having cut the tubing in Item #2 based on similar class characteristics (type of cut and striations). The hose cutter in Item #1 was identified as having cut the tubing in Item #3.
XMRKP3	Test cuts were made with Item #1 and compared microscopically to Item #2 (green) and Item #3 (blue). The results with Item #3 (blue) are positive which means that the striations on Item #3 (blue) match the striations on the test cuts made by Item #1; therefore Item #3 (blue) was cut by item #1. The results with the Item #2 (green) are negative which means that the striations on Item #2 (green) are different than the striations on the test cuts made by item #1; therefore Item #2 (green) was not cut by Item #1.
XTBUT6	Item 1 did not produce the markings on Item 2. Item 1 did produce the markings on Item 3.
XXMZ7Q	2.1 The marks on the marked item 3 were produced by hose cutter marked item 1. 2.2 The marks on the marked item 2 were not produced by hose cutter marked Item 1.
Y6YHYP	Items 1 through 3 were examined and analyzed using microscopy. Toolmarks present on item 3 were identified as having been produced by Item 1. Item 2 exhibits toolmarks consistent with having been produced by a slicing type tool with a single blade. These toolmarks exhibit markings that may be suitable for identification with the tool by which they were produced. Toolmarks present on item 2 were eliminated as having been produced by item 1 due to differences in individual characteristics. Three (3) tests produced with Item 1 are being returned as Item 1T in Sample Pack: T1 and should be maintained for possible future examinations.
YAEYE9	Item #1 operates as designed. Item #2 was not cut by Item #1. Item #3 was cut by item #1.
YKUXZ4	MICROSCOPIC COMPARISON EXAMINATION OF EVIDENCE CUT PIECES OF TUBING ITEM 2 AND ITEM 3 WITH HOSE CUTTER ITEM 1 RECOVERED FROM SUSPECT REVEALED THAT PIECE OF TUBING ITEM 3 WAS CUT WITH HOSE CUTTER ITEM 1.
YMLPJ2	The questioned cut end of item 2 was not cut by item 1, the hose cutter. Sufficient differences were observed to eliminate item 1 as the tool used. The questioned cut end of item 3 was cut by item 1, the hose cutter. This identification is established by having sufficient agreement of unique surface contours.
YP9DV2	The striations on the section of the test hose produced by item 1 are the same as the ones on the section of item3. The striations on the section of the test hose produced by item 1 are different from the ones on the section of item2.

TABLE 2

WebCode	Conclusions
YPRA82	Items 1 - 3 were examined. Tests were made with Item 1 using tubing similar to Items 2 and 3. Tests made with Item 1 were microscopically compared to questioned toolmarks on Item 2 and 3. The questioned end of Item 2 was not cut with Item 1. The questioned end of Item 3 was cut with Item 1.
YW73C7	Item 1 One hose cutter tool Item 2 One 1 3/4 inch section of tubing Item 3 One 2 1/4 inch section of tubing The Item 1 tool was used to make tests in tubing material similar to Items 2 and 3. The Item 2 toolmarks were not made by the Item 1 tool. The Item 3 toolmarks were identified as having been made by the Item 1 tool.
Z2VZFM	2.1 I compared the individual and class characteristic markings on the test tubing and exhibit tubing, using a comparison microscope and found: 2.1.1 The marks on the tubing marked as Item 3, were produced by the hose cutter Item 1. 2.1.2 The marks on the tubing marked as Item 2, were not produced by the hose cutter Item 1.
Z3PT9K	The submitted piece of cut tubing, Agency Item #3, was cut by the submitted tool, Agency Item #1. We are unable to determine if the submitted piece of cut tubing, Agency Item #2, was cut by the submitted tool, Agency Item #1.
Z6XZFK	The Item 1 tubing cutter was identified as having cut the Item 3 piece of tubing. Due to a lack of sufficient corresponding microscopic marks of value, no conclusion could be reached as to whether the toolmarks on the Item 2 piece of tubing were produced by the Item 1 tubing cutter. Additionally, due to a lack of sufficient corresponding microscopic marks of value, no conclusion could be reached as to whether the toolmarks on the Item 2 piece of tubing were produced by the same tool that cut the Item 3 piece of tubing.
Z6ZG74	I conducted a microscopic examination of Item 1 and compared the casts made from test cuts with the casts made from Items 2 & 3. Item 2 had subtle differences in some class characteristics and there was an absence of significant numbers of matching striae. Item 2 was eliminated as having been cut by the tool of Item 1. Item 3 had all discernable[<i>sic</i>] class characteristics that matched Item 1 as well as multiple areas of matching individual characteristics. Item 3 is a match for the toolmarks created by Item 1 and in my opinion the toolmark of Item 3 was created by the tool of Item 1.
ZLZKCM	Examination of Item #1 revealed one (1) Coilhouse Pneumatics brand tubing cutter, black in color. Examination of Item #2 revealed one (1) portion of red PVC tubing, approximately 5/8 inch in outside diameter, one end painted green, with toolmarks observed on the cut end. Examination of Item #3 revealed one (1) portion of red PVC tubing, approximately 5/8 inch in outside diameter, one end painted blue, with toolmarks observed on the cut end. Tests were obtained by using Item #1 and were compared to the toolmarks on Items #2 & #3 with the following results: The Coilhouse Pneumatics brand tubing cutter (Item #1) was used to cause the toolmarks on the cut end of (Item #3). The Coilhouse Pneumatics brand tubing cutter (Item #1) was not used to cause the toolmarks on the cut end of (Item #2).

Additional Comments

TABLE 3

WebCode	Additional Comments
24CNBK	Laboratory policy does not allow for eliminations based on individual characteristics.
3LV37M	Strength of Associations Made in the Identification of Non-Firearm Toolmarks: 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.
3WVDXJ	A single bladed, slicing type tool was used to cut the submitted cut tubing with one end painted green.
6LMKJ9	Laboratory policy states that exclusions can only be made based on class characteristic differences.
6RTBNZ	The Item 2 cut tubing displays the same class characteristics as the tests from Item 1. There are differences in the general character of the individual characteristics present and there was no corresponding individual characteristics found; however, without being able to determine the reproducibility of the stria on Item 2, the hose cannot be eliminated as having been cut by Item 1.
7NPZ8Q	Toolmark identification determines if a toolmark left at a crime scene was produced by a particular suspect tool or not. Toolmarks are typically impressed or striated markings that hard object (the tool) leaves on a relatively softer surface. Hose cutter leaves impression marks as it slides across a softer surface (piece of tubing).
7XYHPN	Item 2 is reported as inconclusive per Laboratory policy - there is agreement of class characteristics but the differences in individual characteristics are insufficient for elimination.
88G93Z	Item 2 should be resubmitted along with any suspect tool.
94WQ72	Due to the insufficient agreement or disagreement of individual characteristics, the 01-AB (Item 2) section of tubing could neither be identified nor eliminated as having been cut by the 01-AA (Item 1) tubing cutters.
9HXAZL	The conclusions are based on the tool, tool mark, microscopic and microscopic comparison examination.
AC4MQX	The six SWGGUN factors for elimination based on individual characteristics were evaluated.
AYGMPX	The inconclusive results for Item 2 was based on consistent class characteristics and insufficient disagreement of individual detail for an elimination due to the muted/lack of individual detail exhibited in the tool marks exhibited on the piece of tubing (item 2) as compared to those exhibited in the test tool marks created using the hose cutters (item 1) and the tool marks exhibited on the piece of tubing (item 3).

TABLE 3

WebCode	Additional Comments
B44WCZ	Test toolmarks made with the submitted tubing/hose cutters (Item 1) were compared to the toolmarks on the cut ends of the evidence tubing.
B8MPRA	Microscopic comparisons of toolmarks between tests from Item 1 to the toolmarks on Item 2 exhibited agreement of all discernible class characteristics and disagreement of individual characteristics, but insufficient for an elimination. Although Item 2 exhibited disagreement of individual characteristics, Item 1 could not be eliminated as the source when the following factors laid out in the SWGGUN Guidelines "Elimination Factors Related to FA/TM Examination" (www.swggun.org) were considered: "Toolmarks - The discipline recognizes that an elimination of a toolmark by other than class characteristics is possible but that such an elimination is an exceptional situation (2.2.3). SWGGUN acknowledges that eliminations based on individual characteristics in firearm and toolmark examinations are exceptional situations and the following factors should be considered. 1. Condition of the working surface of the tool and/or substrate. 2. Material composition of the working surface of the tool and/or substrate. 3. Time of event to time of analysis factors. 4. History of the tool. 5. Number of items. 6. Consistency and reproducibility of the individual characteristics." 5. Number of Items: In this case, only two evidence items were submitted, and although they were not identified to each other, they were not eliminated either due to the possibility that a different working surface from the tool may have made the cuts. The tool submitted, Item 1, had two working surfaces that yielded different toolmarks, the left side and the right side of the blade. Additionally, only 4 test cuts could be made with the available tubing substrate, further limiting amount of comparisons available. 6: Consistency and reproducibility of the individual characteristics. Four test cuts were made with available substrate (tubing) and while three cuts showed reproducibility with positive ID's (cuts 2, 3, and 4), one cut (cut 1) did not have sufficient agreement of individual characteristics for and[sic] ID (inconclusive). Therefore, variation (inconsistency) in test cuts was demonstrated. Although reproducible marks were obtainable with the Item 1 tool, sufficiency for an ID did not occur with each cut and the potential for non-reproducibility exists with this tool.
BH89TL	Item 2 and test cuts made by Item 1 share similar class characteristics, but there is insufficient information to identify or eliminate Item 2 as being cut by Item 1. Traditionally this lab does not eliminate on differences in individual characteristics.
CATMHW	The tubing that was provided for test mark purposes is different than the tubing in items 2 and 3. The tubing in items 2 and 3 is more pink and seems a bit softer than the tubing provided for test mark purposes.
CMGNZN	The only way Item 2 could have been cut by Item 1 is if there was significant alteration of the cutting edge of the tool. There is no evidence of any such alteration.
CN9WZR	[Participant included an association scale that could not be replicated within the report.]
CR7DAZ	[Participant included an association scale that could not be replicated within the report.]
EDY9X6	Similar class characteristics & observed dissimilar individual characteristics suggests item #2 was cut with a different blade or tool than the item #1 cutter.
EMPREY	[Participant included an association scale that could not be replicated within the report.]

TABLE 3

WebCode	Additional Comments
F6N6R7	**Inconclusive was determined by the lack of comparative value of two or more sets of surface contour patterns comprised of individual peaks, ridges and furrows.
FAFAKA	Photo of tool mark was taken for court demonstration purposes.
FR3HQK	In instances of agreement of discernible class characteristics and disagreement of individual characteristics, eliminations are not always made.
GKA8HU	The tool that had cut item 2 used a blade that cut smoother than item 1. The coarse lines on item 1's blade could be class characteristics or accidentally imparted before cutting item 3, but after cutting item 2.
JXBKRP	Cut on Item 2 - striae not sharply defined - very shallow/two dimensional in appearance with far fewer markings visible on Item 2 than on test marks made with Item 1. General disagreement of individual features on Items 2 vs. test marks made with Item 1 but insufficient for an elimination. Result was inconclusive.
KAHUWR	The inconclusive results for item 2 are due to an insufficient agreement or disagreement of individual characteristics between item 2 and test cuts from item 1 for an identification or elimination.
L7YZUY	See first five lines above regarding first cut piece of tubing.
LRFAY4	Item 2 was found to be inconclusive due to lack of marks transferred (from the tool used to cut this tube) onto the PVC tubing. The marks are very faint, therefore a definitive conclusion could not be reached.
LUMUHW	Some striations and cut pattern but not much agreement on individual characteristics for a match for Item 2.
M7T3XU	The toolmarks for comparison have been produced in our lab using the hose cutter Item 1 and the test material provided (piece of PVC tubing). The toolmarks produced with the hose cutter and the questioned toolmarks (pieces of tubing Item 2 and Item 3) have been moulded using a suitable moulding material (AccuTrans). The comparison has been performed with a comparative microscope. The method "Toolmarks examination" is accredited according to ISO 17025.
MJH2PW	There was a noticeable difference in the quality of individual characteristics between the two cut pieces of red tubing, with the blue painted tubing having a significantly higher quality of marks. There were no observed differences in class characteristics nor any significant agreement or disagreement of individual characteristics between the green painted tubing and the test cuts with the hose cutter, so I am unable to either eliminate or identify the green painted tubing to the hose cutter.
P2HMR3	The general characteristics of Item 2, is similar to the characteristics of the test marks made by Item 1. The microscopic detail present on the tests are well defined, whereas those present on the evidence is very shallow with little definition.

TABLE 3

WebCode	Additional Comments
RNGAXM	I believe item 1B (item #2) to be an elimination to item 1A (item #1) based on the lack of agreement of individual characteristics; however, the reviewer of the case file did not agree with this assessment; therefore, per lab policy the result had to be reported out as an inconclusive.
RXK3QM	The individual stria appeared to be more "faint" on Item 2 compared to my test cuts. However, that could change with manipulating the light source.
T23U42	The striae found on tests produced with Item 1 bear a similar general appearance to those found on Item 2. In addition, tests from Item 1 bear similar arc-shaped striae at opposite sides of the cut tube. However, no unique series of corresponding striae were found to link the cut tube in Item 2 with the cutting surfaces of the tool in Item 1.
TAEZTD	Another tool is involved. Tests generated during examination are being returned with Item 1.
UP6DPK	Item 2 bears the same class characteristics as test tool marks from Item 1 and Item 2, however, individual characteristics found on Item 1 and Item 3 could not be found on Item 2. Since Item 2 bears the same class characteristics it cannot be eliminated because the individual characteristics on Item 2 could be the result of the blade being altered or changed after cutting Item 2.
WGH4FE	An inconclusive finding resulted from agreement between all discernible class characteristics, and disagreement between individual characteristics but insufficient for elimination.
WJNRTH	Characteristics on Item #2 are quite different in form and spacing than on Item #3 and Item #1 tests. However, class is similar in that Item #2 and #3 are both cut by shearing action tool. I believe Item #2 was cut by some other tool, but differences are insufficient for exclusion.
XAEH46	Test marks made with the hose cutter recovered from the suspect (Item 1) were microscopically compared to the first and second cut pieces of tubing (Items 2 and 3). The second cut piece of tubing (Item 3) was identified as being cut with the hose cutter recovered from the suspect (Item 1) based on sufficient individual detail observed. Based on an insufficient amount of corresponding individual detail observed, it was inconclusive if the first cut piece of tubing (Item 2) was cut with the hose cutter recovered from the suspect (Item 1).
XMJPF	Laboratory policy states that exclusions can only be made based on class characteristic differences.
YKUXZ4	ALTHOUGH THEY BEAR SIMILAR CLASS CHARACTERISTICS, THE CUT PIECE OF TUBING ITEM 2 COULD NOT BE IDENTIFIED OR ELIMINATED AS HAVING BEEN CUT WITH HOSE CUTTER ITEM 1 DUE TO INSUFFICIENT AGREEMENT OF THE MICROSCOPIC MARKINGS PRESENT ON CUT PIECE OF TUBING ITEM 2.
YW73C7	Tests generated during examination are being returned in the same container as the Item 1 tool. Item 2 should be resubmitted along with any suspect tool.
Z2VZFM	An identification photo image was taken for court demonstration purposes.
Z3PT9K	We are unable to determine if the submitted piece of cut tubing, Agency Item #2, was cut by the submitted tool, Agency Item #1. Agency Item #2 and test cuts made with the submitted

TABLE 3

WebCode	Additional Comments
	tool, Agency Item #1, displayed agreement of all discernible class characteristics without agreement or disagreement of individual characteristics due to absence, insufficiency, and lack of reproducibility.
Z6XZFK	Laboratory SOP requires a definitive class difference for exclusions. In this case there was not a difference in class characteristics and the difference in the fine microscopic characteristics noted could be due to changes in the tool's cutting surface from the time one Item was cut to when the second Item was cut.

Appendix: Data Sheet

Collaborative Testing Services ~ Forensic Testing Program **Test No. 15-528: Toolmarks Examination**

DATA MUST BE RECEIVED BY July 27, 2015 TO BE INCLUDED IN THE REPORT

Participant Code:

WebCode:

Accreditation Release Section

CTS submits external proficiency test data directly to ASCLD/LAB and ANAB. 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 and/or ANAB. (Accreditation Release section on the last page must be completed and submitted.)
- This participant's data is **NOT** intended for submission to ASCLD/LAB or ANAB.

Online Data Entry

Visit www.cts-portal.com to enter your proficiency test results online. If you have any questions please do not hesitate to contact CTS.

Scenario:

Police are investigating a break-in at a factory. The factory manager informed the investigator that several areas were vandalized. The investigator noted that the red tubing that carried high pressure air contained questioned toolmarks and retrieved both for submission. A suspect was apprehended later that day and police seized a hose cutter from his possession. Investigators are requesting that you examine the toolmarks on the submitted tubing and determine if either could have been cut using the hose cutter recovered from the suspect.

Please note the following:

- A piece of PVC tubing has been included for possible test mark purposes.
- To assist in distinguishing the side of tubing NOT to be examined, the end of the Item 2 tubing has been marked with green paint and the end of the Item 3 tubing has been marked with blue paint.

Items Submitted (Sample Pack T1):

- Item 1: Hose cutter recovered from suspect.
- Item 2: First cut piece of tubing. (painted green)
- Item 3: Second cut piece of tubing. (painted blue)

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

- | | | | | | | |
|--------|-----|--------------------------|----|--------------------------|---------------|--------------------------|
| Item 2 | Yes | <input type="checkbox"/> | No | <input type="checkbox"/> | Inconclusive* | <input type="checkbox"/> |
| Item 3 | Yes | <input type="checkbox"/> | No | <input type="checkbox"/> | Inconclusive* | <input type="checkbox"/> |

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

Please return all pages of this data sheet.

Page 1 of 3

Participant Code:

WebCode:

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

3.) Additional Comments

<p>Return Instructions: Data must be received via online data entry, fax (please include a cover sheet), or mail by <i>July 27, 2015</i> to be included in the report.</p>	<p>Participant Code: ONLINE DATA ENTRY: www.cts-portal.com FAX: +1-571-434-1937 or Toll-Free: 1-866-FAX-2CTS (329-2287)</p>
<p>QUESTIONS? TEL: +1-571-434-1925 (8 am - 4:30 pm EST) EMAIL: forensics@cts-interlab.com www.ctsforensics.com</p>	<p>MAIL: Collaborative Testing Services, Inc. P.O. Box 650820 Sterling, VA 20165-0820 USA</p>

Please return all pages of this data sheet.

Participant Code:

WebCode:

Collaborative Testing Services - Forensic Testing Program

RELEASE OF DATA TO ACCREDITATION BODIES

The following Accreditation Releases will apply only to:

Participant Code:

WebCode:

for Test No. **15-528: Toolmarks Examination**

This release page must be completed and received by **July 27, 2015** to have this participant's submitted data included in the reports forwarded to the respective Accreditation Bodies.

ASCLD/LAB RELEASE

If your lab has been accredited by ASCLD/LAB and you are submitting this data as part of their external proficiency test requirements, have the laboratory's designated individual complete the following.

The information below must be completed in its entirety for the results to be submitted to ASCLD/LAB.

ASCLD/LAB Legacy Certificate No. _____ ASCLD/LAB International Certificate No. _____

Signature _____ Date _____

Laboratory Name _____

Location (City/State) _____

ANAB RELEASE

If your laboratory maintains its accreditation through ANAB, please complete the following form in its entirety to have your results forwarded.

ANAB Certificate No. _____

Signature and Title _____ Date _____

Laboratory Name _____

Location (City/State) _____

Please return all pages of this data sheet.