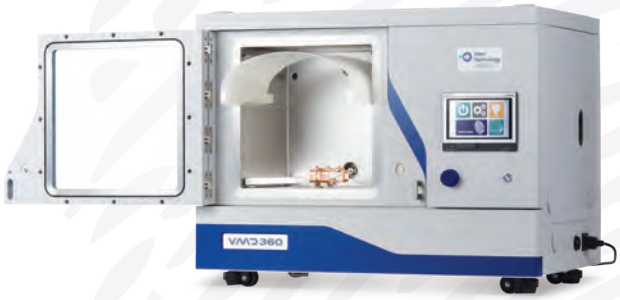
LATENT FINGERMARK DEVELOPMENT

VMD360



VMD560

VMD1260

FORENSIC VMD

West Technology FORENSICS

Our new range of forensic VMD systems utilise the latest in advanced vacuum technology and have been designed by forensic scientists to ensure consistent and uniform latent fingermark development.

Quick & Simple Operation

The VMD range is operated via an intuitive, simple to use icon-based touch control screen. The unique control system and advanced vacuum technology provides quick and easy processing of evidence, typically in <10 minutes from start to finish.

Evidence can be safely and easily suspended or magnetically mounted on a retractable evidence holder.

Developing fingermarks using VMD has never been so simple thanks to the new auto evaporation mode.

The new generation VMD's feature a fully automated evaporation process at a push of a button.

For the very first time, the user can automatically evaporate the gold from start to finish at the push of a button. Other metals such as zinc, can be automatically evaporated and deposition stopped instantly once the fingermark has developed.

The optimised evaporation sources allow for up to 3 metal evaporations in a single VMD process, e.g. gold + zinc + silver, resulting in rapid and uniform fingermark development.

Innovative Design

The VMD systems are self-contained for simple installation and are available in a range of models to suit customer requirements, laboratory space and budgets.

The timed start function allows the systems to be instantly ready so that evidence can be processed immediately, increasing work flow and saving valuable time.

Unlike some other forensic processes, VMD is extremely safe, with low health risk to the operator and no requirement for costly filtration replacements.

New features

- Fully automated gold evaporation
- Semi-automated zinc evaporation
- Easy to use icon driven controls
- Automatic zinc pressure control
- Improved process lighting
- WiFi app for remote system monitoring
- HD full colour touch control screen

	VMD360	VMD560	VMD1260
Overall	Height 712mm (28″) Width 928mm (36.5″) Depth 606mm (23.6″)	Height 1892mm (74.5″) Width 1132mm (44.6″) Depth 717mm (28.2″)	Height 1974mm (77.7″) Width 1400mm (55.1″) Depth 2059mm (81″)
Maximum exhibit	Height 480mm (18.8″) Width 285mm (11.2″)	Height 800mm (31.5″) Width 560mm (22″)	Height 1214mm (47.8″) Width 1200mm (47.2″)

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THE PROCESS

Vacuum Metal Deposition

West Technology FORENSICS

Vacuum Metal Deposition (VMD) is the most powerful latent fingermark development technique available and has been approved by The Home Office Centre for Applied Science and Technology (CAST) as a Category A Process.

The technique is widely used to develop latent fingermarks on non-porous, semi-porous and porous exhibits. Fingermarks developed using VMD are a much higher quality (often with 3rd level detail), with excellent contrast and ridge clarity when compared to other methods available to forensic scientists.

The standard VMD process employs the sequential vacuum deposition of atomic layers of gold followed by zinc. Exciting new research has expanded the VMD technique to include single metal deposition processes e.g. silver, sterling silver and copper, plus new multi-metal deposition processes e.g. gold/zinc/silver and silver/zinc. These new processes are particularly successful on recycled and biodegradable plastics.

VMD has been proven to develop latent fingermarks on aged exhibits including cold cases. The technique has also provided remarkable results on exhibits that have been submerged in water, buried underground or have been subjected to high temperatures e.g. fired ammunition casings and arson.

VMD is the best technique for a wide range of exhibits, including but not limited to flexible plastic packaging, plastic bottles, glass, fabrics, firearms & fired ammunition, wood, glossy paper, thermal paper, polymer & paper bank notes.

Key research has shown that VMD can develop fingermark ridge detail on tight weave fabric e.g. Egyptian cotton. In addition, VMD has been used to to determine the sequence of events within a crime by visualising contact areas e.g. grab impressions on fabrics, with the possible application to aid targeted DNA sampling.

The VMD process can also be used sequentially with other development techniques, making it ideal for processing cold cases that have been previously treated unsuccessfully using other development techniques.

The VMD process is very rapid (typically less than 10 minutes) and produces high quality fingermarks that can be photographed straight away. The standard technique is very stable, developing fingermarks that will not fade and can be imaged many days later if stored appropriately.

The use of alternative light sources has been identified as an excellent method to further enhance VMD developed fingermarks, e.g. reflected infrared imaging on substrates with complex printing and co-axial lighting on substrates with a reflective surface.

Image enhancement software can further aid ridge detail visualization on difficult substrates.

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KEY RESEARCH

Touch marks on fabrics

West Technology FORENSICS

Fabrics are known to be notoriously difficult substrates for touch and fingermark detection. The success rate of detection greatly depends on the type of fabric being examined.

Forensic Vacuum Metal Deposition (VMD) is one of the only techniques currently recommended by the UK Home Office for fingermark visualisation on fabrics. Research has also shown that VMD has low interference on subsequent DNA recovery, making it the preferred technique for mark development on clothing and other fabric evidence.

The use of gold/zinc VMD has previously been recommended, however, forensic scientists at West Technology recently embarked on a new research project to refine the capability of VMD for developing fingermarks and general touch marks on a range of different fabric types.

The research aimed to identify the optimal metal processes for a range of light and dark fabrics.

Metal processes tested

For the 'proof of concept' stage of the project the six different metal processes were tested a piece of white cotton fabric with fresh (~15mins old) and one-day old marks to ascertain which provided the best quality of development.

Gold/zinc
Gold/zinc/silver *
Silver *
Silver/zinc
Sterling silver *
Copper/zinc *

* Developed the best quality of ridge detail and contrast.

Based upon this conclusion, the next stage of the research was conducted using these four VMD metal processes.

Four different types of fabrics and two different colours of (black and white) were tested:

Cotton
Poly-cotton
Polyester
Satin

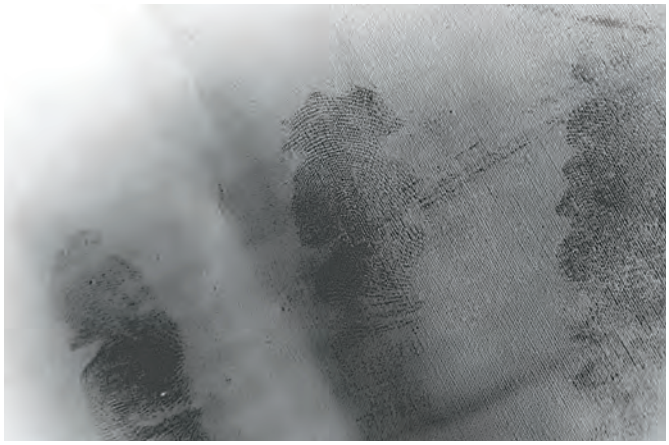
A single handprint was deposited onto the middle of the fabric and three individual fingerprints and a sebaceous control print were deposited in the corners.

Each of the 32 fabric samples were allowed to naturally age for seven days.

Results

Grade	Description of mark
0	No obvious ridge development.
1	Some evidence of contact but no ridge detail.
2	Low quality or limited ridge detail. Suitable for exclusion.
3	Moderate quality ridge detail. Suitable for identification.
4	High quality ridge detail resembling fingermark. Suitable for identification.

Table 1: Grading scale for assessment of developed fingermarks



148 marks (92.5%) developed ridge details suitable for targeted DNA sampling.

- 160 marks (both fingermarks and hand marks) were processed and graded.
- 55 out of 160 prints (34%) developed grade 2 or greater ridge detail
- 92.5% of the handmarks showed palmar flexion creases
- copper/zinc gave the best results on cotton and poly-cotton
- sterling silver gave the best results for polyester and satin
- Poly-cotton demonstrated a better ability to retain fingerprint residues than any of the other fabric types tested.

Conclusion

Forensic VMD successfully developed touch impressions on all four different types fabrics. Development of touch marks could potentially help in the identification of those involved in criminal incidents through the development of ridge detail and palmar flexion creases; visualising areas that could be targeted for DNA; and helping to corroborate a sequence of events.

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KEY RESEARCH

Knives – Harsh Conditions

West Technology FORENSICS

West Technology Forensics recently carried out research on the development of latent fingermarks on knives that had been subjected to harsh environmental conditions to realistically simulate the challenging crime scenes where the evidence can be buried, subjected to high temperature e.g. arson or discarded into a water source e.g. river or lake.

Forensic Vacuum Metal Deposition (VMD) has repeatedly proven its capability in developing fingerprints on metallic items such as fired cartridge casings, knives and firearms, which is one of the reasons why the UK Home Office recommends the forensic VMD as the 'go to' development process for untreated metals[1]. Their other recommendations for the VMD process include:

- Items exposed to high temperatures up to 900°C (1,652°F)
- Items where fingermark residue may have been removed
- Items that have been previously wetted or submerged

Based on these recommendations, forensic scientists at West Technology's Application Laboratory undertook a short research project to investigate the recovery of fingerprints from 30cm (12") steel knives subjected to harsh environmental conditions.

Metal processes tested

Initially three VMD metal processes were evaluated:

Gold/zinc
Silver
Silver/zinc

The next stage of the research was conducted using only the silver VMD process as silver developed the best quality of ridge detail on both the knife blade and handle.

Natural marks from five individual donors were placed onto each side of the knives. One side was left untouched after deposition and the other wiped with a paper towel after 15 minutes.

Each knife was then subjected to a different environmental condition:

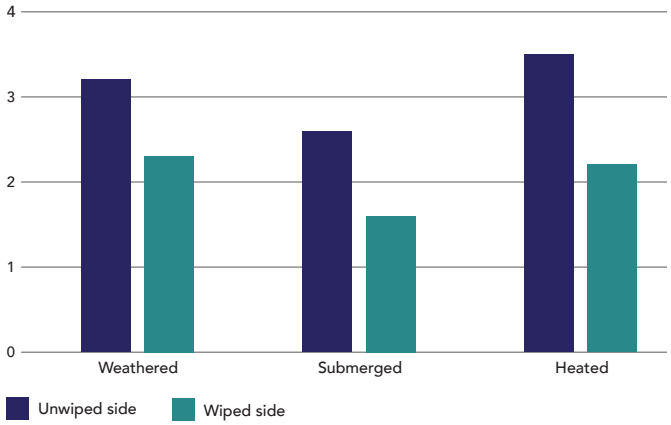
Submerged	Placed in a pond for 48hrs
Weathered	Buried in soil and leaves for 36 hrs
Heated	Placed into open fire at 270 °C (518°F) for 10 minutes

[1] CAST Fingerprint Visualisation Manual 2014

Grade	Description of mark
0	No obvious ridge development.
1	Some evidence of contact but no ridge detail.
2	Low quality or limited ridge detail. Suitable for exclusion.
3	Moderate quality ridge detail. Suitable for identification.
4	High quality ridge detail resembling fingermark. Suitable for identification.

Table 1: Grading scale for assessment of developed fingermarks

Summary of results



Grade 4 ridge detail with clear ridge definition including sweat pore position and shape was developed on an average of 35% of the total prints deposited.

VMD revealed 83% on untouched side and 61% on wiped side fingermarks with a Grade 2 or higher ridge detail.

Conclusion

The silver forensic VMD process offers great potential for developing latent fingermarks on metal substrates such as knives even when the surface of the substrate has been exposed to harsh environmental condition.

The successful development of ridge detail on the wiped side of the knife blade confirms that the forensic VMD process is a very effective process whether there is any biological residue from the fingermark present or not; this fact is corroborated by the results from the successful development of ridge detail on the knives that were heated.

VMD also successfully developed ridge detail on the plastic handles of the knives. This highlights the flexibility and sensitivity of the process across a wide range of substrate types.

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KEY RESEARCH

Fired Ammunition

West Technology FORENSICS

Vacuum Metal Deposition (VMD) is known for its ability to develop high quality fingermarks on difficult substrates. West Technology Forensics undertook a 2-month research study to test VMD's capabilities to develop fingermarks on fired ammunition – a notoriously challenging exhibit to recover fingermarks from.

Literature and operational forensic laboratories worldwide have noted the difficulty in developing sufficient ridge detail from fired cartridges, with the success rate for developing identifiable fingermarks typically <2%. It has been postulated that the mechanism of firing ammunition creates both high temperatures and abrasive friction on the surface of the cartridge, which removes any biological fingermark residue greatly reducing the development of latent fingermarks present and potential DNA recovery.

Ridge detail was developed on 82% of samples processed. High quality ridge detail was developed on 72% of shotgun cartridges and 65% of rifle cartridges.

The research work carried out at West Technology Forensics Laboratory aimed to determine if ridge detail could be developed from fired cartridges using the VMD technique[1]. Different metal processes were tested to establish if a particular metal or multi-metal combination might be superior over the others.

[1] Brewer, E.R.; *The Capability of Forensic Vacuum Metal Deposition for Developing Latent Fingermarks on Fired Ammunition: A Preliminary Study Comparing Alternative Metal Processes.* Journal of Forensic Identification. 2019, 69 (3), 299-327

Metal processes tested

Gold/zinc
Silver
Silver/zinc
Sterling silver
Copper/zinc
Aluminium/zinc

Fingermarks were deposited onto 12 bore, fibre wadded shotgun cartridges and Winchester Super X 243 rifle cartridges. Natural and sebaceous (using a reference pad) marks were deposited onto each of the cartridge samples prior to firing.

The samples were allowed to naturally age for different time periods prior to firing.

Time (from deposition to firing)

< 5 minutes
1 hour
1 day
7 days
28 days

Developed marks were assessed using a grading scale similar to that used by the UK Home Office.

Grade	Description of mark
0	No obvious ridge development
1	Evidence of touch
2	Low quality or limited ridge detail
3	Moderate quality ridge detail
4	High quality ridge detail resembling fingermark

For rifle cartridges, the Silver VMD process was the most successful at developing ridge detail, with 80% of deposited marks being visualised to grade 3 or above. For sebaceous deposits, 100% of marks were developed to grade 2 or above by all metal processes tested.

Silver was the most successful metal process on rifle cartridges. No obvious deterioration in mark quality was observed for older samples.

Gold/zinc was the most successful metal process on shotgun cartridges. The quality of development increased over time for sebaceous marks.

Development on shotgun cartridges was graded in two stages due to the mix of plastic and brass material. Overall, gold/zinc was the most successful metal process, developing 70% of deposited marks. Silver, sterling silver and copper/zinc were also particularly successful at developing high quality marks on the brass material.

The aging of marks did not have a noticeable effect on the development of sebaceous marks for either ammunition type tested. Development quality reduced for natural marks after 7 days.

The results of the study show that VMD offers strong capabilities in developing identifiable ridge detail on both ammunition types, with all metal processes successfully developing both natural and sebaceous marks.

Fingermarks developed by VMD are of a much higher definition (often to 3rd level detail) and have better contrast than marks developed using other techniques. The VMD process can also be used sequentially with many other traditional techniques.

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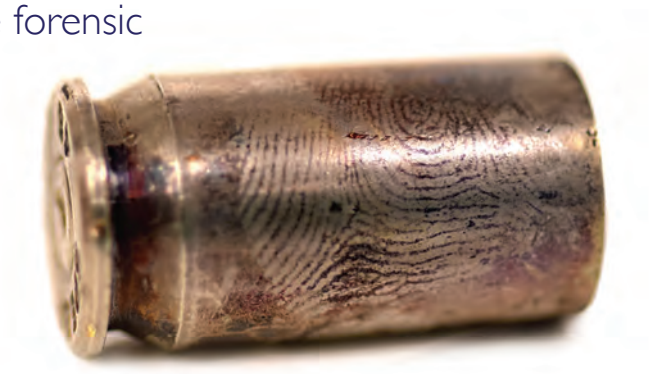
KEY RESEARCH

Fired Handgun Ammunition

West Technology FORENSICS

Recent research carried out at West Technology Forensics' laboratory concluded that high quality ridge detail could be consistently developed from a range of fired rifle and shotgun cartridges using the forensic Vacuum Metal Deposition (VMD) process.



Our latest exciting research concentrates on fired cartridges from revolvers and semi-automatic pistols[1].

Visualising fingermarks on fired handgun cartridges has always been considered problematic, especially from semi-automatic pistols.

Amongst the possible reasons cited are the conditions within the chamber during firing, where the cartridge is exposed to high temperatures, excessive friction forces and the rapid expansion and contraction of the metal casing. Other possible factors include the loading of the magazine and the automatic ejection of the cartridge case after firing.

For this research, in collaboration with the UK Royal Armouries, five different revolver and semi-automatic pistol models were chosen, including a Colt M1911 and Smith & Wesson 29.

As with the previous research, fingermarks were deposited onto a range of cartridges including 357 Mag., 9mm, .44 Rem. Mag. and 45ACP.

Natural or sebaceous marks were placed onto cartridge samples and then the samples were allowed to naturally age for different time periods prior to firing.

Time Period (from placement to firing)
< 5 minutes
1 hour
1 day
7 days
28 days

Metal Processes Tested

The previous research on fired rifle and shotgun cartridges had concluded that, of the 6 original VMD processes used, the most effective were 2 single metal and 2 multi-metal processes:

Silver
Sterling silver
Gold/zinc
Copper/zinc

[1] Brewer, E.R.; *Visualization of Latent Fingermark Detail on Fired Handgun Casings Using Forensic VMD* Journal of Forensic Identification. 2020, 70 (3), 323

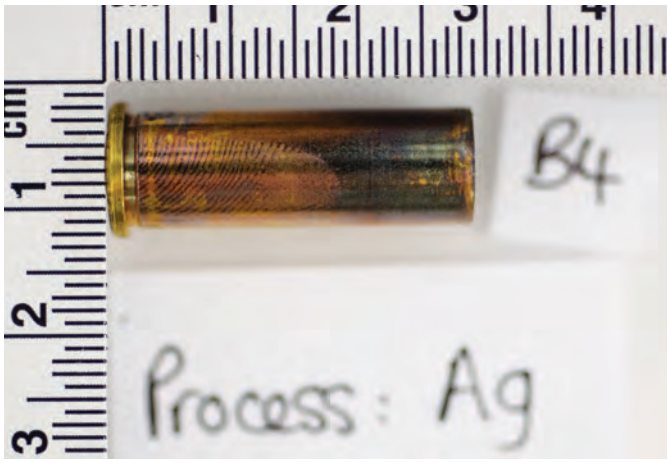
Results

The developed marks were assessed using a grading scale, as recommended by the UK Home Office.

The results of this study clearly showed that the traditional gold/zinc VMD process was the least effective for fired handgun cartridges.

The most effective VMD process was silver; however, both the copper/zinc and sterling silver VMD processes also produced excellent results.

The grades for ridge detail developed from fired revolver cartridges were higher when compared to the semi-automatic pistol cartridges and further research is required to investigate disparity. It was found that the larger calibre pistol ammunition had a greater success for fingermark visualisation, which could be due to the larger surface area.



Ridge detail was developed on 49% of samples processed. High quality identifiable ridge detail was developed on 12% of handgun cartridges.

It was interesting that, as with the previous research on fired rifle and shotgun cartridges, the ageing of marks did not have a noticeable effect on the ability to develop ridge detail.

The overall success rates for developing and visualising ridge detail on fired handgun cartridges were reduced, when compared to the results for rifle and shotgun cartridges, however, the success rate is still much higher than the <1% cited in existing published literature for other forensic techniques.

Other added benefits of the VMD process include:

- A much higher definition of ridge detail compared to other more traditional techniques
- Quick processing of cartridges in as little as 5 minutes
- Process 50 to 100+ cartridges in a single process (system dependant)
- Does not affect subsequent DNA testing
- Extremely safe process with no filtration needed
- Low cost per run
- Used operationally by Law Enforcement worldwide
- UK Home Office - Category A fingermark development process

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KEY RESEARCH

Glassine Bags (Stamp Bags)

West Technology FORENSICS

Glassine bags (otherwise known as stamp bags) are small wax packets that are used to distribute illicit drugs, most commonly heroin. They are sometimes stamped with a logo by drug dealers to market their contents. The stamps on the heroin bags can provide important clues to investigators that often lead to the source of the drugs.

Introduction

Forensic Vacuum Metal Deposition (VMD) has repeatedly proven its capability in developing fingerprints on paper and polymer-based substrates. It was brought to the attention of our Forensic Scientists at West Technology's Application Laboratory that conventional forensic processes such as ninhydrin or cyanoacrylate fuming were unsuccessful in developing latent fingermarks on Glassine bags.

A short research study was undertaken with the objective of investigating the potency of forensic VMD to develop identifiable ridge detail on a variety of glassine bags with and without stamps.

Metal processes tested

Initially 5 VMD metal processes were evaluated to determine the three processes that gave the best results:

Gold/zinc *
Silver
Silver/zinc *
Sterling silver
Copper/zinc *

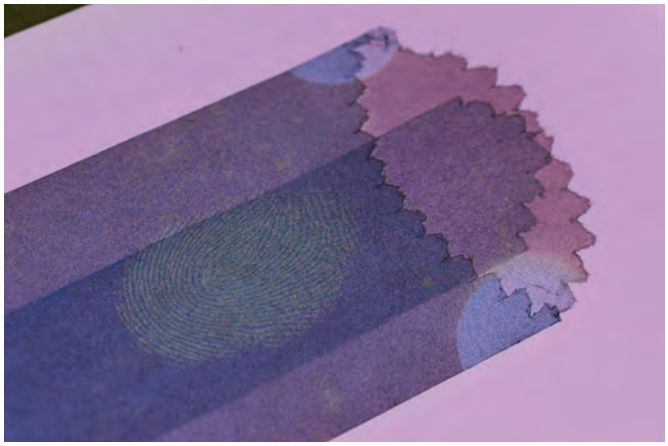
* Developed the best quality of ridge detail

For this research, eight different glassine bag types were used. 4 solid colour plain bags and four stamped bags with mixed colours.

Natural fingermarks from three donors were placed onto each of the 288 samples and allowed to naturally age for different time periods.

Time (from deposition to processing)

1 day
7 days
14 days
28 days



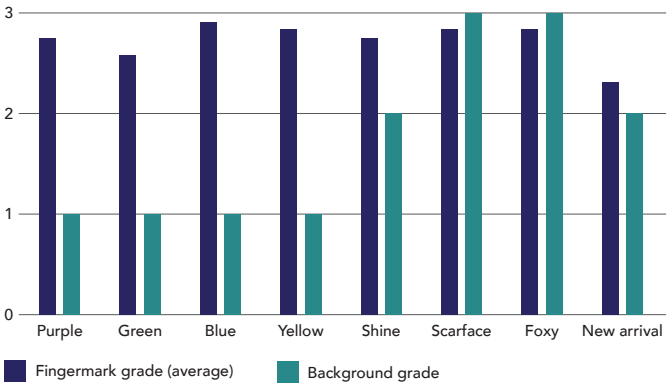
Results:

Every single fingermark from all donors was successfully developed with all three VMD processes, however some metal were more effective than others.

Grade	Description of mark
0	No obvious ridge development.
1	Some evidence of contact but no ridge detail.
2	Low quality or limited ridge detail. Suitable for exclusion.
3	Moderate quality ridge detail. Suitable for identification.
4	High quality ridge detail resembling fingermark. Suitable for identification.

Table 1: Grading scale for assessment of developed fingermarks

Summary of silver/zinc results



Silver/zinc VMD process developed grade 3+ ridge detail on 75% of the bags.

Grade	Description of background
0	No ink/pattern interference.
1	Some ink pattern details, light colour.
2	Up to 50% of developed fingermark obscured by background ink / pattern.
3	More than 50% of developed fingermark obscured by background ink / pattern / colour.
4	About 80–100% of fingermark obscured by background.

Table 2: Grading scale for assessment of background pattern

The most effective VMD process across the eight different bags was silver/zinc. Gold/zinc was the least effective of all three processes and Copper/zinc developed good ridge detail but with less contrast.

It was noted however, that the use of additional Infra-Red imaging improved the contrast and could remove the background pattern. The results of this study show that forensic VMD is highly effective in developing fingerprints on glassine bags and offers an alternative to ninhydrin or cyanoacrylate fuming.

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AFTER SALES

VMD Training, Installation & Support

West Technology FORENSICS

West Technology Forensics is committed to providing first class training to our customers. We have a specialist team of highly skilled training instructors and installation engineers. We are also dedicated to offering our customers and other VMD users detailed, effective technical application support should help be required with a particular substrate type.

West Technology Forensics is the world's leading provider of forensic VMD systems for latent fingermark development.

Our experienced and knowledgeable instructors provide full training in all aspects of forensic VMD including system operation and the application of the VMD process to a wide range of substrate types.

We offer two levels of training course:

Operational
The training covers all aspects of system use and the gold/zinc and silver forensic VMD processes.

Advanced
The training is for customers who want to learn more about alternative metal processes and imaging developed fingermarks.

We offer individual or group training packages, either at the customers premise or at West Technology's modern training facility in Yate, U.K.

A typical training course consists of the following:

- System operation
- Substrate handling
- VMD processing techniques
- Substrate type and choice of VMD process
- Sequential processing
- The basics of vacuum
- Good housekeeping practices

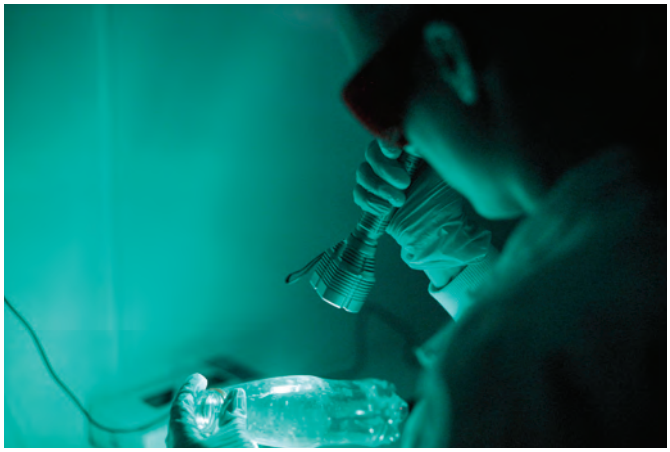
We are also happy to offer bespoke packages that are specifically formatted to suit our customers' exact needs.

Our modern, well equipped Application Laboratory is staffed by our team of forensic scientists.

West Technology are at the forefront of forensic VMD research with a range of projects, both in-house and collaborative with some of the world's leading forensic academic research institutes.

The breadth of our in-house research program also includes looking at key aspects of VMD system design to further improve and optimise them for use in forensic and fingerprint laboratories.

Every system is supplied with a comprehensive installation and training package as standard, something no other provider can offer.



The intense nature of the demands on forensic laboratories to process exhibits rapidly and effectively is something that West Technology Forensics puts at the heart of their technical and service support policy.

We provide unrivalled technical and service support which includes:

- Secure, internet based, remote diagnostic support
- Local support in over 50+ countries worldwide
- On-going support and servicing
- Flexible service contracts
- Remote software upgrades

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VMD ACCESSORIES

Ammunition Rack

West Technology FORENSICS

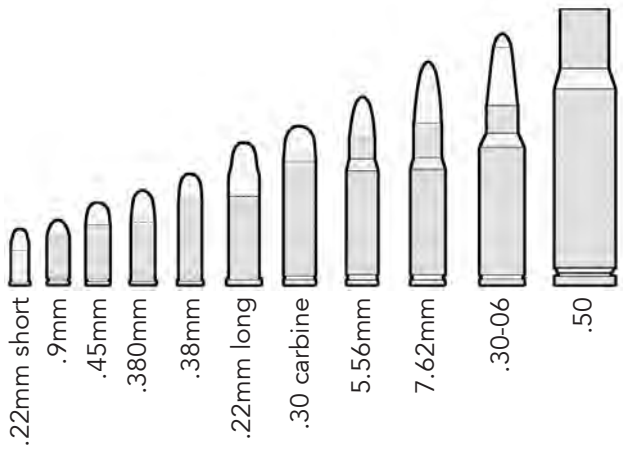
The VMD Ammunition Rack holds a wide range of handgun and rifle cartridges for quick and easy processing

Innovative Design

The lightweight, easy to use accessory, magnetically attaches to the VMD evidence holder for quick and safe mounting of up to 10 live or discharged cartridges.

Each cartridge is mounted via the rim or extractor groove, ensuring that the cartridge body can be fully processed for fingerprints without damaging any possible ballistic evidence.

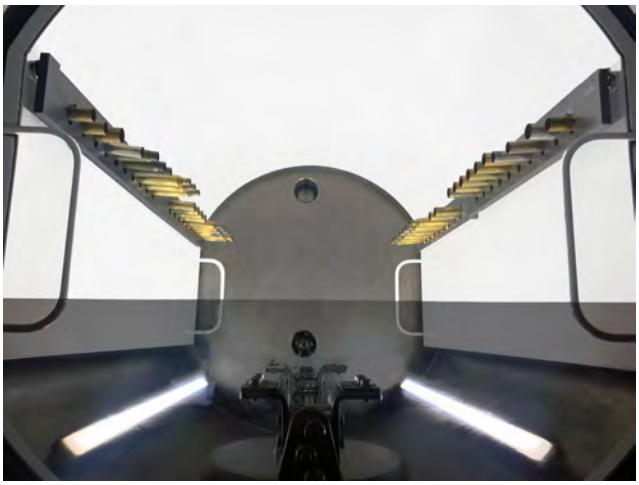
A range of handgun and rifle ammunition can be mounted from .22mm up to .50 caliber



Multiple ammunition racks can be used simultaneously, allowing large numbers of cartridges to be processed in minutes.

Specification

Dimensions: L 270 mm (10.5"), H 40 mm (1.5")
Weight: 130 g
Material: Anodised Aluminium
Compatibility: VMD360/560/1260



Forty cartridges processed simultaneously in a VMD560.